



Learning from the Past Part 2: Long-Term Capital Management

Learn from the past, Prepare for the future

This is the sequel of the previous Quant View piece which talked about Portfolio Insurance and Black Monday Market Crash of 1987. In this report, we will discuss the fall of Long-Term Capital Management, the famous hedge fund which “picked up nickels in front of a steamroller”.



Source: Getty Images

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LTCM Crisis and the 1997 Asia Financial Crisis

Long-term Capital Management (LTCM) was a hedge fund located in Greenwich, Connecticut, founded by John Meriwether in 1994 that included Nobel Prize recipients Myron Scholes and Robert Merton. Most of the early staff included members from Meriwether's arbitrage trading group at Solomon Brothers, the same group that was purportedly responsible for 70-90% of Salomon Brothers' profits in the late 1980s and early 1990s.

Quantitative Anatomy

LTCM employed strategies that were known as convergence trades, which involved taking long and short positions on similar substitute securities whose prices had diverged by buying the cheap security and selling short on the expensive security. One example of a convergence trade involves taking a short position in a liquid, on-the-run treasury bond that has just been issued, and taking a long position on a less liquid, off-the-run treasury bond that trades and has been previously issued. The former, more popular bond trades at a premium to the less popular latter bond, although both securities share similar credit risk and have comparable payoffs. Profit made from this kind of trade comes from the liquidity premium that, in general, should decrease or disappear over time, once a newer and more liquid bond has been issued. LTCM also implemented other types of trades that were similar in spirit, including SWAP spreads in the European and Latin American markets, other European convergence, U.S. bond flattening and equity bond volatility arbitrage.

LTCM convergence trades relied on the divergence between a securities actual and fair value. Since these price differences were often small, the firm needed to take highly-levered positions to produce reasonable profits. LTCM partners believed that the level of net risk by applying this strategy was relatively low; as long as the firm stuck to liquid instruments and quantitative models used by the fund kept a high correlation between the short and long positions.

While this type of trading is clearly likely to be profitable in the long run, traders must stay solvent until security prices converge. This concept is better known as "Limits of Arbitrage" popularized by Shleifer and Vishny (1997) – in their model informed "smart" traders can make profits from small price discrepancies due to irrational trading (by "noise" or uninformed traders) in the long-run, but they have to survive the fickleness of financial markets. If these informed investors use leverage, they may go broke before they can realize a profit as prices can deviate more from rational fundamentals.

LTCM originally raised \$1.3 billion, and generated annualized returns after fees of over 20% for the first year, and 43% and 41% for the second and third years, respectively (Shirreff (2017)). The firm's early success was believed to be due to the combination of advanced quantitative models and traders' judgment and experience implementing those models (Jorion (2000)). LTCM was able to leverage itself through repos with commercial and investments banks, due to its



reputation on Wall Street, as it was viewed as a safe investment mainly because of the little available information about the firm's leverage and its strategies.

By 1997, inflows and positive performance increased LTCM's capital base to over \$7 billion. The combination of performance and prestige allowed the firm to charge higher fees when compared to other firms - LTCM fees consisted of an annual 2% management fee and 25% incentive fee, while others funds were charging a 1% fixed fee and 20% of profits. By the end of 1997, the firm was facing challenges deploying such a large amount of capital. The company earned a 27% return that year, and returned over \$2.7bn to investors. In response to a lack of opportunistic trades and narrowing return premium of identified market anomalies, they reduced the firm's capital base and increased the leverage ratio.

Macroeconomic Reasons

The Asia financial crisis in July 1997 involved a series of currency devaluations that affected much of East Asian markets. The crisis started with the financial collapse of Thailand's currency, the baht, which failed when the country went bankrupt, as it acquired a significant amount of foreign debt in order to increase the amount of foreign currency in the country. The financial crisis' effect on Thailand soon spread out to other Asian countries, affecting most of Southeast Asia, including Japan, by raising these countries' private debt and devaluating their currencies (relative to the dollar) by as much as 38%. Stock markets and other asset prices declined as much as 60%. The crisis raised investors' and countries' concern over a worldwide financial meltdown, requiring that countries adopt more protectionist measures to ensure their own currency stability.

The Russia financial crisis in August 1998 involved an overhang from the Asia currency crisis, high fixed exchange rates between the ruble and foreign currencies, large fiscal deficits and reductions in worker productivity. The Russian stock, bond and currency markets fell as a result of concern over a default on sovereign debt and ruble devaluation. Russia had been struggling with a shrinking economy since 1991, even though Russia's economic growth was positive in the first half of 1997. Weak fiscal position, Russia's political crisis and the international market crisis made Russia's capital position unsustainable. On August 17, 1998, Russia's government and the Central Bank of Russia issued a statement announcing (Pinto, Brian and Sergei (2010)):

- A significant devaluation of the ruble; the bounds of the corridor in which the ruble is allowed to fluctuate were widened from 5.27-7.13 to 6.00-9.50 ruble to the US Dollar.
- A temporary 90-day moratorium would be imposed on the payment of some bank obligations.
- A default on short-term Treasury Bills known as GKO's, as well as longer-dated ruble-denominated bonds, named OFZs.

On September 2, 1998, the Central Bank of Russia decided to remove the currency peg and allowed the ruble to free-float. The ruble started to significantly depreciate, losing 66% of its value in the following three weeks. The Asia crisis of 1997 and the Russia crisis of 1998 significantly affected volatility of global stock, bond and currency markets. Developing countries saw an increase in the cost of borrowing, not only in Asia, but also in Europe and Latin American countries. This is evidenced by higher spreads on international bonds. Spreads on



East Asian Eurobonds rose between 1% and 5%, and Latin American countries experienced a similar effect on their bonds spreads. Moreover, the Russian GKO's (Government Short-Term Commitment's) default caused commotion among foreign and domestic investors. The overlapping of these crisis significantly undermined investor confidence, given that the Asia crisis effects lasted until 1999.

Quantitative Crisis

The macroeconomic events in 1997 and 1998 brought increased volatility – particularly in fixed income markets. In May and June of 1998, LTCM monthly returns recorded losses of -6.42% and

-10.14%, respectively, which subsequently reduced the firm's capital by \$461 Million (Capocci (2013)). Following losses, Salomon Brothers liquidated positions in LTCM which potentially contributed to a 10% performance decline in July. The liquidation depressed the price of LTCM long positions and increased securities prices on their short positions. Despite LTCM's negative performance, the firm partner's expectations were that prices would soon return to their fair value consistent with the idea that in the long-run limits of arbitrage do not apply.

On August 17, 1998, the Russia crisis and the government announcement of GKO's default led to further deteriorations in LTCM's capital position. Initially, the fund believed that its GKO positions were hedged against currency declines through short ruble positions. Unfortunately, the banks that guaranteed the ruble hedge were forced to shut down after the ruble collapsed, leaving LTCM without a hedge to offset losses from the GKO's default. The firm's losses were significant, but still not large enough to cause LTCM's demise.

The combination of different past macroeconomic events provoked a flight to liquidity across markets. This is a phenomenon in which investors sell less liquid or what they consider to be risky assets, and purchase more liquid and safer investments instead, such as U.S. Treasuries. In this case, many investors sold European, Japanese, Asian and Latin American bonds due to uncertainty in the global fixed income markets, and they purchased the most liquid asset they could find, the recently issued on-the-run U.S. treasuries, further increasing the spread between on-the-run and off-the-run U.S. treasuries. The ultimate cause of LTCM's fall was the shifting from global fixed-income portfolio managers to the recently-issued U.S. treasuries, which negatively affected LTCM's short and long positions, raising prices for on-the-run bonds and decreasing off-the-run bond prices.

By August, LTCM had lost 52% of its value, its equity dropped much faster than its assets, increasing the firm's leverage ratio from 27:1 to 50:1 (Jorion (1999)). The firm began seeking capital, but none of LTCM partners were willing to increase their positions within the firm. Portfolio losses further accelerated in the upcoming days. The divergence from fair value worsened due to liquidation of similar positions from other banks and trading desks on Wall Street. LTCM was forced to liquidate a number of its positions, taking on more losses. By September 22, the firm's equity was only \$400m, with over \$100bn in liabilities, causing a rise in the leverage ratio to 250:1.

LTCM became a casualty of limits-to-arbitrage, meaning that LTCM could not stay solvent long enough to profit from convergence of associated positions to fair values. The problem with convergence strategies that LTCM employed was

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the lack of consideration towards liquidity as a risk factor; additionally, they did not assess accurately the probability that all of their trades would have negative performance at the same time as this situation had never occurred previously.

Aftermath

LTCM's early success garnered a very positive reputation among Wall Street firms, which resulted in nearly every major US institution investing capital with LTCM. Soon after becoming distressed, LTCM began liquidating positions to meet counterparty margin calls. Concern began to spread among the Street that a LTCM collapse could have a chain reaction affecting other markets and institutions - leading to a potential crash of the financial system.

With LTCM running out of options to raise new capital, the Federal Reserve Bank of New York organized a bailout of \$3.625 Billion to avoid this scenario (Capocci (2013)). The Fed used no federal funds to orchestrate the bailout instead leaning on large banks for capital.

In return, the participating banks received 90% share in the fund, and the promise that a supervisory board would be established. LTCM partners received 10% of the fund's shares, worth \$400 Million, which was used to pay the firm and principals' debts. Partner capital which had once totaled \$1.9 Billion was completely wiped out.

Soon after the LTCM bailout, U.S. Federal Reserve chairman Alan Greenspan cut Fed fund rates by 25 basis points to 5.25%. Later on, Greenspan cut them again by another 0.25%, leaving the Fed fund rates at 5%. Heavy criticism from market observers towards these measures cited that the move would encourage other large financial institutions to assume more risk. After the bailout, Long-Term Capital Management continued operations, audited by Price Waterhouse LLP. In the year following the bailout, LTCM earned 10% returns. By beginning of 2000, the fund had been completely liquidated, and the creditors that financed the bailout had been paid back in full.

Conclusion

LTCM became a casualty of limits-to-arbitrage primarily due to its highly leveraged positions. For the convergence strategies to work, one has to survive the fickleness of the markets. If the prices deviate more from the fundamentals, the highly leveraged convergence strategy may go broke before a profit is realized.



Macro update

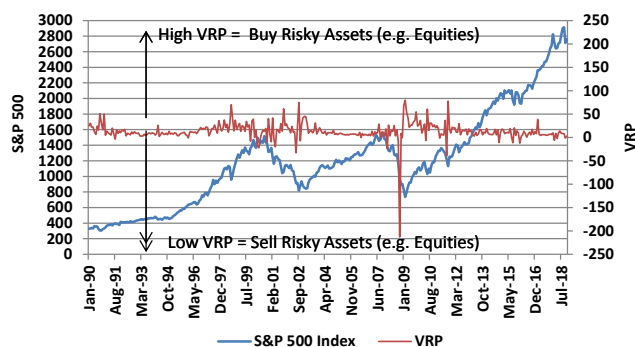
Turning our attention to the bigger picture, we also take the opportunity to update our favorite top-down market indicators.

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.

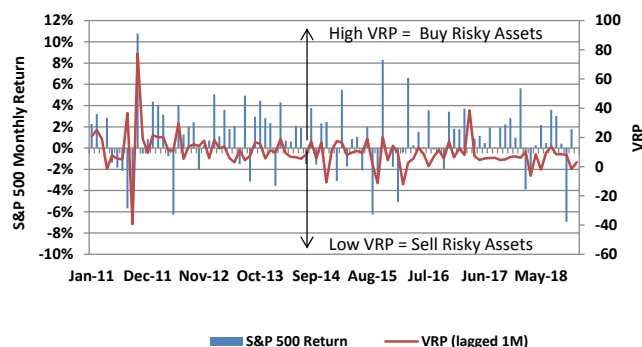
Our VRP indicator is at 3.0, less than the long-term average of 12. This reading signals slightly bearish sentiment. Generally, we pay attention to the VRP when it hits extreme levels (like +/- 2 standard deviations, or outside -10 and 34).

Figure 1 : Variance Risk Premium (VRP)



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

Figure 2 : 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

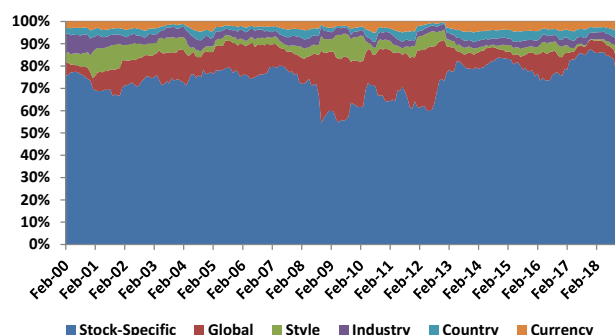
Another metric that we watch closely is the so-called “opportunity set” for investors. Think of this as the total alpha on the table. Our main interest is to understand what is driving that opportunity, because this can allow us to position our strategies to ‘pick the juiciest fruit in the orchard.’ In Figure 6, we show the opportunity set for global equity investors, and in Figure 7, we show the same for Emerging Market equity investors.

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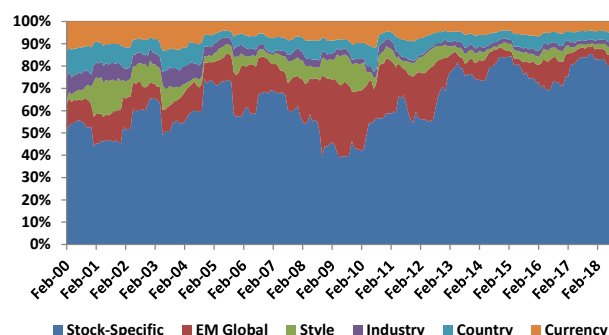


Figure 3 : Global opportunity set



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

Figure 4 : Emerging Markets opportunity set



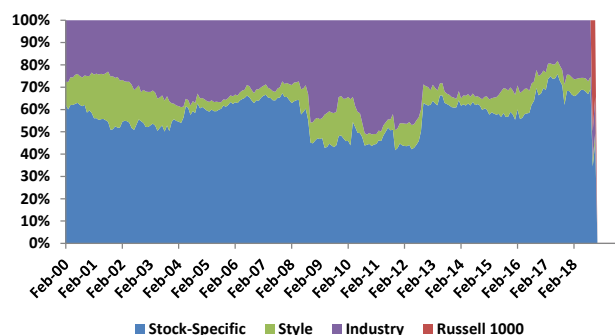
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

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

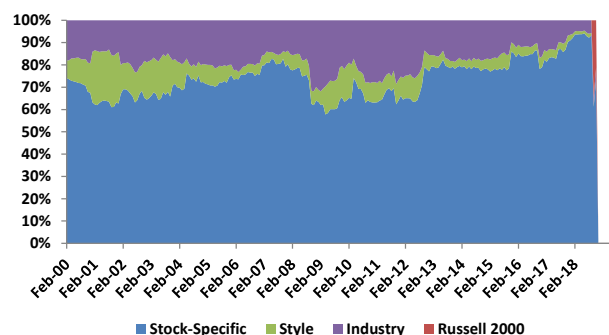
In Figure 8, we show the opportunity set for the large-cap universe, and in Figure 9, we show the opportunity set for the small-cap universe.

Figure 5 : Large-cap opportunity set



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

Figure 6 : Small-cap opportunity set



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

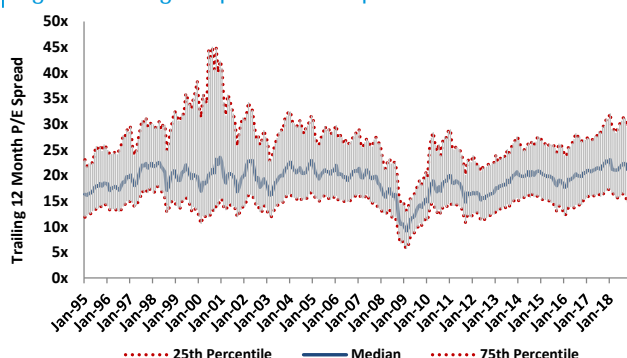
Both charts show that bottom-up stock picking is making a strong comeback. The blue area in both charts has reached levels last seen in 2007. The crucial observation is that the relative opportunity coming from stock selection is higher for small-cap stocks. In other words, this universe is particularly 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

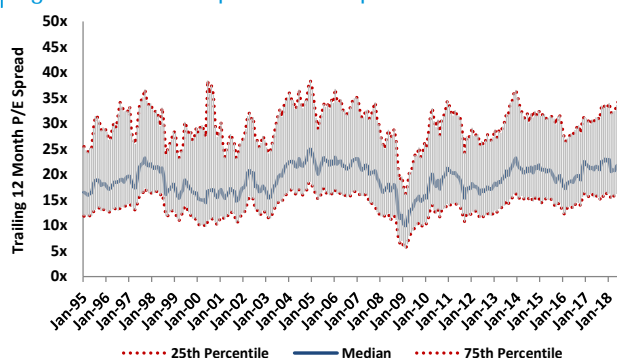
Similar to the opportunity set, valuation spreads allow investors to gauge the level of stock selection opportunity in the market. Widening valuation spreads typically indicate more stock-level differentiation, and consequently, a better environment for stock selection. On the other hand, narrowing valuation spreads are indicative of lower levels of stock differentiation. Figure 10 and Figure 11 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 7 : Large cap valuation spreads



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

Figure 8 : Small cap valuation spreads



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

Keeping an eye on correlations

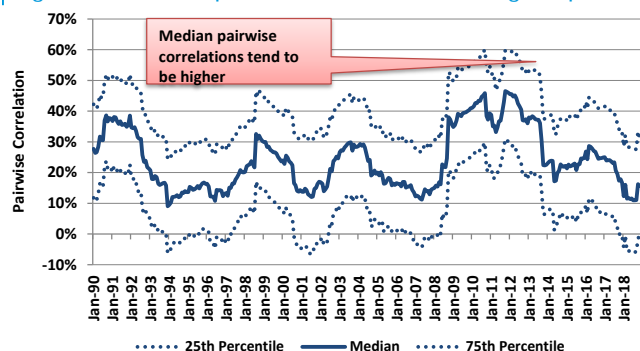
The median pairwise correlation among stocks in the market is closely related to the opportunity set and valuation spreads. This is calculated by taking every possible pair of stocks and computing the correlation of their monthly returns based on the past 24 months of data, and then taking the median across all the pairs. Figure 12 shows the median pairwise correlation for large caps. In general, median pairwise correlations for small-cap stocks (shown in Figure 13) tend to be lower when compared with 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.

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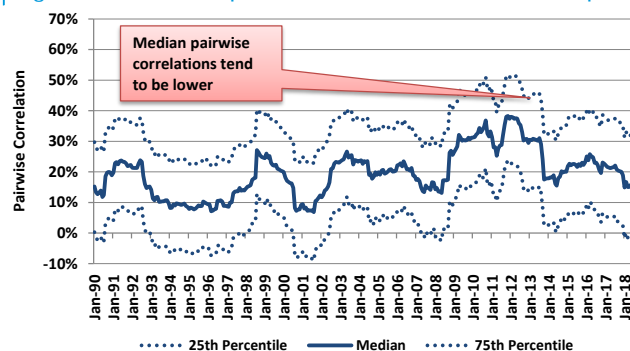


Figure 9 : Median pairwise correlation for large caps



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

Figure 10 : Median pairwise correlation for small caps



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

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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](#)

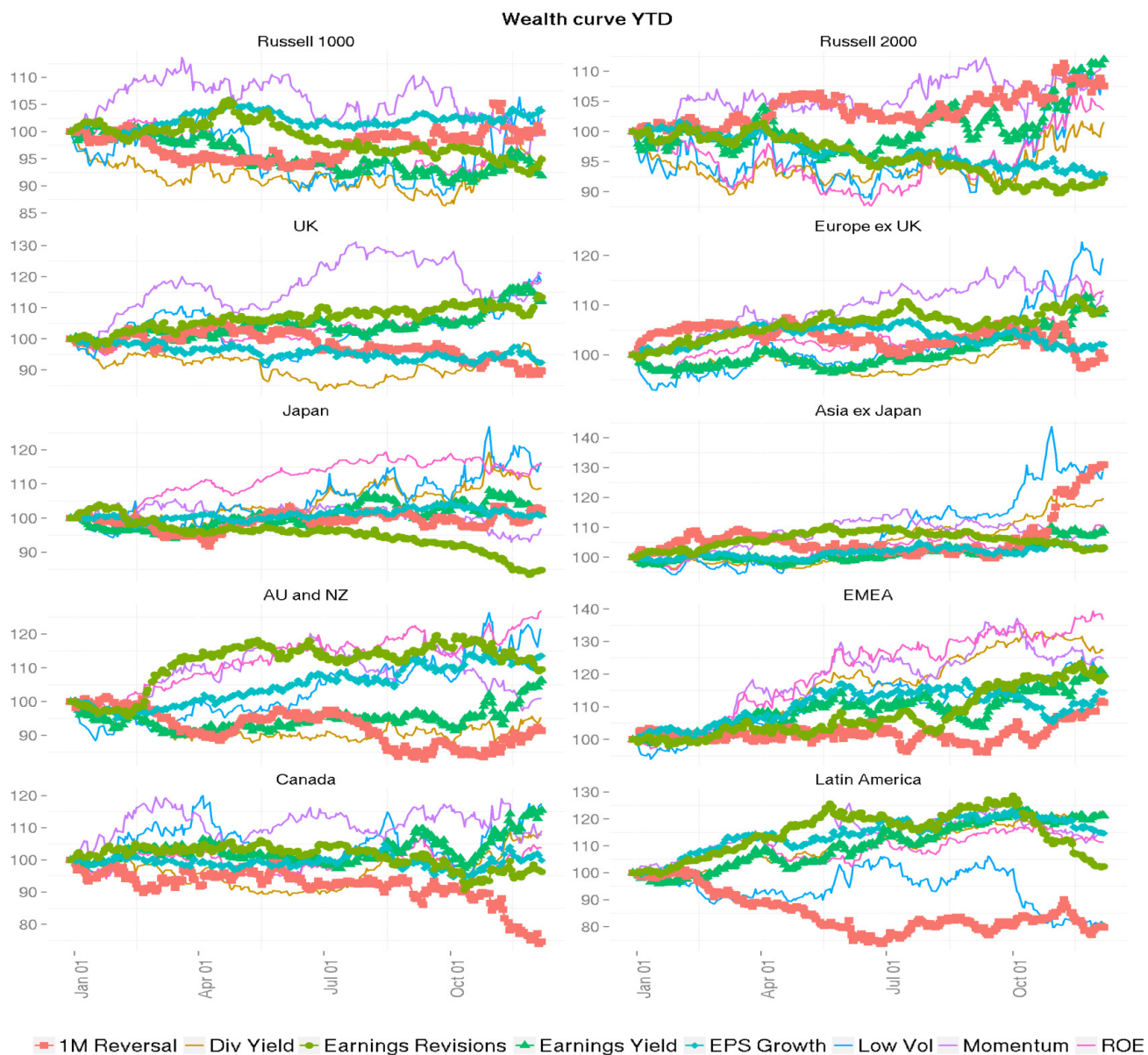
For the most recent weekly factor performance, as well as factor performance delineated by different universes (e.g., large cap, small cap) and regions, please contact us at DBEQS.Americas@db.com to be added to our Weekly Dashboard distribution list.

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Figure 11 : 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

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 12 : Current N-LASR model stock recommendations

BEST BUY IDEAS					BEST SELL IDEAS				
Ticker	Name	SEDOL	Country	N-LASR Score (higher is better long)	Ticker	Name	SEDOL	Country	N-LASR Score (lower is better short)
UTX	UNITED TECHNOLOGIES CORP	2915500	USA	2.26	004870 KS	Tway Holdings Co Ltd	659965	Korea	-2.05
120110 KS	Kolon Industries Inc	85TVWD	Korea	2.10	2395 JT	Shin Nippon Biomedical Laboratories	673890	Japan	-1.98
WRE	WASHINGTON REIT	2942304	USA	2.05	025320 KS	Synopex Inc.	617866	Korea	-1.92
OFC	CORPORATE OFFICE PROPERTY	2756152	USA	2.04	GND SJ	Grindrod Ltd	B0LNVL	South Africa	-1.90
WFC	WELLS FARGO & CO	2649100	USA	1.99	KODK	EASTMAN KODAK CO	BDZDSJ9	USA	-1.89
NEWAB SS	New Wave Group AB B	B0FLGQ	Sweden	1.97	SIGA	SIGA TECHNOLOGIES INC	2107437	USA	-1.89
ITC IB	ITC Ltd	B0JGGP	India	1.92	4686 JT	Justsystems Corp	607979	Japan	-1.89
7003 JT	Mitsui E&S Holding	659738	Japan	1.91	4725 TT	Taiwan Prosperity Chemical Corp	B1FLSN	Taiwan	-1.89
6952 JT	Casio Computer Co	617896	Japan	1.89	PETRONM MK	Petron Malaysia Refining & Marketing	632159	Malaysia	-1.89
CHMF RX	Severstal PJSC	B589C5	Russia	1.89	142760 KS	Biocore Corp	BSRQV2	Korea	-1.88
BDN	BRANDYWINE REALTY TRUST	2518954	USA	1.87	SML NZ	Synlait Milk Ltd	B4JWJZ	New Zealand	-1.87
STB NO	Storebrand	485283	Norway	1.86	095190 KS	Emkorea Co Ltd	B24D54	Korea	-1.87
CS FP	AXA	708842	France	1.86	RX FP	Recylex SA	467940	France	-1.87
SYD AU	Sydney Airport	B70DWB	Australia	1.86	6194 JT	Atrae Inc	BYLGL	Japan	-1.86
CCOI	COGENT COMMUNICATIONS HLDGS	B06RWD1	USA	1.85	5290 JT	Vertex Corp	BFMZYL	Japan	-1.84
BBT	BB&T CORP	2830904	USA	1.84	EPW AU	ERM Power Ltd	B3W35X	Australia	-1.80
CB	CHUBB LTD	B3BQMF6	USA	1.84	6049 JT	ItoKuro Inc	BYMK2Q	Japan	-1.78
THULE SS	Thule Group AB	B5QXJ0	Sweden	1.82	4743 TT	Oneness Biotech Co Ltd	B606XG	Taiwan	-1.78
1618 HK	Metallurgical Corporation of China Ltd H Shares	B42SRM	China	1.81	3788 JT	Gmo Cloud KK	B0Q3FT	Japan	-1.77
MAY MK	Malayan Banking Bhd	655632	Malaysia	1.80	SASA TI	Sasa Polyester Sanayi AS	B03MXD	Turkey	-1.77

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

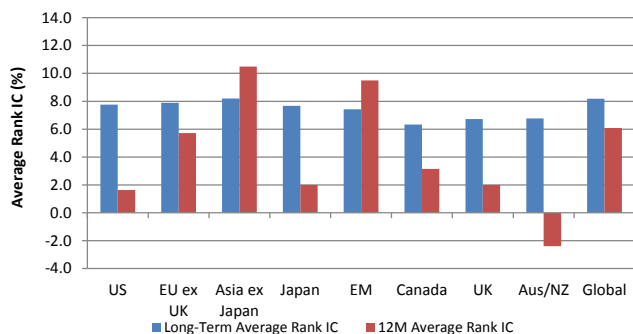
Past performance is no guarantee of future results. Transaction costs can vary. Additional information is available upon request.

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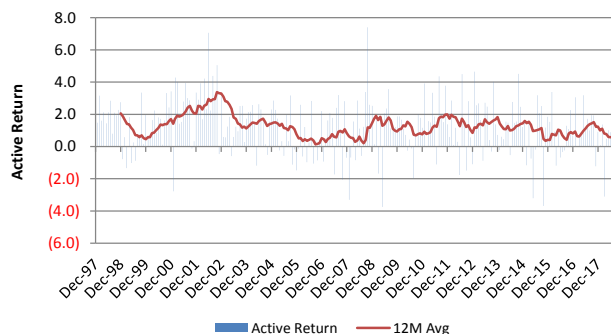


Figure 13 : Regional model performance, average rank IC



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

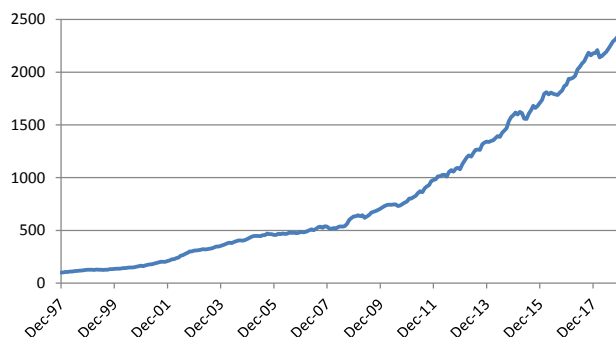
Figure 14 : Global portfolio active return, after costs



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

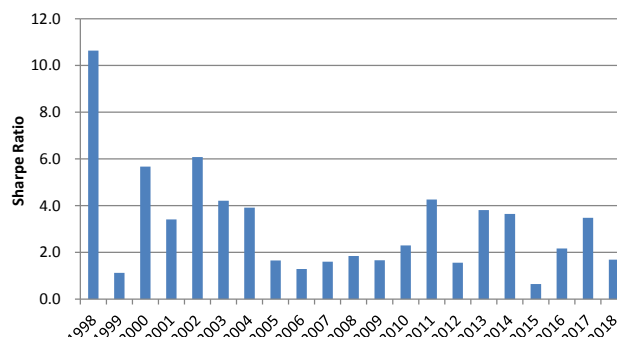
Figures below show the cumulative performance of the optimized strategy, and the annualized Sharpe Ratio (after costs) by calendar year.

Figure 15 : Global portfolio cumulative, after costs



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

Figure 16 : Annualized Sharpe Ratio, after costs



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



Top-down country rotation

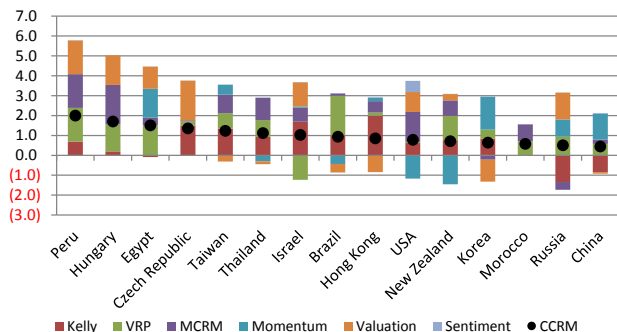
CCRM country rotation model

- 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

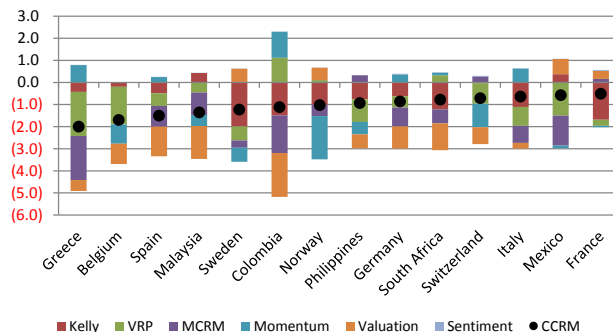
Figures below show the top and bottom third of countries, as ranked currently by our CCRM model. The bars show what is driving these calls.

Figure 17 : Top tercile countries



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

Figure 18 : Bottom tercile countries



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

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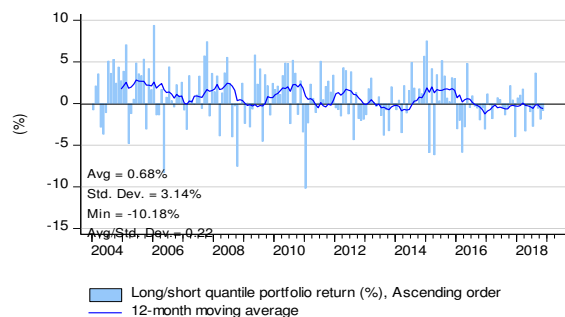


Model performance

Figures below show the performance of the model over time.

Figure 19 : Long/Short portfolio return (%)

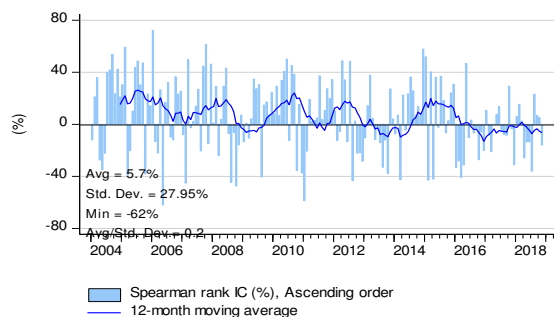
Composite CRM, equally weighted six-factor model



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

Figure 20 : Model performance with rank IC

Composite CRM, equally weighted six-factor model



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



Top-down asset allocation

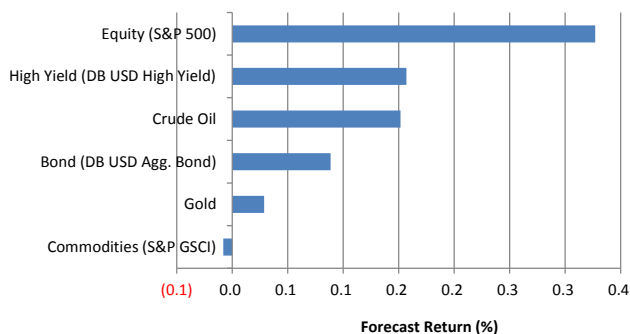
Quant Tactical Asset Allocation (QTAA) model

- 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

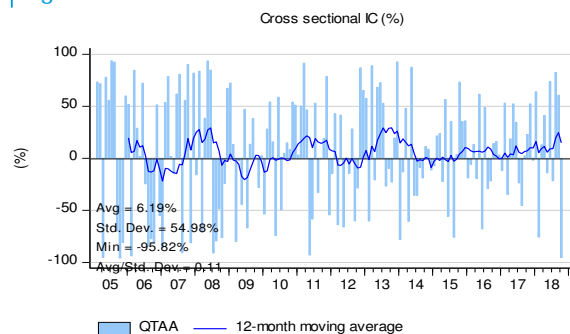
Figures below show the current ranking of our six asset classes, ranked from best to worst in terms of month-ahead forecast returns and the monthly performance of the QTAA model over time.

Figure 21 : Current QTAA forecasts



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

Figure 22 : Performance of QTAA model



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



Top-down style rotation

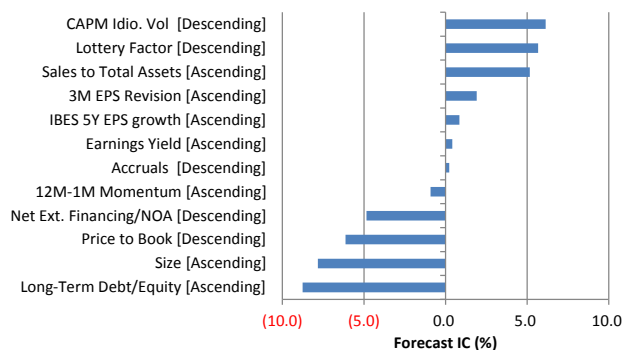
Style rotation model

- 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

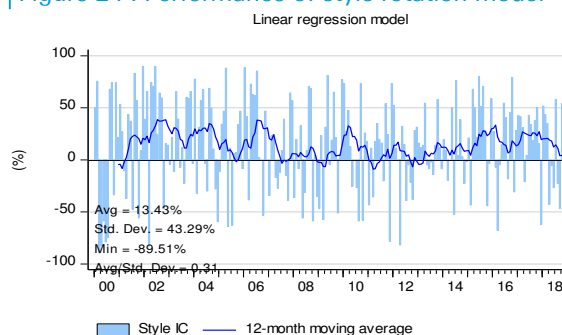
Figures below show the current ranking of our 12 factors, ranked from best to worst in terms of month-ahead forecast performance and the monthly performance of the Style Rotation model over time.

Figure 23 : Current Style Rotation forecasts



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

Figure 24 : Performance of style rotation model



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

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The Quant View



Appendix A: Factor performance

Figure 25 : US factor performance, measured as rank IC (Russell 3000 universe)

			Current	Average IC (%)							Since Inception					
Factor Name	Direction ¹	# of Stocks	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	2,994	11.34	2.04	2.58	2.82	13.93	0.20	42.59	(33.26)	0.00	371	2,891	54.99	98.22	
2 Expected dividend yield	Ascending	2,994	12.43	2.29	2.66	3.06	14.41	0.21	44.46	(33.89)	0.00	371	2,891	54.45	98.88	
3 Price-to-operating EPS, trailing 12M, Basic	Descending	2,132	(2.50)	(0.35)	(0.35)	2.28	10.33	0.22	30.82	(32.28)	0.00	295	2,324	56.27	93.60	
4 Operating earnings yield, trailing 12M, Basic	Ascending	2,970	8.11	0.65	2.81	4.57	12.40	0.37	47.24	(33.30)	0.00	295	2,887	62.37	95.33	
5 Earnings yield, forecast FY1 mean	Ascending	2,821	5.85	(1.00)	2.68	4.29	11.93	0.36	48.88	(34.61)	0.00	371	2,575	62.80	94.73	
6 Earnings yield, forecast FY2 mean	Ascending	2,817	2.52	(2.05)	2.38	3.70	11.62	0.32	47.02	(34.31)	0.00	371	2,490	63.07	94.34	
7 Earnings yield x IBES 5Y growth	Ascending	1,222	(6.81)	(3.43)	(0.14)	1.49	10.08	0.15	41.11	(26.63)	0.01	295	1,823	58.64	93.32	
8 Sector-rel Operating earnings yield, trailing 12M, Basic	Ascending	2,970	8.81	2.65	2.85	4.20	8.09	0.52	28.96	(14.90)	0.00	295	2,883	68.81	94.98	
9 Hist-rel Operating earnings yield, trailing 12M, Basic	Ascending	2,363	(2.72)	0.18	0.44	1.38	6.25	0.22	20.73	(18.74)	0.00	201	2,120	60.70	95.98	
10 Operating cash flow yield (income stmt def)	Ascending	2,994	(1.77)	(0.78)	1.88	3.75	10.73	0.35	47.14	(32.67)	0.00	371	2,891	62.80	94.79	
11 Cash flow yield, FY1 mean	Ascending	1,766	(7.97)	(2.63)	(0.96)	2.09	16.81	0.12	66.06	(54.29)	0.02	341	936	55.13	94.54	
12 Free cash flow yield	Ascending	2,901	5.12	1.93	2.30	4.66	7.79	0.60	31.93	(22.64)	0.00	334	2,576	73.95	94.43	
13 Price-to-sales, trailing 12M	Descending	2,889	(7.59)	(2.45)	(0.70)	1.36	10.86	0.13	30.02	(41.46)	0.02	371	2,813	55.26	98.59	
14 Price-to-book	Descending	2,838	(5.07)	(2.73)	(0.50)	0.54	10.81	0.05	26.28	(35.75)	0.34	371	2,776	47.71	95.72	
15 EBITDA/EV	Ascending	2,958	(11.22)	(0.83)	1.48	3.80	9.75	0.39	39.32	(27.15)	0.00	371	2,841	64.42	91.58	
16 Price-to-book adj for ROE, sector adj	Descending	2,678	(2.55)	(3.60)	(1.24)	0.26	8.58	0.03	22.50	(33.21)	0.56	371	2,465	47.98	95.74	
2. Growth																
17 Hist 5Y operating EPS growth	Descending	2,879	5.37	0.40	0.94	1.35	8.37	0.16	30.58	(22.70)	0.01	283	2,759	56.18	95.33	
18 Hist 5Y operating EPS acceleration	Ascending	2,879	(7.33)	(0.82)	0.31	0.84	6.29	0.13	25.31	(16.13)	0.02	283	2,759	55.83	93.00	
19 IBES 5Y EPS growth	Ascending	2,239	8.67	(0.09)	1.01	1.11	7.83	0.14	21.65	(27.86)	0.01	371	2,299	56.33	98.07	
20 IBES 5Y EPS growth/stability	Ascending	2,239	12.90	1.37	1.91	1.61	7.63	0.21	20.64	(19.20)	0.00	371	2,299	58.76	98.36	
21 IBES LTG EPS mean	Descending	1,487	9.92	(0.30)	(0.33)	1.40	14.84	0.09	37.64	(52.38)	0.07	371	2,082	48.79	97.10	
22 IBES FY2 mean DPS growth	Ascending	2,225	10.39	0.90	1.82	1.42	8.39	0.17	24.12	(21.96)	0.02	198	1,704	53.54	84.21	
23 IBES FY1 mean EPS growth	Ascending	2,707	(9.27)	(0.92)	0.92	1.12	7.21	0.15	20.76	(24.42)	0.00	371	2,547	61.46	88.83	
24 Year-over-year quarterly EPS growth	Ascending	2,959	(6.08)	(0.68)	0.76	2.41	6.71	0.36	23.85	(21.12)	0.00	295	2,894	55.42	79.08	
25 IBES FY1 mean CPFS growth	Descending	1,557	7.16	0.23	(0.78)	0.17	10.30	0.02	38.08	(42.07)	0.78	298	731	50.34	92.24	
26 IBES SUE, amortized	Ascending	2,676	(0.85)	0.93	1.63	1.07	6.18	0.17	20.62	(16.30)	0.00	310	1,400	56.77	72.96	
3. Price Momentum and Reversal																
27 Total return, 1D	Descending	2,994	8.50	(0.77)	1.83	4.62	7.15	0.65	16.33	(33.75)	0.00	371	2,891	76.38	1.90	
28 Total return, 21D (1M)	Descending	2,993	(0.06)	(1.03)	0.70	1.75	10.54	0.17	29.03	(43.69)	0.00	371	2,890	56.06	1.09	
29 Maximum daily return in last 1M (lottery factor)	Descending	2,987	11.73	4.24	4.21	5.10	14.56	0.35	39.13	(56.07)	0.00	371	2,784	64.15	50.48	
30 21D volatility of volume/price	Descending	2,994	0.50	0.66	0.58	0.43	6.54	0.07	24.16	(21.49)	0.21	371	2,882	52.02	52.37	
31 Total return, 252D (12M)	Ascending	2,877	(6.28)	0.60	(0.46)	2.90	13.90	0.21	39.62	(57.00)	0.00	371	2,802	62.26	89.68	
32 12M-1M total return	Ascending	2,877	(7.02)	0.33	(0.23)	3.66	13.09	0.28	37.65	(49.06)	0.00	371	2,802	62.80	88.28	
33 Price-to-52 week high	Ascending	2,910	6.93	3.02	2.12	3.20	17.30	0.18	49.63	(62.50)	0.00	371	2,104	61.19	84.47	
34 Total return, 1260D (60M)	Ascending	2,332	10.59	1.78	1.94	1.42	10.87	0.13	25.63	(35.41)	0.01	359	2,254	57.10	97.26	
4. Sentiment																
35 IBES LTG Mean EPS Revision, 3M	Ascending	1,470	(2.86)	(0.64)	(0.31)	0.76	3.81	0.20	11.16	(12.06)	0.00	371	2,054	60.65	58.84	
36 IBES FY1 Mean EPS Revision, 3M	Ascending	2,779	(0.88)	(1.00)	(0.27)	2.65	8.20	0.32	29.96	(33.00)	0.00	371	2,517	64.96	71.70	
37 IBES FY1 EPS up/down ratio, 3M	Ascending	2,774	(1.95)	(0.63)	0.29	2.82	7.64	0.37	27.54	(28.44)	0.00	371	2,995	67.12	78.90	
38 Expectation gap, short-term - long-term	Descending	2,108	11.60	3.65	1.65	1.22	5.37	0.23	11.80	(19.91)	0.00	371	2,128	57.95	91.12	
39 IBES FY1 Mean CPFS Revision, 3M	Ascending	1,716	(1.20)	0.82	0.55	1.98	14.64	0.13	69.38	(75.04)	0.01	340	868	63.24	61.38	
40 IBES FY1 Mean SAL Revision, 3M	Ascending	2,729	(4.14)	(0.42)	0.84	1.31	7.76	0.17	27.43	(24.32)	0.01	270	2,290	61.48	67.88	
41 IBES FY1 Mean FFO Revision, 3M	Ascending	188	17.09	3.80	2.27	2.51	19.47	0.13	71.43	(80.00)	0.02	343	99	56.85	67.94	
42 IBES FY1 Mean DPS Revision, 3M	Ascending	1,321	(4.43)	(1.58)	(0.08)	0.68	5.08	0.13	14.91	(17.55)	0.06	195	1,105	58.97	63.50	
43 IBES FY1 Mean ROE Revision, 3M	Ascending	2,831	(0.88)	0.81	0.68	1.01	6.21	0.16	23.70	(18.19)	0.02	295	2,804	59.49	60.68	
44 Recommendation, mean	Descending	2,831	(6.21)	(1.56)	(0.51)	0.67	7.49	0.09	21.85	(19.41)	0.12	300	2,694	57.00	94.87	
45 Mean recommendation revision, 3M	Descending	2,810	(2.11)	0.12	(0.14)	1.00	3.88	0.26	19.86	(11.55)	0.00	297	2,680	61.95	60.74	
46 Target price implied return	Descending	2,809	9.14	4.06	2.03	0.44	15.94	0.03	60.74	(39.59)	0.67	236	2,533	48.73	81.04	
47 Mean target price revision, 3M	Ascending	2,789	(4.27)	1.17	0.68	2.20	12.35	0.18	30.14	(41.94)	0.01	233	2,519	61.37	74.61	
5. Quality																
48 ROE, trailing 12M	Ascending	2,828	8.48	2.27	3.05	3.81	10.05	0.38	33.42	(29.52)	0.00	295	2,853	65.42	93.97	
49 Return on invested capital (ROIC)	Ascending	2,954	7.35	2.65	3.40	4.12	10.18	0.40	33.02	(31.24)	0.00	295	2,870	68.81	95.85	
50 Sales to total assets (asset turnover)	Ascending	2,887	(4.04)	1.70	0.79	1.38	8.52	0.16	22.78	(22.02)	0.00	371	2,825	55.53	99.20	
51 Operating profit margin	Ascending	2,884	0.97	3.92	3.07	1.38	5.59	0.25	16.98	(14.17)	0.00	371	2,745	60.92	97.86	
52 Current ratio	Descending	2,246	(1.93)	2.48	0.87	1.69	10.12	0.17	31.95	(38.66)	0.00	371	2,244	54.18	97.54	
53 Long-term debt/equity	Ascending	2,823	2.96	(0.24)	(0.17)	0.68	9.31	0.07	35.65	(28.14)	0.16	371	2,760	49.60	96.83	
54 Altman's z-score	Ascending	2,135	6.13	3.32	2.61	0.70	9.15	0.08	31.74	(30.44)	0.14	371	2,160	51.48	97.62	
55 Merton's distance to default	Ascending	2,380	15.25	5.35	3.99	3.58	12.08	0.30	35.09	(41.45)	0.00	371	2,350	66.04	94.43	
56 Ohlson default model	Descending	2,176	2.18	3.23	3.05	2.38	6.53	0.36	16.95	(25.59)	0.00	334	2,140	67.96	98.08	
57 Accruals (Sloan 1996 def)	Descending	2,108	(4.68)	1.54	(0.47)	0.28	4.22	0.07	12.07	(15.48)	0.20	371	2,141	53.64	87.90	
58 Firm-specific discretionary accruals	Descending	1,012	(4.52)	1.56	(0.62)	0.20	3.68	0.05	10.45	(12.89)	0.34	311	1,936	53.70	65.70	
59 Hist 5Y operating EPS stability, coef of determination	Ascending	2,879	3.42	(0.25)	0.15	0.89	4.90	0.18	20.01	(12.27)	0.00	283	2,759	52.30	97.09	
60 IBES 5Y EPS stability	Descending	2,239	11.61	2.14	2.15	1.36	8.26	0.16	25.00	(34.33)	0.00	371	2,299	55.26	98.90	
61 IBES EPS dispersion	Descending	2,821	12.58	4.52	3.93	1.97	9.43	0.21	31.67	(28.25)	0.00	371	2,575	60.65	83.05	
62 Payout on trailing operating EPS	Ascending	2,132	11.72	2.03	0.76	0.73	12.95	0.06	38.55	(30.91)	0.28	371	2,204	49.33	97.17	
63 YoY change in # of shares outstanding	Descending	2,897	10.16	3.01	2.36	2.58	8.87	0.29	19.53	(46.21)	0.00	371	2,788	60.11	92.26	
64 YoY change in debt outstanding	Descending	2,363	(3.15)	(1.29)	(1.31)	0.04	4.06	0.01	13.07	(10.40)	0.85	371	2,228	53.37	89.47	
65 Net external financing/net operating assets	Ascending	2,977	1.10	1.15	1.19	2.27	8.45	0.27	44.61	(21.76)	0.00	371	2,857	60.38	94.58	
66 Piotroski's F-score	Ascending	2,994	1.04	0.32	1.78	2.82	8.04	0.35	29.20	(27.83)	0.00	371	2,893	67.65	88.73	
67 Mohanram's G-score	Ascending	542	5.24	4.46	3.03	2.61	9.83	0.27	35.27	(32.14)	0.00	283	420	58.66	95.54	
6. Technicals																
68 # of days to cover short	Descending	414	(2.33)	0.44	2.10	2.18	7.29	0.30	33.80	(25.16)	0.00	371	2,031	59.57	91.96	
69 CAPM beta, 3Y monthly	Descending	4,151	1.35	2.49	1.60	10.12	12.68	0.08	40.19	(42.70)	0.16	312	3,061	50.96	96.38	
70 CAPM idiosyncratic vol, 1Y daily	Descending	3,140	18.33	4.41	4.99	5.27	17.58	0.30	42.60	(60.80)	0.00	359	2,909	62.12	98.76	
71 Realized vol, 1Y daily	Descending	2,911	18.55	4.69	4.88	5.11	18.26	0.28	42.69	(59.63)	0.00	371	2,807	61.19	98.59	
72 Skewness, 1Y daily	Descending	2,911	8.82	1.11	1.39	1.15	5.36	0.21	13.93	(22.86)	0.00	371	2,807	56.33	89.86	
73 Kurtosis, 1Y daily	Descending	2,911	3.78	(1.77)	(0.07)	1.32	5.60	0.24	15.28	(15.82)	0.00	371	2,807	61.19	91.50	
74 Idiosyncratic vol surprise	Descending	2,930	(11.64)	(1.09)	0.15	2.54										

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The Quant View



Figure 26 : Global factor performance, measured as rank IC (S&P BMI World universe)

Factor Name	Direction ¹	Current # of Stocks	Average IC (%)			Since Inception										Serial Corr (%) ³
			Last M	12M Avg	3Y Avg	Avg	Std Dev	Avg / Std Dev	Max	Min	p-value ²	# of Months	Avg # of Stocks	Hit Rate (%)		
1. Value																
1 Dividend yield, trailing 12M	Ascending	10,874	2.71	3.94	4.76	4.16	9.97	0.42	36.88	(23.89)	0.00	347	8,524	64.84	97.86	
2 Dividend yield, FY1	Ascending	8,303	1.10	2.15	2.84	3.84	10.22	0.38	32.17	(22.90)	0.00	290	5,900	63.10	98.25	
3 Dividend yield, FY2	Ascending	8,236	1.04	1.93	2.74	3.67	10.31	0.36	33.19	(24.39)	0.00	280	5,879	62.86	98.25	
4 Price/Earnings	Descending	8,961	0.74	(0.60)	1.41	3.41	12.29	0.28	39.66	(50.73)	0.00	340	6,781	59.41	96.39	
5 Price-to-FY0 EPS	Descending	8,642	1.56	(2.13)	0.37	2.29	9.96	0.23	28.98	(37.08)	0.00	347	6,458	59.08	96.55	
6 Earnings yield, FY0	Ascending	9,858	5.32	0.21	2.21	3.60	8.77	0.41	31.67	(18.68)	0.00	347	7,482	62.54	96.47	
7 Earnings yield, forecast FY1 mean	Ascending	9,066	4.64	(0.91)	1.96	4.16	10.41	0.40	35.35	(22.20)	0.00	347	6,913	62.82	95.80	
8 Earnings yield, forecast FY2 mean	Ascending	8,957	3.24	(2.37)	1.43	3.69	11.38	0.32	37.31	(31.50)	0.00	347	6,749	60.23	95.93	
9 Cash flow yield, FY0	Ascending	7,475	(1.99)	(0.84)	0.89	3.03	6.64	0.46	26.42	(11.80)	0.00	223	5,558	68.16	97.40	
10 Cash flow yield, FY1 mean	Ascending	6,356	(1.46)	(2.40)	0.22	1.39	9.50	0.15	31.42	(32.01)	0.01	279	4,921	54.12	96.01	
11 Price/Sales	Descending	10,326	(0.67)	(2.44)	1.26	1.31	9.11	0.14	26.48	(31.59)	0.01	347	7,997	55.62	99.27	
12 Price/Book	Descending	10,430	0.90	(1.27)	0.83	0.86	10.23	0.08	31.56	(37.54)	0.12	347	8,053	54.76	98.45	
13 Est Book-to-price, median	Ascending	7,865	0.18	(2.29)	0.03	0.49	9.68	0.05	30.37	(26.29)	0.45	231	6,072	51.52	98.29	
14 EBITDA to EV	Ascending	3,184	(2.52)	(1.21)	1.10	3.83	10.64	0.36	36.69	(26.20)	0.00	347	5,004	62.54	95.65	
15 Sales/EV	Ascending	10,242	(2.11)	(2.32)	1.59	1.86	7.48	0.25	24.81	(20.06)	0.00	347	7,946	62.25	99.05	
2. Growth																
16 IBES 5Y EPS growth	Ascending	8,839	3.51	1.15	1.16	1.24	5.84	0.21	19.09	(21.86)	0.00	347	6,666	60.52	98.03	
17 EPS Growth	Ascending	9,714	(2.59)	0.34	0.69	1.99	6.37	0.31	29.72	(28.97)	0.00	331	7,409	64.95	87.97	
18 IBES LTG EPS mean	Descending	4,029	(2.15)	1.00	0.12	1.10	11.22	0.10	28.22	(40.36)	0.07	347	4,280	51.30	96.50	
19 IBES FY1 mean EPS growth	Ascending	8,731	(2.01)	(0.90)	(0.48)	0.31	5.80	0.05	14.44	(20.10)	0.32	347	6,753	53.60	88.71	
20 IBES FY1 mean CFPS growth	Descending	5,568	1.25	1.01	0.76	1.48	3.99	0.37	7.47	(11.39)	0.00	223	4,311	62.33	91.72	
21 IBES FY2 mean DPS growth	Ascending	8,221	5.91	(1.26)	0.48	2.02	10.12	0.20	38.85	(31.49)	0.00	289	5,760	58.48	88.38	
22 Asset growth	Descending	10,298	(3.49)	0.50	0.57	0.60	7.91	0.08	21.57	(27.36)	0.16	347	7,814	52.16	93.74	
3. Price Momentum and Reversal																
23 Total return, 1D	Descending	10,897	2.08	2.64	1.87	3.39	7.01	0.48	21.94	(41.58)	0.00	347	8,621	70.89	1.83	
24 Weekly Total Return	Descending	10,897	15.51	3.24	2.98	2.73	8.34	0.33	30.60	(33.64)	0.00	347	8,620	64.27	1.29	
25 Total return, 21D (1M)	Ascending	10,895	(10.16)	(1.38)	(1.39)	0.10	10.75	0.01	27.69	(44.07)	0.87	347	8,615	52.16	3.86	
26 Total return, 252D (12M)	Ascending	10,639	(10.30)	1.04	1.18	4.10	13.78	0.30	41.64	(46.50)	0.00	347	8,402	66.57	90.61	
27 12M-1M total return	Ascending	10,639	(6.97)	1.56	1.76	4.65	13.29	0.35	40.96	(42.52)	0.00	347	8,402	68.01	88.94	
28 Total return, 1260D (60M)	Ascending	9,093	2.60	0.80	0.65	1.57	13.25	0.12	40.32	(44.84)	0.03	347	6,912	58.79	97.71	
4. Sentiment																
29 IBES LTG Mean EPS Revision, 1M	Ascending	4,023	(2.71)	0.14	0.22	0.63	2.57	0.25	7.26	(8.59)	0.00	347	4,245	61.67	1.22	
30 IBES LTG Mean EPS Revision, 3M	Ascending	3,984	(1.41)	0.68	0.46	0.81	3.34	0.24	11.05	(10.26)	0.00	347	4,191	61.38	60.68	
31 IBES FY1 EPS up/down ratio, 1M	Ascending	4,915	(9.77)	1.34	1.21	3.44	5.34	0.64	17.76	(13.76)	0.00	347	4,615	75.22	34.19	
32 IBES FY1 EPS up/down ratio, 3M	Ascending	8,171	(8.10)	1.31	1.26	3.46	5.65	0.61	17.92	(12.36)	0.00	347	6,231	74.06	78.22	
33 IBES FY1 Mean EPS Revision, 1M	Ascending	8,946	(7.23)	1.46	0.98	2.68	4.97	0.54	16.50	(12.79)	0.00	347	6,761	71.47	23.23	
34 IBES FY1 Mean EPS Revision, 3M	Ascending	8,825	(6.83)	1.57	1.03	3.21	6.42	0.50	19.37	(20.12)	0.00	347	6,665	72.62	73.79	
35 IBES FY1 Mean CFPS Revision, 3M	Ascending	6,129	(1.68)	0.83	0.74	2.25	5.19	0.43	15.81	(23.83)	0.00	269	4,731	74.72	63.41	
36 IBES FY1 Mean DPS Revision, 1M	Ascending	6,676	(4.81)	1.59	1.27	1.70	4.14	0.41	12.65	(16.63)	0.00	288	4,850	72.92	10.97	
37 IBES FY1 Mean DPS Revision, 3M	Ascending	6,618	(9.39)	1.02	1.09	2.16	5.54	0.39	19.08	(24.51)	0.00	286	4,792	71.33	65.94	
38 IBES FY1 Mean FFO Revision, 1M	Ascending	8,047	(5.25)	1.50	1.06	2.05	3.96	0.52	11.73	(8.89)	0.00	215	5,204	75.81	13.49	
39 IBES FY1 Mean FFO Revision, 3M	Ascending	7,860	(5.59)	2.07	1.14	2.71	5.51	0.49	16.27	(14.53)	0.00	212	5,104	72.64	67.85	
40 IBES FY1 Mean ROE Revision, 1M	Ascending	8,945	(5.05)	1.16	1.10	1.73	4.06	0.43	13.70	(10.51)	0.00	267	6,172	68.16	15.49	
41 IBES FY1 Mean ROE Revision, 3M	Ascending	8,818	(6.65)	0.96	1.12	2.16	5.03	0.43	15.70	(13.58)	0.00	265	6,049	69.06	69.49	
42 Target price implied return	Descending	8,885	(5.78)	2.44	0.96	1.15	13.18	0.09	55.58	(36.25)	0.19	231	6,993	54.55	82.97	
43 Recommendation, mean	Descending	9,147	1.46	(2.26)	(0.88)	1.47	6.59	0.22	17.41	(16.84)	0.00	300	7,598	63.33	94.76	
44 Mean recommendation revision, 3M	Descending	9,094	(2.61)	0.32	(0.00)	1.60	2.84	0.56	10.01	(10.13)	0.00	297	7,573	71.38	60.24	
5. Quality																
45 Return on Equity	Ascending	10,301	3.25	2.68	3.04	4.05	9.40	0.43	30.68	(34.69)	0.00	299	8,158	68.90	97.20	
46 return on capital	Ascending	10,329	3.66	1.67	2.64	4.19	11.42	0.37	49.47	(34.02)	0.00	347	7,546	66.28	98.02	
47 Return on Assets	Ascending	10,417	1.22	4.50	3.48	4.67	12.55	0.37	44.20	(30.31)	0.00	347	7,666	65.13	98.07	
48 Asset Turnover	Ascending	10,341	(6.56)	4.10	2.55	2.77	15.77	0.18	44.64	(51.55)	0.00	347	8,051	58.21	99.86	
49 Gross margin	Ascending	9,795	(2.98)	3.75	1.45	1.76	5.55	0.32	16.60	(13.45)	0.00	347	7,391	63.40	98.96	
50 EBITDA margin	Ascending	10,429	(3.90)	4.34	2.56	3.90	13.18	0.30	42.97	(41.30)	0.00	347	8,074	59.94	96.68	
51 Berry Ratio	Ascending	8,504	(1.82)	0.82	1.72	2.49	8.88	0.28	29.57	(20.79)	0.00	347	5,859	58.79	97.93	
52 IBES FY1 EPS dispersion	Descending	9,066	4.81	2.77	1.17	0.92	9.45	0.10	32.68	(25.37)	0.07	347	6,913	52.74	88.04	
53 IBES 5Y EPS growth/stability	Ascending	8,837	4.53	2.19	1.57	1.59	5.74	0.28	18.66	(20.47)	0.00	347	6,666	61.38	98.30	
54 YoY change in debt outstanding	Descending	8,683	0.35	(0.41)	(0.24)	0.20	3.66	0.06	11.51	(11.34)	0.30	347	6,695	53.31	91.55	
55 Current ratio	Descending	8,724	(0.68)	(0.11)	0.08	0.53	8.39	0.06	27.86	(27.01)	0.24	347	6,603	49.57	98.55	
56 Long-term debt/equity	Ascending	10,246	(6.25)	1.78	1.30	0.81	6.25	0.13	22.37	(18.17)	0.02	347	7,957	54.76	98.91	
57 Merton's distance to default	Ascending	9,117	1.45	5.01	3.05	2.92	10.76	0.27	31.19	(31.18)	0.00	347	6,896	61.67	93.16	
58 Capex to Dep	Descending	8,364	(4.42)	2.59	1.18	1.54	6.50	0.24	22.38	(19.93)	0.00	347	5,756	60.52	97.14	
6. Technicals																
59 Realized vol, 1Y daily	Descending	10,630	(3.26)	7.94	5.94	5.33	14.41	0.37	29.45	(44.64)	0.00	347	8,407	63.11	98.96	
60 Skewness, 1Y daily	Descending	10,630	0.04	4.24	3.52	1.83	5.21	0.35	15.03	(32.98)	0.00	347	8,407	65.99	90.10	
61 Moving average crossover, 15W-36W	Ascending	10,584	(12.26)	2.00	2.11	2.94	13.78	0.21	37.15	(45.46)	0.00	347	7,552	63.69	91.33	
62 Normalized abnormal volume	Ascending	10,868	(3.12)	4.70	3.59	2.57	6.29	0.41	20.47	(14.71)	0.00	347	8,417	63.98	66.89	

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

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