



## A Performance Study on Initial Public Offerings

### Quantitative macro and micro forecasts for this month

In this report we present our latest small cap quantitative forecasts for the coming month. Our models are designed to generate both bottom-up stock selection ideas as well sector rotation and market timing calls.

### Conditions seem ripe for an increase of IPO activity

With the market reaching all time highs combined with an onslaught of venture backed growth and startup companies; the market seems ripe for an increase in IPO activity.

### Analyzing the performance of IPOs is not an easy task

Most financial databases do not contain IPO pricing or fundamental prospectus data. As such, analyzing the performance of IPOs can be challenging.

### An event study on IPO performance

In this month's edition of the Quant View we take on this challenge by analyzing the performance of US companies post an IPO. We analyze approximately two thousand IPOs from 1990 to 2013.

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# Analyzing IPOs

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## Analyzing the performance of IPOs is challenging

With the market reaching all time highs and an onslaught of venture backed innovative growth and startup companies, conditions are ripe for an increase in IPO activity. However, analyzing the historical performance of IPOs is not a straightforward task. Most financial databases do not contain IPO data. Typical quantitative databases do not contain any fundamental prospectus data. The vast majority of IPOs in the US market occurred prior to 2001; therefore, obtaining high quality historical pricing and fundamental data can be difficult. As such, assessing the performance of IPOs is a challenging feat. In this month's edition of the Quant View we take on this challenge by analyzing the performance of US companies post an IPO. We analyze approximately two thousand IPOs from 1990 to 2013. Our small cap IPO universe is composed of stock with an approximate IPO market value of less than \$300M. The goal is to investigate the performance of stocks after their IPO date and possibly identify certain characteristics that may help investors in their selection process.

### IPOs in the US are in decline

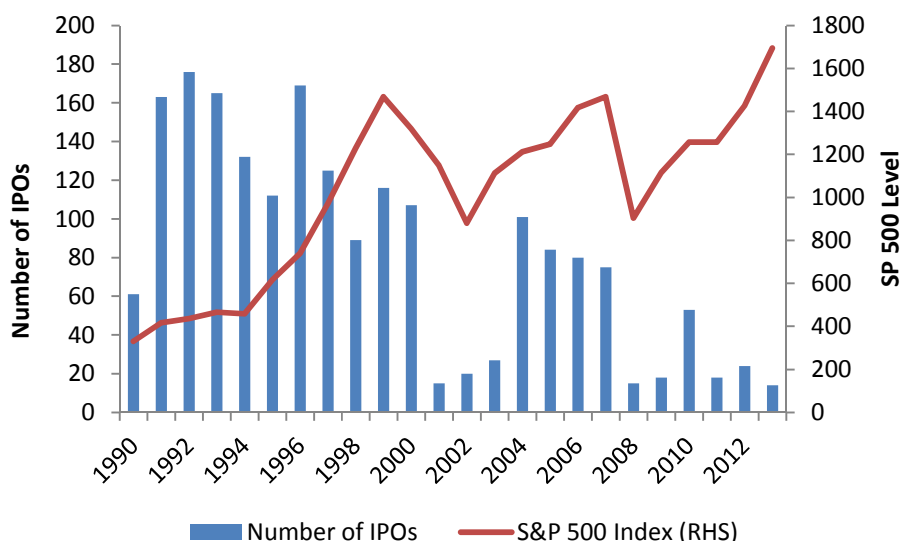
We begin with Figure 1 which shows the number of IPOs over time. From 1990 to 2013, there were approximately two thousand IPOs in the US market with a strong run up during the technology bubble. Thereafter, the number of IPOs has declined significantly since the late 1990's. Recent academic studies point out that the decline in IPOs can be attributed to increased regulation around that market as well as additional costs imposed on publicly traded companies.<sup>1</sup> Figure 1 also shows that the number of IPOs is strongly correlated to market performance. This is not too surprising since most companies would prefer to IPO during stable or rising market conditions.

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<sup>1</sup> For more information, see Ritter, Jay R. and Gao, Xiaohui and Zhu, Zhongyan, Where Have All the IPOs Gone? (August 26, 2013). Available at SSRN: <http://ssrn.com/abstract=1954788> or <http://dx.doi.org/10.2139/ssrn.1954788>



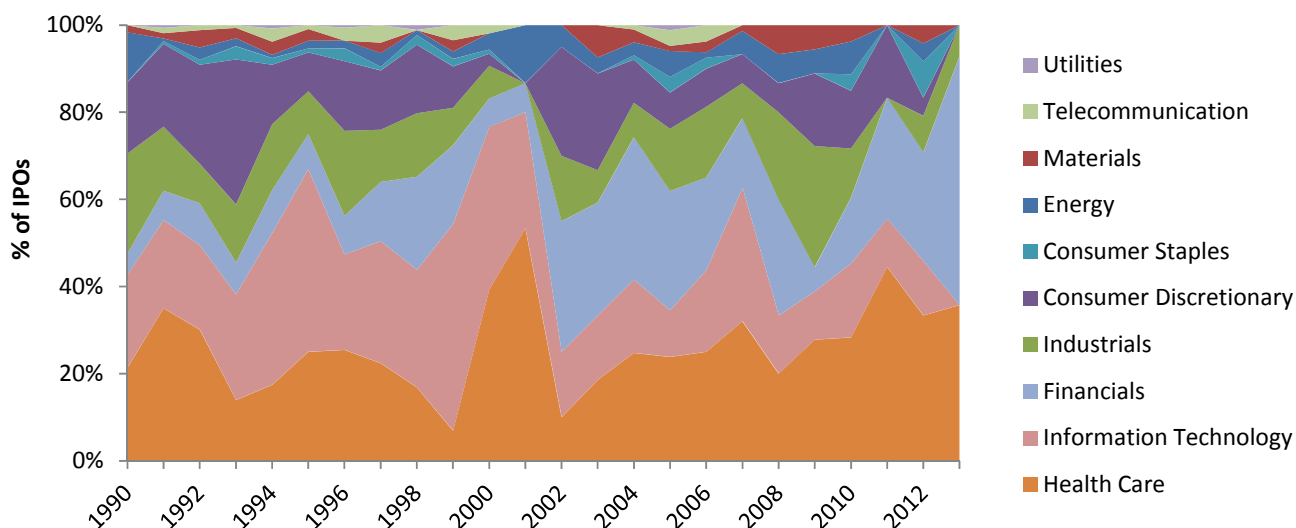
Figure 1: Number of IPO's overtime within the US market



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

The get a sense of sector level IPO activity, Figure 2 shows the percentage of IPOs within each sector. The vast majority of IPOs over time tend to be Technology and Health Care stocks, while Utility and Telecommunication stocks have had the least number of IPOs.

Figure 2: Percentage of IPOs within each sector overtime



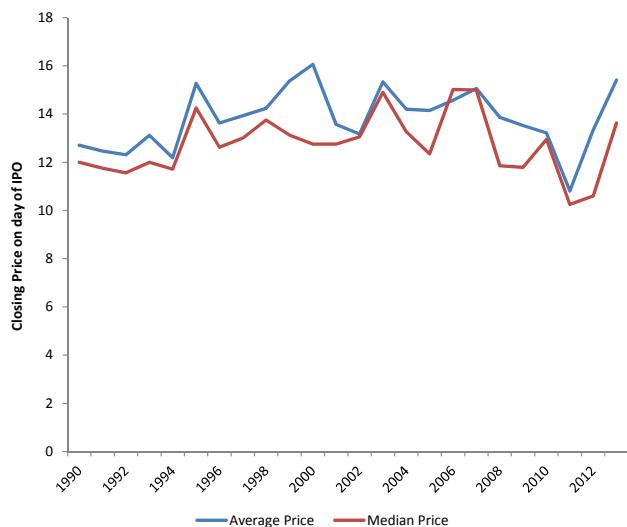
Source: Bloomberg Finance LLP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 3 shows the average and median closing stock price for US stocks on the day of the IPO. This is not the IPO price but it provides an approximate proxy of the average IPO price for US stocks over time. The figure also shows that there was an increase in IPO pricing during the technology bubble.



Figure 4 shows the median market cap for US stocks after an IPO. This again is not the IPO valuation, but a proxy of it. We see elevated levels of IPO valuation during the technology bubble of the late 1990s. More recently, IPO valuations have increased substantially.

Figure 3: Average price on the day after an IPO



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

Figure 4: Average market cap after IPO



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

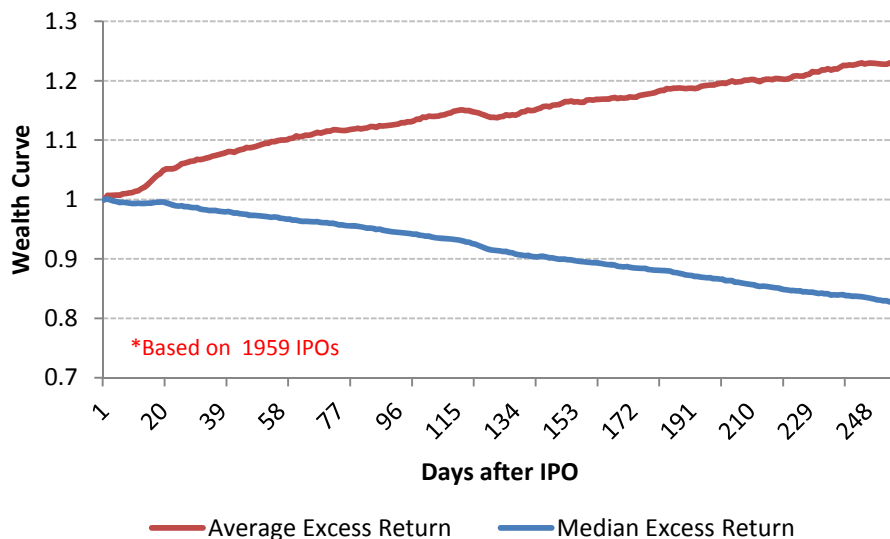
### Post IPO performance is on average promising

Understandably, investors are most interested in post IPO performance. To analyze this, Figure 5 shows the results of an IPO event study based on our sample of approximately two thousand IPOs in the US market. Essentially, our event study aligns all the IPOs together and calculates the average performance of all the stocks post the IPO date. We examine the average excess cumulative performance around the time of an IPO to one year after the IPO (Figure 5). The first quite promising result from the analysis is that the average one year excess return post an IPO is approximately 23%. Just to be clear, returns are based on from the day after the IPO to one year following the IPO date. This is because our financial database does not contain the IPO price. So this analysis assumes that investors purchase the stock the day after an IPO. As such there may be additional performance to be gained if investors are able to secure the IPO price.

Figure 5 also shows that the median excess cumulative performance underperforms the average as the IPO progresses over time. This means that the distribution of excess returns is skewed, implying that a majority of IPOs underperform one year after going public, but there are a number of IPOs that significantly outperform. These results may look tempting to those interested in selecting only those outsize performing IPOs, but as we will see in the next section, it may be safer to invest in all offerings to secure positive performance. Figure 5 also shows that a significant portion of the outperformance is derived within the first month (21 days) of an IPO where the average excess performance increases sharply and the median excess performances remains fairly stable.



Figure 5: Average/Median excel wealth following an IPO

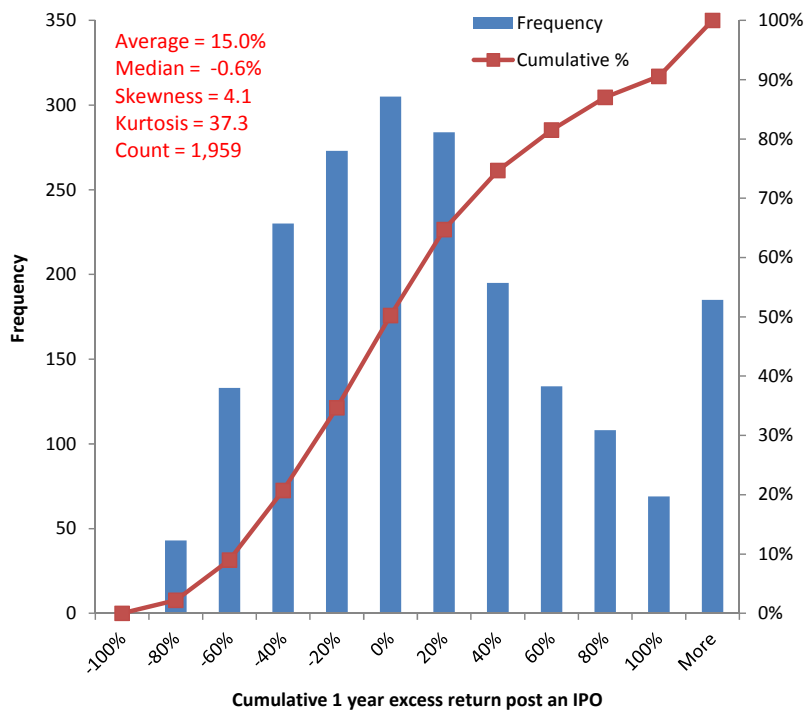


Source: Bloomberg Finance LLP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Another approach to analyze the performance of IPOs is to plot the distribution of individual excess company returns, one year post the IPO date (Figure 6). At the company level, we see an auspicious average excess performance of approximately 15% over the sample of IPOs. We also see a cluster of companies that have excess returns of greater than 100%. This uneven performance across IPOs leads to a distribution of excess returns that is positively skewed and has excess kurtosis, which is another way of saying the distribution is heavy to the right tail.



Figure 6: Distribution of 1 year excess returns



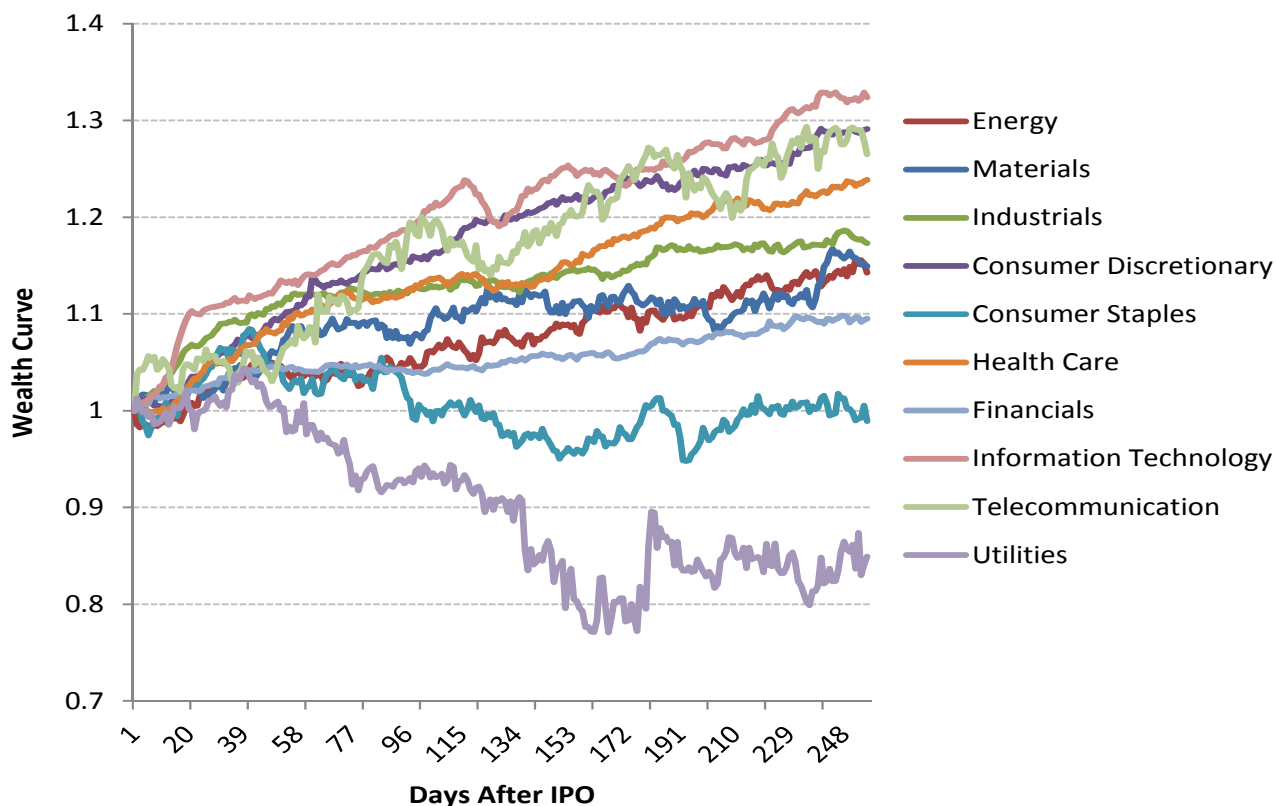
Source: Bloomberg Finance LLP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

### IPO performance by sector

Examining IPOs within sectors can help reveal any important or significant sector performance differences. Figure 7 shows the average excess performance across sectors. The results show that Consumer Discretionary and Information Technology stocks show the best average performance over the sample.



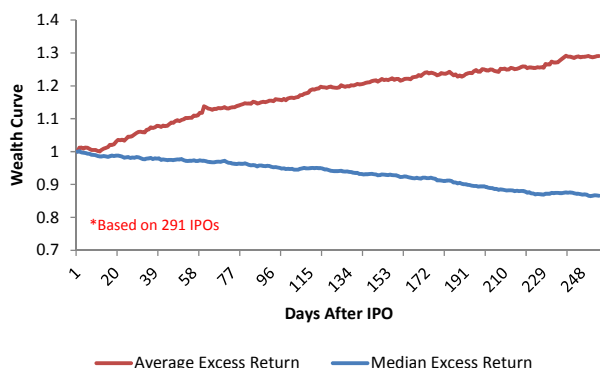
Figure 7: Average excess performance post IPO by sector



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

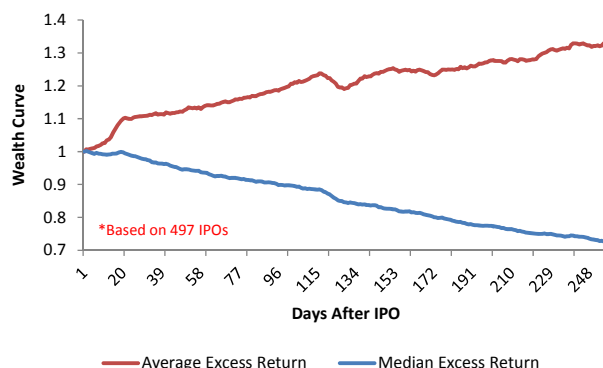
An event study similar to that in Figure 5 can give a more detailed picture of performance in for Consumer Discretionary and Technology IPOs (Figure 8 and Figure 9).

Figure 8: IPO event study for Consumer Discretionary stocks



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

Figure 9: IPO event study for Technology stocks

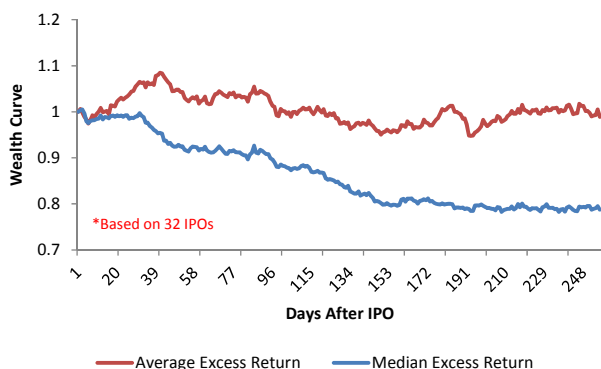


Source: Bloomberg Finance LLP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank



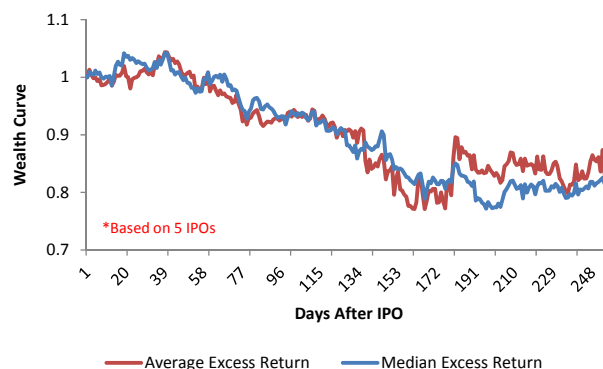
The results in Figure 7 also show that Consumer Staples and Utility are the worst performing IPO sectors over the sample. Figure 10 and Figure 11 verify this result using the event study analysis. However, we must keep in mind that these sectors have the least number of stocks and IPOs in our sample. Our financial database has approximately thirty-two and five IPOs for Consumer Staples and Utility stocks, respectively. This lack of data will undoubtedly limit the accuracy of these results within these two sectors.

Figure 10: IPO event study for Consumer Staple stocks



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

Figure 11: IPO event study for Utility stocks



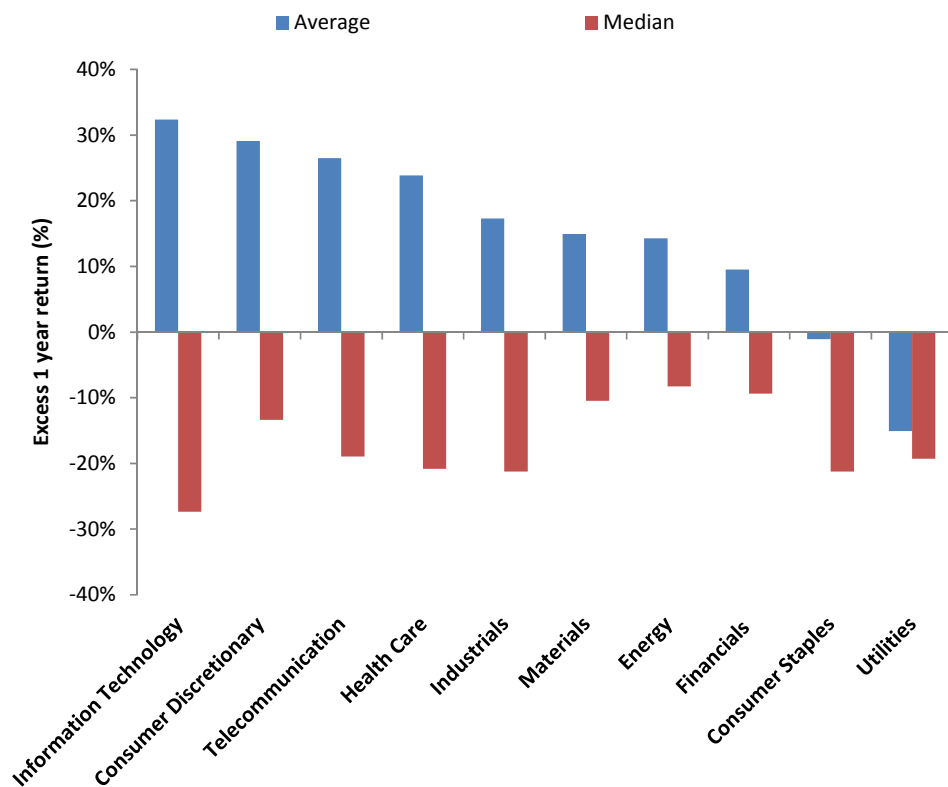
Source: Bloomberg Finance LLP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Similar to the result in Figure 5 our analysis at the sector level also shows a divergence between the average and median one year excess returns. This skewed result implies that a majority of IPOs underperform after one year; nonetheless, the smaller number of IPOs which outperform have such outside returns that it causes the average one-year return to IPO investing to be positive over time. These results suggest that, barring any significant IPO selection ability, investors should invest across all the IPOs in order to capture the significant upside offered by a minority of the deals.





Figure 12: 1 year post IPO performance by sector



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



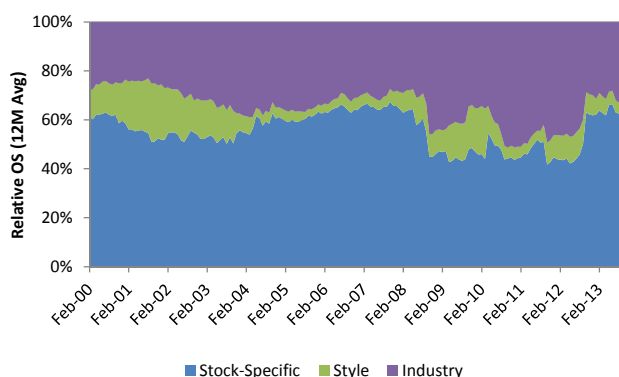
# Small caps, big opportunity

In this month's "The Quant View: Small Cap Edition" we analyze various quantitative and fundamental models to show that there is greater stock level differentiation among smaller cap stocks, which presents alpha opportunities for investors. This monthly publication will also point out the various noteworthy observations from our models specifically for small cap stocks. For this report, we will use the Russell 2000 index to define our small caps universe. Where we compare to large caps, we will use the Russell 1000 as our proxy.

## The small cap opportunity set

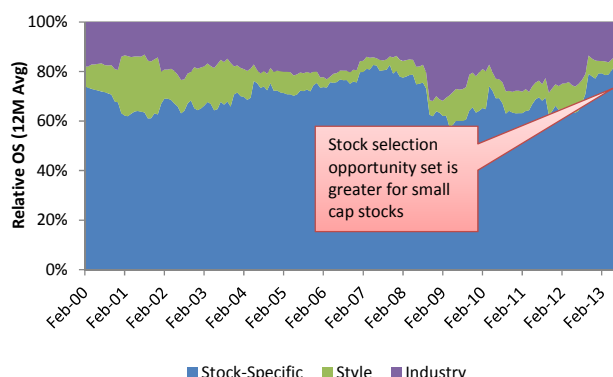
We think of the opportunity set as the total available alpha on the table. Our main interest is to understand what is driving that opportunity, because this can allow us to position our strategies to pick in the orchard with the juiciest fruit. In Figure 13 we show the opportunity set for the large cap universe, and in Figure 14 we show the opportunity set for the small cap universe.

Figure 13: Large cap opportunity set



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

Figure 14: Small cap opportunity set



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

Both charts actually tell a similar story. The key result is the size of the blue portion relative to the other colors. The blue 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 industries and styles. When the financial crisis exploded 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, earnings quality, etc.) shrunk sharply; no one cared if a stock looked good on fundamentals if it was exposed to Europe for example. Needless to say, such an environment was challenging for quants and non-quants alike, since both camps tend to use stock specific information to differentiate between stocks.

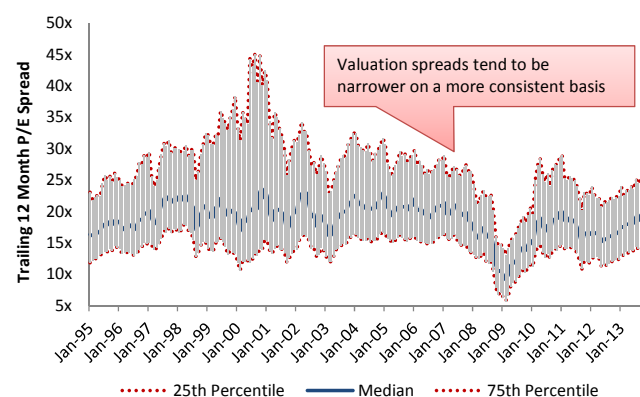
However, the good news is that both charts show that bottom-up stock picking is making a strong comeback. The blue area in both charts has reached levels last seen in 2007. The crucial observation is that the relative opportunity coming from stock selection is higher for small cap stocks. In other words,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



## Valuation spreads

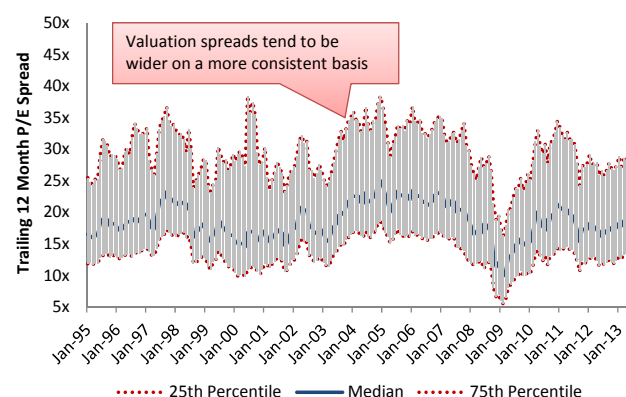
Similar to the opportunity set, valuation spreads allow investors to gauge the level of stock selection opportunity in the market. Widening valuation spreads typically indicate more stock-level differentiation and therefore a better environment for stock selection. On the other hand, narrowing valuation spreads are indicative of lower levels of stock differentiation. Figure 15 and Figure 16 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. Note that during the past month, valuation spreads have remained fairly consistent within small caps.

Figure 15: Large cap valuation spreads



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

Figure 16: Small caps valuation spreads



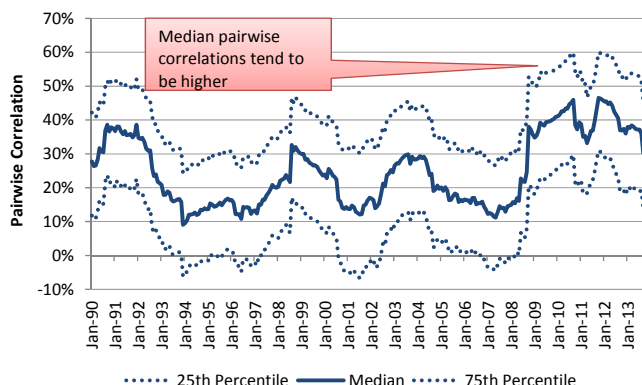
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

## Keeping an eye on correlations

Closely related to the opportunity set and valuation spreads is the median pairwise correlation among stocks in the market. 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 17 shows the median pairwise correlation for large caps. While it has come down from the peak in the financial crisis, it is still relatively high compared to its long-term average, so investors are not yet completely out of the woods. Interestingly, in general median pairwise correlations for small cap stocks (Figure 18) 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. Note that during the past month, medium pairwise correlations have remained relatively steady within small caps.

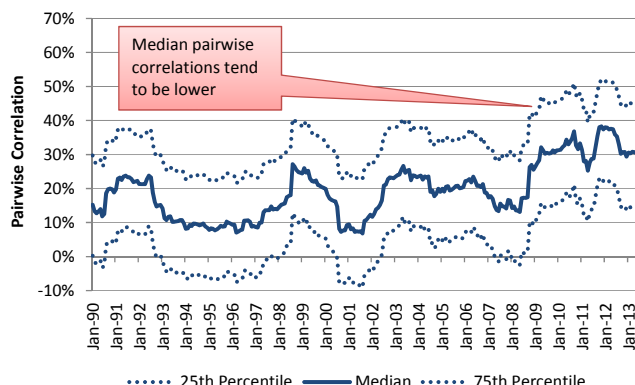


Figure 17: Median pairwise correlation for large caps



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

Figure 18: Median pairwise correlation for small caps



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

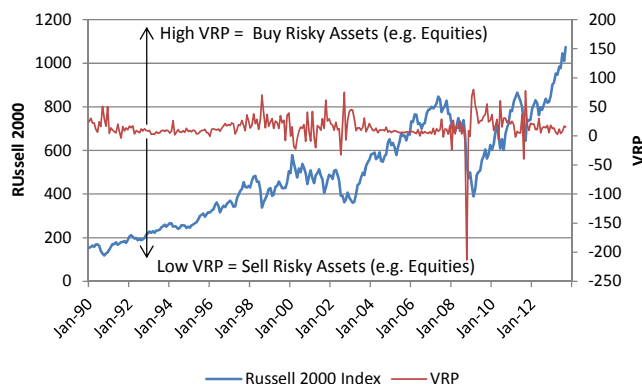
## Macro update

Our results so far indicate that the small cap world is a favorable environment for applying stock picking skill. But market timing is also important. Picking good stocks is nice, but when everything is falling even doing that is sometimes not enough. What kind of quant tools can we use to do market timing?

### Our favorite market timing indicator

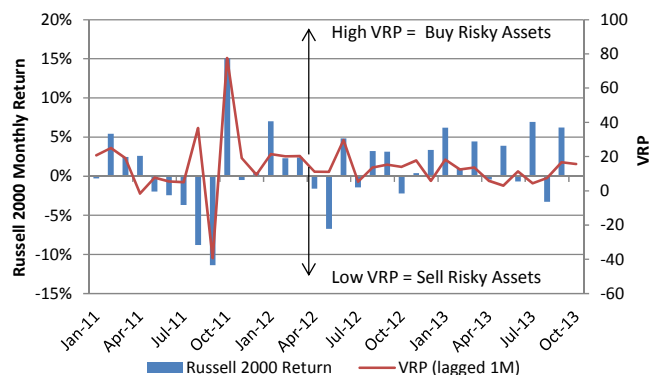
Our Variance Risk Premium (VRP) indicator is a contrarian indicator that measures market overreaction and underreaction to realized risk. Today our VRP indicator is reading 16, compared to a long-term average of 14.3. The VRP is slightly lower than last month. Generally we pay attention to the VRP when it hits extreme levels (like +/- 2 standard deviations).

Figure 19: Variance Risk Premium (VRP)



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

Figure 20: Recent VRP (lagged) and market returns



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



# The Small Cap Dashboard

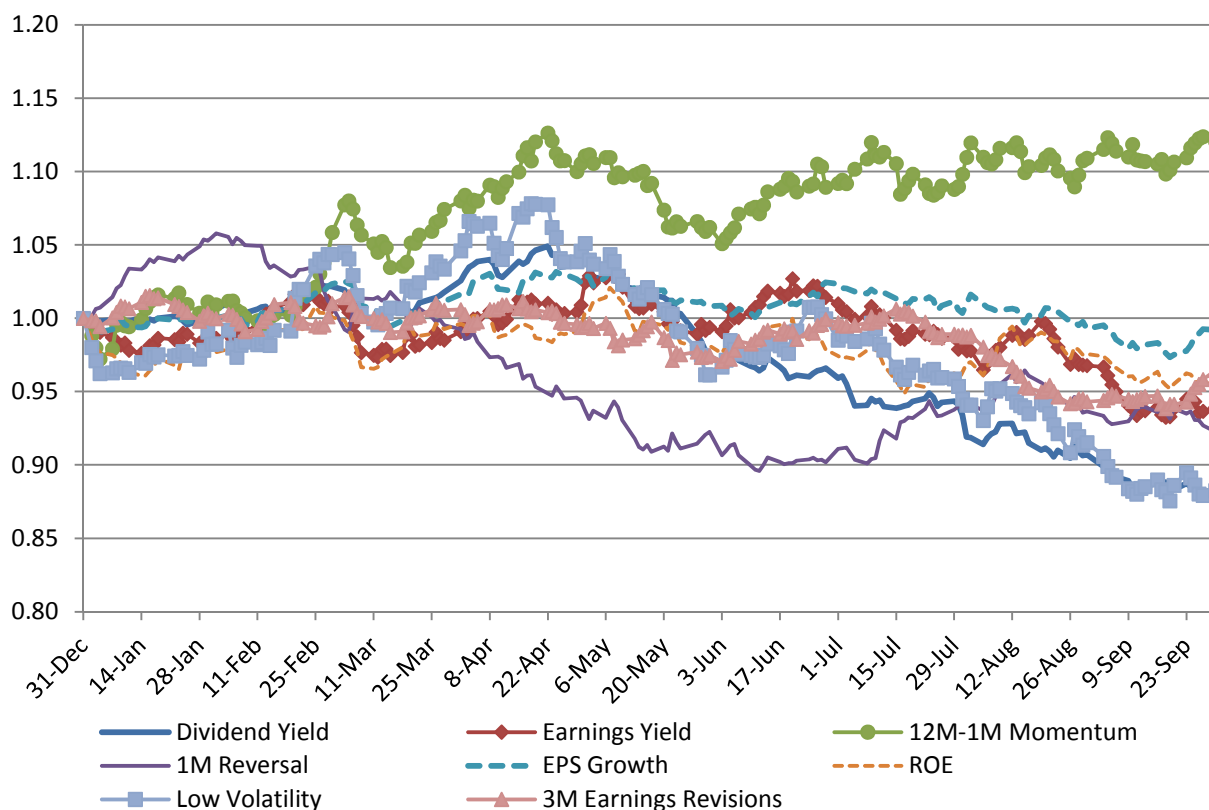
## Which styles have been working in small caps?

This month we highlight the DB Small Cap Dashboard, an easy-to-use cheat sheet that shows which styles have been working within small cap stocks. We track cumulative factor performance year-to-date, and highlight what we think are the noteworthy observations. Figure 21 shows the results for small caps.

[For more details see our website](#)

For the most recent daily factor performance, as well as factor performance delineated by different universes (e.g., large cap, small cap) and regions, please see our Global Quantitative Strategy website at <https://eqindex.db.com/gqs/>. Note that you need a username and password to log on to this website. If you don't have login details, please contact us at [DBEQS.Americas@db.com](mailto:DBEQS.Americas@db.com) and we'd be happy to set you up.

Figure 21: Small Caps (Russell 2000): 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

## Top stock picks from our QCD stock selection model

- The QCD model is our flagship stock selection model for U.S. small cap equities.
- The model incorporates a number of unique features including dynamic factor selection, a non-linear TREE component, and 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 22 shows the best 20 buy ideas and sell ideas from today's model. Note that a complete ranking for all Russell 2000 stocks is available in spreadsheet format. If you would like to get a copy of the spreadsheet, please contact us at [DBEQS.Americas@db.com](mailto:DBEQS.Americas@db.com).

Figure 22: Current QCD model stock recommendations fro Russell 2000 universe

BEST BUY IDEAS (SECTOR NEUTRAL)					BEST SELL IDEAS (SECTOR NEUTRAL)				
Ticker	Name	CUSIP	GICS Sector	QCD Score (higher is better long)	Ticker	Name	CUSIP	GICS Sector	QCD Score (lower is better short)
SRI	STONERIDGE INC	86183P102	Consumer Discretionary	24.9%	OMER	OMEROS CORP	682143102	Health Care	-25.0%
MOD	MODINE MANUFACTURING CO	607828100	Consumer Discretionary	22.9%	WD	WALKER & DUNLOP INC	93148P102	Financials	-22.5%
NATR	NATURES SUNSHINE PRODS INC	639027101	Consumer Staples	17.4%	PRKR	PARKERVISION INC	701354102	Information Technology	-22.0%
USNA	USANA HEALTH SCIENCES INC	90328M107	Consumer Staples	16.1%	RBCN	RUBICON TECHNOLOGY INC	78112T107	Information Technology	-21.7%
WLB	WESTMORELAND COAL CO	960878106	Energy	15.0%	ACHN	ACHILLION PHARMACEUTICALS	00448Q201	Health Care	-21.1%
ZEUS	OLYMPIC STEEL INC	68162K106	Materials	14.2%	MCBI	METROCORP BANCSHARES INC	591650106	Financials	-19.4%
TTEC	TELETECH HOLDINGS INC	879939106	Information Technology	13.8%	EOX	EMERALD OIL INC	29101U209	Energy	-15.9%
GPX	GRAPHIC PACKAGING HOLDING CO	388689101	Materials	13.7%	TWER	TOWERSTREAM CORP	892000100	Telecommunication Services	-14.9%
EEFT	EURONET WORLDWIDE INC	298736109	Information Technology	13.1%	BOBE	BOB EVANS FARMS	96761101	Consumer Discretionary	-14.4%
WNR	WESTERN REFINING INC	959319104	Energy	11.6%	IRDM	IRIDIUM COMMUNICATIONS INC	46269C102	Telecommunication Services	-13.7%
SIGI	SELECTIVE INS GROUP INC	816300107	Financials	11.4%	ACFN	ACORN ENERGY INC	4848107	Industrials	-12.4%
MTZ	MASTEC INC	576323109	Industrials	11.2%	LWAY	LIFEWAY FOODS INC	531914109	Consumer Staples	-12.4%
BKR	BAKER (MICHAEL) CORP	57149106	Industrials	10.6%	BTH	BLYTH INC	09643P207	Consumer Discretionary	-11.2%
MMSI	MERIT MEDICAL SYSTEMS INC	589889104	Health Care	8.8%	BPZ	BPZ RESOURCES INC	55639108	Energy	-10.6%
LHCG	LHC GROUP INC	50187A107	Health Care	8.7%	SCTY	SOLARCITY CORP	83416T100	Industrials	-10.2%
CACC	CREDIT ACCEPTANCE CORP	225310101	Financials	8.6%	SNAC	INVENTURE FOODS INC	461212102	Consumer Staples	-10.2%
CBB	CINCINNATI BELL INC	171871106	Telecommunication Services	4.8%	GNE	GENIE ENERGY LTD	372284208	Utilities	-8.4%
OTTR	OTTER TAIL CORP	689648103	Utilities	4.6%	UTL	UNITIL CORP	913259107	Utilities	-8.0%
ORA	ORMAT TECHNOLOGIES INC	686688102	Utilities	3.1%	ZOLT	ZOLTEK COS INC	98975W104	Materials	-7.1%
CNSL	CONSOLIDATED COMM HLDGS INC	209034107	Telecommunication Services	1.3%	MDW	MIDWAY GOLD CORP	598153104	Materials	-6.8%

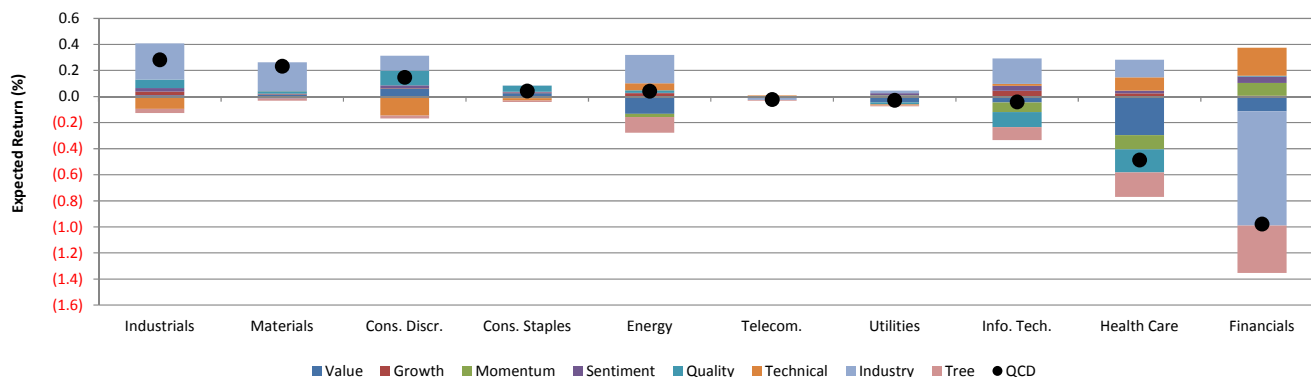
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank



### Current sector recommendations

The QCD model also implicitly makes sector predictions. Figure 23 shows the current ranking of the 10 GICS Level 1 Sectors, ranked from best (most likely to outperform this month) to worse (least likely to outperform). The bars show the key drivers for each call.

Figure 23: Current QCD sector recommendations for Russell 2000 universe

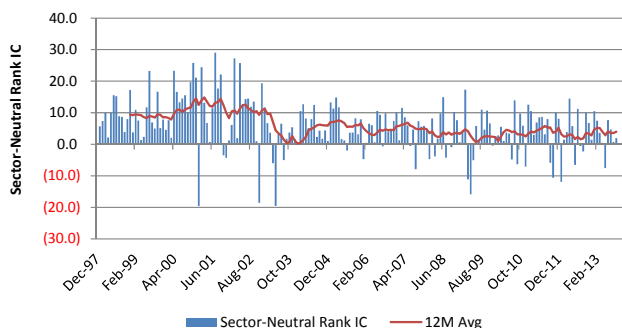


Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

### Small cap model performance

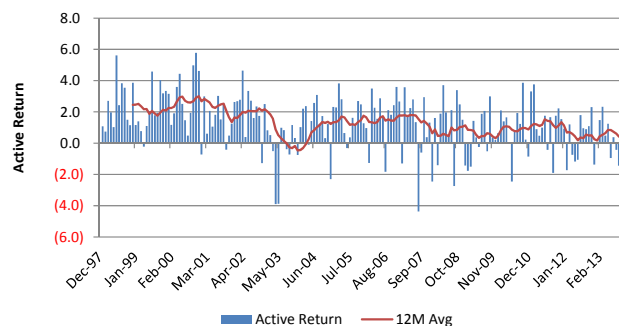
The QCD model has performed well since inception. Figure 24 shows the pure signal performance, measured as a monthly sector-neutral rank information coefficient (IC). Figure 25 shows the performance of an actual model portfolio, after costs, based on a realistically optimized market-neutral strategy.

Figure 24: Model performance, sector-neutral rank IC



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

Figure 25: Model portfolio active return, after costs

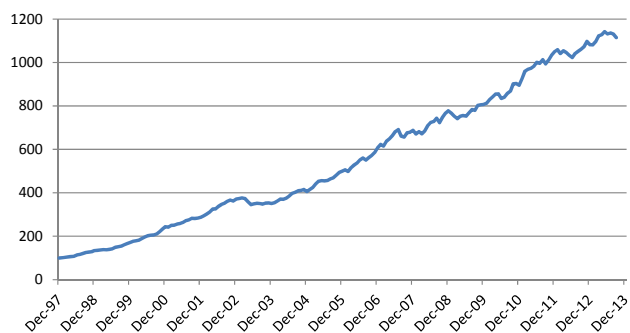


Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank

Figure 26 shows the cumulative performance of the optimized strategy, and Figure 27 shows the annualized Sharpe ratio (after costs) by calendar year.

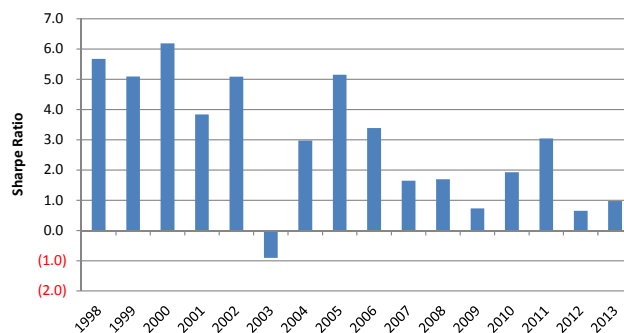


Figure 26: Model portfolio cumulative, after costs



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

Figure 27: Annualized Sharpe ratio, after costs



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





## Top stock picks from our N-LASR global stock selection model

- The N-LASR model is our flagship stock selection model for small cap 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 28 shows the best 20 buy ideas and sell ideas from today's model. Note that a complete ranking for all small cap stocks is available in spreadsheet format. If you would like to get a copy of the spreadsheet, please contact us at [DBEQS.Americas@db.com](mailto:DBEQS.Americas@db.com).

Figure 28: Current N-LASR model stock recommendations for Russell 2000 universe

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)
ESL	ESTERLINE TECHNOLOGIES CORP	2322047	USA	1.93	SUPN	SUPERNUS PHARMACEUTICALS INC	B722BG4	USA	-2.11
FRED	FREDS INC	2354385	USA	1.93	GTIX	GTX INC	2263726	USA	-2.10
MTZ	MASTEC INC	2155306	USA	1.76	ROIC	RETAIL OPPORTUNITY INVTS CP	B28YD08	USA	-2.09
PIKE	PIKE ELECTRIC CORP	B0FBMR8	USA	1.73	ADC	AGREE REALTY CORP	2062161	USA	-1.98
WSO	WATSCO INC	2943039	USA	1.69	SLRC	SOLAR CAPITAL LTD	B61FRC6	USA	-1.97
LZB	LA-Z-BOY INC	2508405	USA	1.64	UTI	UNIVERSAL TECHNICAL INST	2002543	USA	-1.90
GPX	GRAPHIC PACKAGING HOLDING CO	B2Q8249	USA	1.64	MAKO	MAKO SURGICAL CORP	B2PLY09	USA	-1.85
BWS	BROWN SHOE CO INC	2146924	USA	1.64	OMER	OMEROS CORP	B4NB858	USA	-1.85
CECE	CECO ENVIRONMENTAL CORP	2011970	USA	1.61	TGH	TEXTAINER GROUP HOLDINGS LTD	B054D55	USA	-1.82
VAC	MARRIOTT VACATIONS WORLDWIDE	B45K9N8	USA	1.59	PMT	PENNYMAC MORTGAGE INVEST TR	B3V8JL7	USA	-1.81
LPX	LOUISIANA-PACIFIC CORP	2535243	USA	1.56	UMH	UMH PROPERTIES INC	2908191	USA	-1.78
EME	EMCOR GROUP INC	2474164	USA	1.55	FUR	WINTHROP REALTY TRUST	2340760	USA	-1.78
BLMN	BLOOMIN' BRANDS INC	B847RJ0	USA	1.53	TICC	TICC CAPITAL CORP	2182478	USA	-1.75
SCBT	FIRST FINANCIAL HOLDINGS INC	BC9KR47	USA	1.49	GTY	GETTY REALTY CORP	2698146	USA	-1.75
LSCC	LATTICE SEMICONDUCTOR CORP	2506658	USA	1.48	ACRE	ARES COMMERCIAL REAL ESTATE	B77PWP5	USA	-1.73
CCF	CHASE CORP	2212289	USA	1.48	SBSI	SOUTHSIDE BANCSHARES INC	2485876	USA	-1.73
CORE	CORE MARK HOLDING CO INC	B0637B2	USA	1.46	FSC	FIFTH STREET FINANCE CORP	B39W7B7	USA	-1.67
ATX	COSTA INC -CL A	BF2HSC1	USA	1.44	STWD	STARWOOD PROPERTY TRUST INC	B3PQ520	USA	-1.67
SIGI	SELECTIVE INS GROUP INC	2766173	USA	1.44	ZAZA	ZAZA ENERGY CORP	B6TF632	USA	-1.66
AHS	AMN HEALTHCARE SERVICES INC	2813552	USA	1.44	UBSI	UNITED BANKSHARES INC/WV	2905794	USA	-1.64

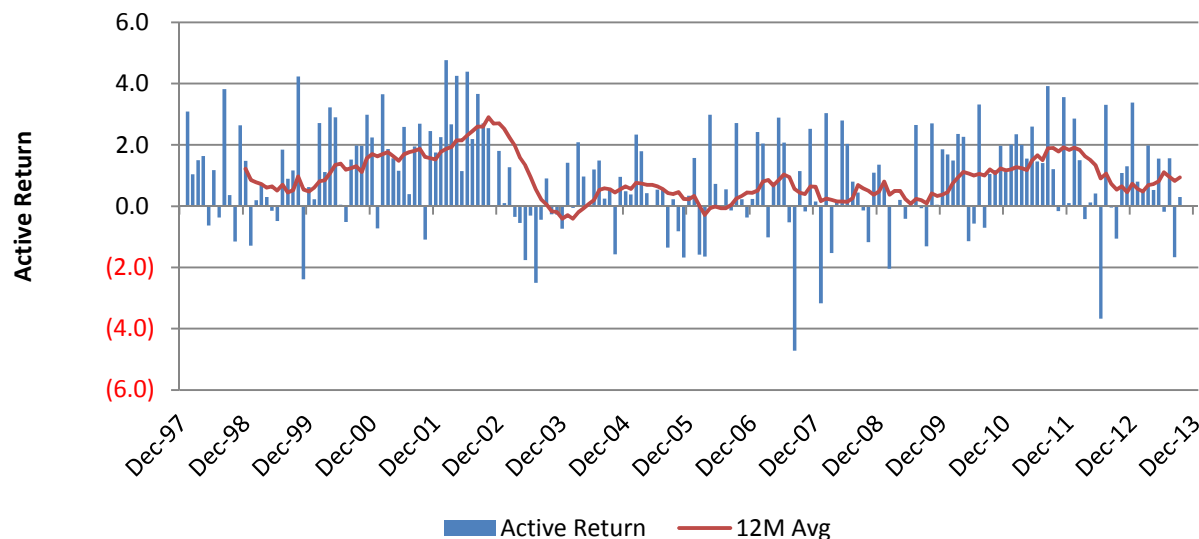
Source: Bloomberg Finance LP, Compustat, IBES, MSCI, Russell, S&P, Thomson Reuters, Worldscope, Deutsche Bank



### Small cap model performance

The N-LASR model has performed well since inception. Figure 29 shows the average pure signal performance, measured as a monthly rank information coefficient (IC).

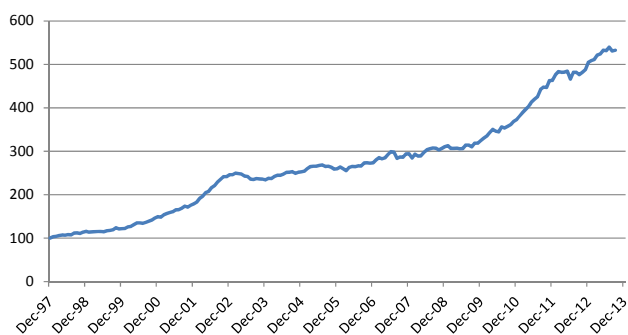
Figure 29: Model portfolio active return, after costs



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

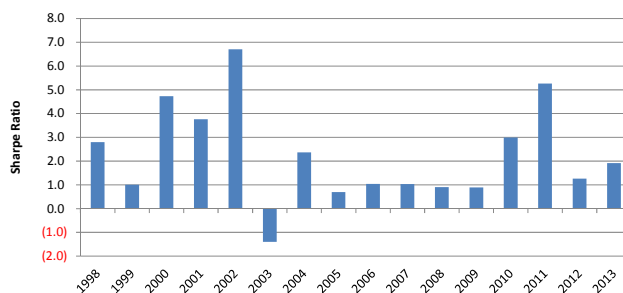
Figure 30 shows the cumulative performance of the optimized strategy, and Figure 31 shows the annualized Sharpe ratio (after costs) by calendar year.

Figure 30: Portfolio cumulative, after costs



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

Figure 31: Annualized Sharpe ratio, after costs



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



# Appendix 1

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