

Buying out-performers is too late

Mathew Verdouw, CMT, CFTe

August 2016

ABSTRACT

In this paper we test the results of buying securities that have been outperforming the market. We are told two rules in finance: “Buy Low and Sell High” and also “Past Performance is not a guarantee of Future Returns”. Yet many advisers and investors will recommend the best performing securities based on that very assumption. This paper will show that to maximize returns, there has to be a different way to examine when a security should be bought. We do this by using the Relative Rotation Graphs (RRG) to test if absolute returns can be improved by responding the relative strength performance on the RRG charts. The paper will also explain the basic concepts behind the RRG and give the results from testing in all market conditions.

Introduction

It's a commonly used adage that investors should buy low and sell high. Everyone who is interested in the capital appreciation of their investments is trying to live by that rule to maximise their capital growth. Another often-quoted saying in the financial services industry, is that past performance does not guarantee future returns. Yet, it is common for a Financial Advisor to sit with a client and recommend the funds that have performed the best over a specific period of time—basing their advice on the premise that an outperforming fund will continue to outperform. This is essentially buying high and hoping that past performance will lead to future returns.

It is the purpose of this paper to expose how buying the best performing securities are hurting portfolio returns, and to show that investing in the worst performing securities (buying low) leads to much better returns.

A key step in this process is quantifying performance of one security against a benchmark. This is typically done by dividing the value of the security by the value of the benchmark. We call this "Relative Strength". When the Relative Strength line is rising, the security is outperforming the benchmark on a capital returns basis.

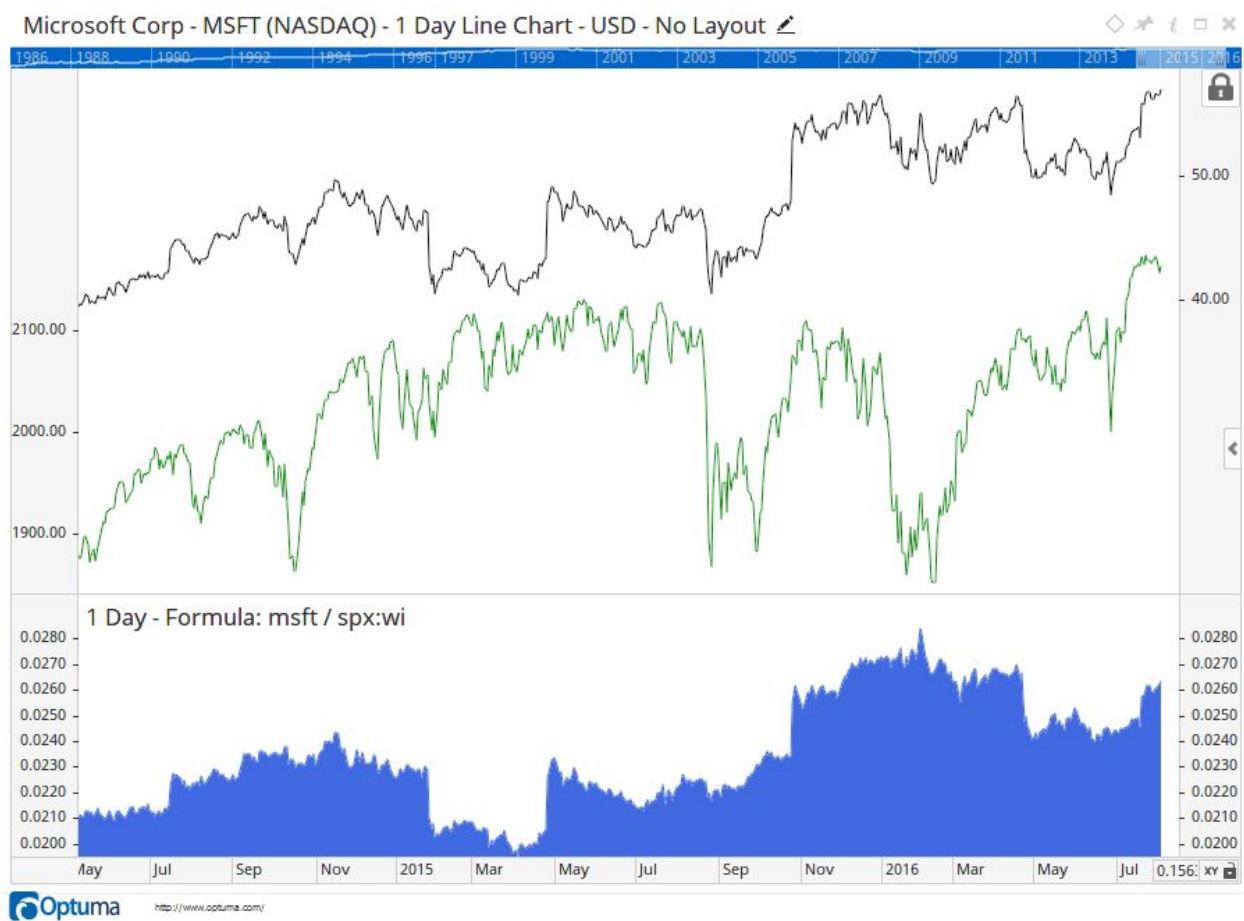
Once we have the Relative Strength for the security, we then need to compare multiple securities to identify the candidates that we would want to include in our portfolio. The issue with the typical values for the Relative Strength is that there has not been a simple, meaningful way to rank securities by their relative performance. A higher priced security will have a higher relative value when divided by the index than a lower priced security. Does that mean the returns are better? Not necessarily.

Relative Rotation Graphs (RRGTM) were developed to solve this issue by normalizing the Relative Strength calculations and provide a view of them on a single chart. We will use the RRG heavily in this paper.

The final step in this paper will be to explore the quantitative results across thousands of securities to prove the idea and to see what other filters we can add to improve our results.

Relative Strength

Relative Strength is derived by mathematically comparing a security with a benchmark. A typical example is to divide the price of an index by the price of an equity. For example, in the image below we have a chart with Microsoft (MSFT) as the black line, the S&P 500 Index as the green line. At the bottom of the chart, the blue shaded value is the result of dividing MSFT by the S&P 500.



The chart reveals that the capital growth of MSFT is greater than the capital growth of the broader S&P 500 each time the shaded area is increasing. Conversely, when the shaded area is falling, MSFT is underperforming the S&P 500.

It's important to remember that an index like the S&P 500 is an average¹ of the capital values of all the equities that are the constituents of that index. This means that at any time there will be constituent equities that are outperforming the index. By definition, there also must be constituent equities that are underperforming.

¹ Indices are more complex than a simple average. They include factors that are adjusted every time that equities are added and removed to maintain a smooth historical dataset.

Historically, one of the first Relative Strength papers was published by H.M. Gartley in 1945². While there was a short renaissance in 1967 by Robert Levy³, the concept was not popularized until the 1990's when in 1993 the *Journal of Finance* published "Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency" by Narasimhan Jegadeesh and Sheridan Titman⁴.

Why is this important?

In today's investment environment, investors can easily choose direct equity investment, commodities, currencies, indexes or ETFs. In fact, ETFs give investors a simple way to gain exposure to different asset classes and international investments.

In a direct equity portfolio, the Portfolio Manager needs to be able to provide alpha⁵ over their chosen benchmark, or investors are likely to transfer their funds into an index fund. If a Portfolio Manager can overweight⁶ the outperforming equities in their portfolio, and underweight (or sell) the underperformers, then they can provide alpha over the index.

It's important to note that in a strong Bull market, all the index constituents may be rising in absolute value, but some will still be performing better than the index (average). Using Relative Strength allows the Portfolio Manager to identify the equities that are outperforming on a relative basis.

² H. M. Gartley, Relative Velocity Statistics: Their Application in Portfolio Analysis, Financial Analysts Journal, January/February 1995, Volume 51 Issue 1 DOI: <http://dx.doi.org/10.2469/faj.v51.n1.1853>

³ Levy, R. A. (1967), RELATIVE STRENGTH AS A CRITERION FOR INVESTMENT SELECTION. The Journal of Finance, 22: 595–610. doi:10.1111/j.1540-6261.1967.tb00295.x

⁴ JEGADEESH, N. and TITMAN, S. (1993), Returns to Buying Winners and Selling Losers: Implications for Stock Market Efficiency. The Journal of Finance, 48: 65–91. doi:10.1111/j.1540-6261.1993.tb04702.x

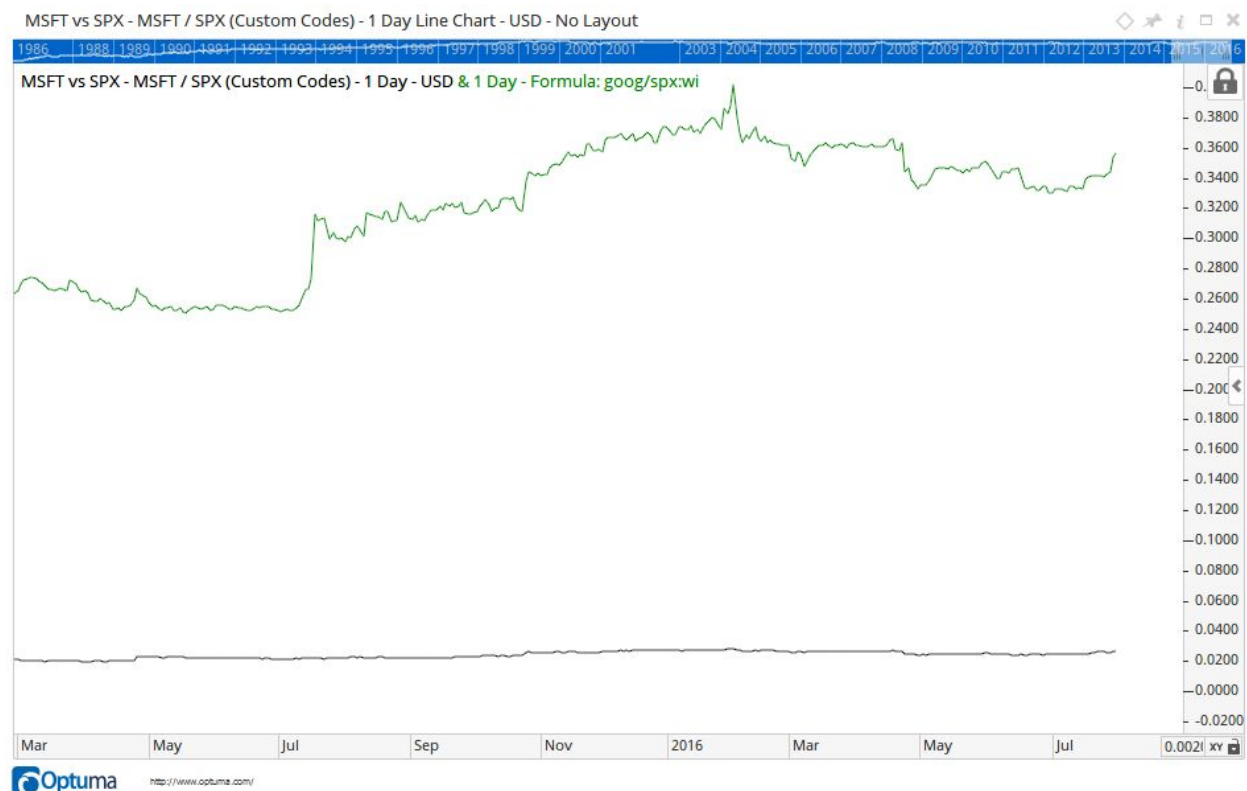
⁵ Alpha is the measure of active returns over the Benchmark's returns.

⁶ The concept of overweighting an equity is when the Portfolio Manager looks at the equity's weight in the benchmark and then chooses to hold a higher weight of that equity in their portfolio. Many of the world's larger portfolios mirror the constituents of their chosen benchmark and the overweight and underweight to provide extra alpha.

We need more than binary over/under performing

The issue with Relative Strength has always been that the actual numerical value of the division has no meaning beyond the binary positive / negative result. How can we identify the very best performer out of all the outperformers?

If we look at the values of Microsoft divided by the S&P 500 and Google (Alphabet) divided by the S&P 500 you can see the problem. The Google value is more than ten times bigger than the Microsoft value. Does that mean Google should be in the portfolio?



For Relative Strength to be truly useful, we must have a way to define the trend of the relative strength (Relative Trend) and normalize these values so that we can actually rank the equities by their relative performance.

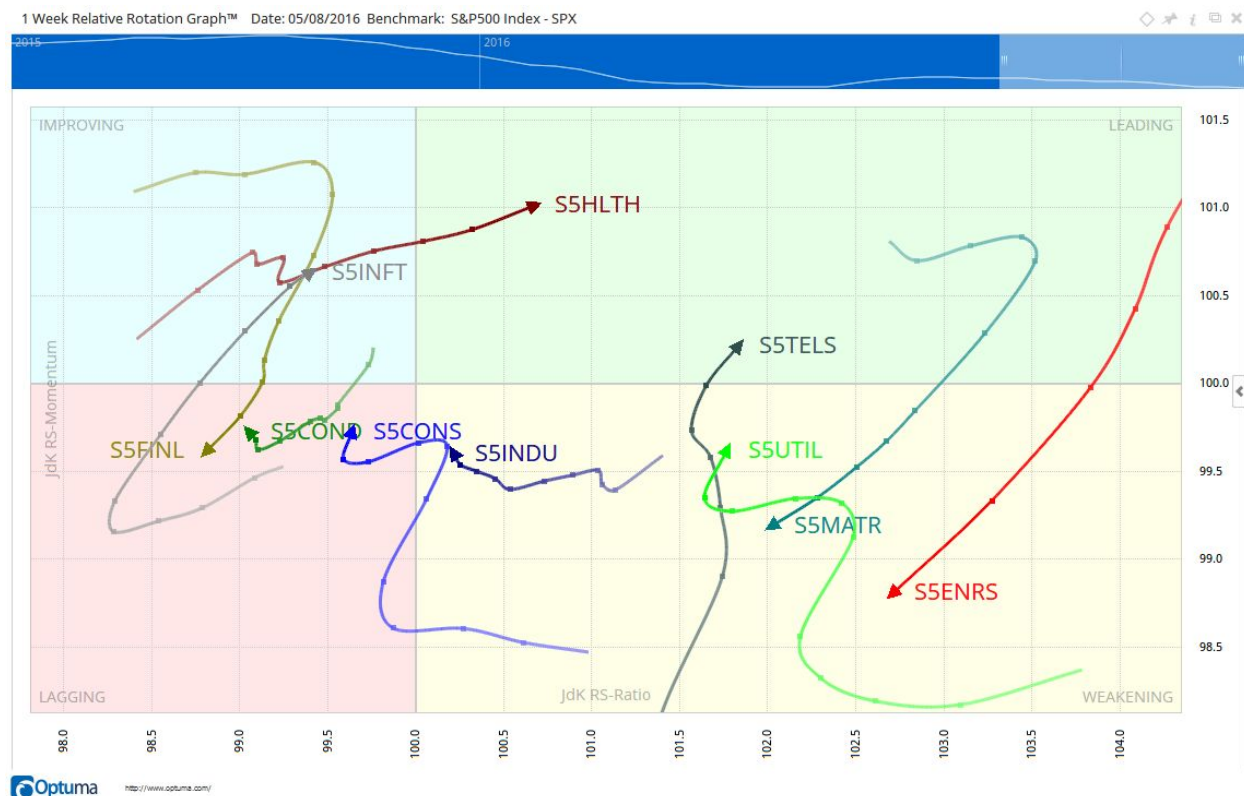
Relative Trend is defined as the trend (is it rising or falling) of the securities being divided by the benchmark.

Introducing Relative Rotation Graphs

The Relative Rotation Graph (RRG®) is a unique way that multiple securities can be viewed on a single chart, showing their current and historical Relative Trend, and by extension, their relative performance. The RRG was developed by Julius de Kempenaer, a sell-side analyst in The Netherlands. de Kempenaer would visit Portfolio Managers and be asked about his opinion on equities. Often, they were equities that he had not analysed before. What was even more difficult was that the Portfolio Managers would want to know how that one equity compared to others.

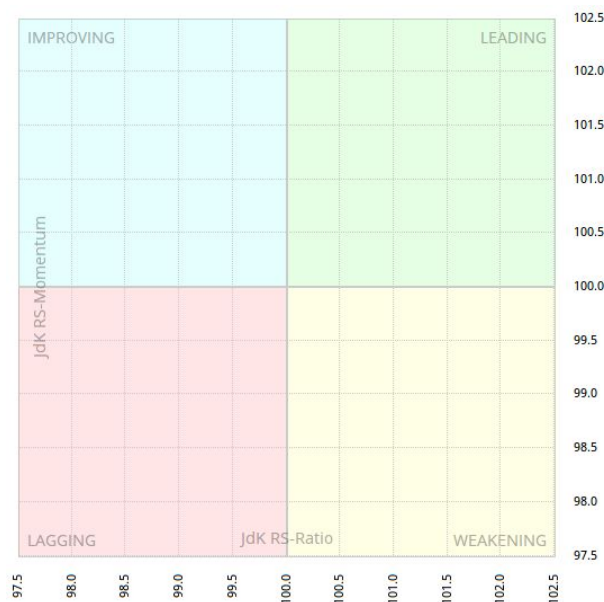
It was from the need to be able to answer those questions that de Kempenaer created the concept of the RRG. Early incarnations of the RRG were manually built in Excel, but today a number of software packages have included RRGs.

The following is a weekly RRG of the ten S&P 500 Sectors with the S&P 500 index as the benchmark. That is, we are looking at the relative performance of the ten sectors compared to each other. From an equity selection perspective, we would do this if we were looking for Sector with the best Relative Trend so we can examine equities within it.



The values are plotted on a grid that is centred at 100,100. The x axis (JdK RS-Ratio) is a measure of the normalized Relative Trend. The y axis (JdK RS-Momentum) is the Rate of Change of the Relative Trend or its Momentum. This gives an indication of the velocity of the Relative Trend.

The grid has been coloured to highlight the four main quadrants with 100,100 in the centre.



Leading Securities that are in the Leading quadrant are in a relative uptrend versus the benchmark and the trend is getting stronger. A portfolio that is weighted with these securities is expected to outperform the benchmark.

Weakening Securities in the Weakening quadrant still have positive Relative Trend but the momentum of the trend has changed. The falling momentum is an early warning that the Relative Trend is about to change. A Portfolio Manager should watch these securities as there is a high probability that they could start to underperform the benchmark.

Lagging Securities in the Lagging quadrant are in a relative downtrend versus the benchmark and the trend is getting weaker. These securities are expected to underperform the benchmark.

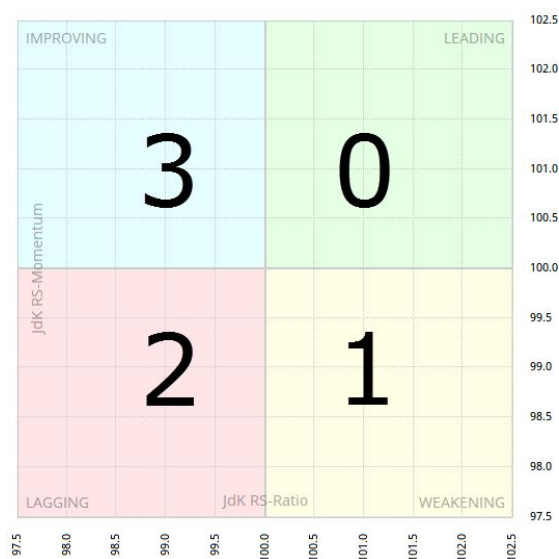
Improving Securities in the Improving quadrant still have negative Relative Trend but the momentum of the trend is improving. The rising momentum is an early indication that the Relative Trend is about to change.

Each of the securities on the RRG have an arrow which shows the most recent observation for that security. The tail shows the reader where the security has been. The tail on the arrow has multiple marks. These marks are the previous observations for that security. On a weekly RRG, the mark that is closest to the arrowhead would be the observation from the previous week, and so on. This allows the RRG to give the viewer a sense of where the security has been in the past.

As Analysts, we have all heard about the concept of Sector Rotation and knew that performance was cyclical by observing sine waves on charts. What de Kempenaer was able to finally visualize was that there is a predominant clockwise rotation of Relative Trend that securities follow. It was the first time that analysts had graphical proof that many of today's outperforming securities would soon rotate and underperform the benchmark.

In the Weekly RRG of the S&P 500 Sectors above, the red Energy Sector (S5ENRS) was well into the Leading quadrant six weeks ago (the length of the tail). While it still has positive Relative Trend at the time this chart was drawn, the trajectory shows that it is rotating into the Weakening quadrant.

Many of the scripts in the rest of this paper reference the quadrants by number. These have been shown in the image below as a reference.



Rotation Probabilities

Before we dig in and find the best place on the RRG to add positions to our portfolio, we first need to establish that the rotations do in fact occur. When you use software that allows you to scroll through the history, this is visually evident (and we encourage interested readers to try that). In this paper without animated charts, we need to rely on our statistics.

To test this, we examined over 20,000 rotations. Every time an equity exited a quadrant, we noted which quadrant it entered. In the table below, the first column is the quadrant the equity exited. The subsequent columns show the probability that that the equity rotated into that quadrant. Eg. When a security was in Leading, 92% of the observations moved into Weakening.

Current Quadrant	Moves To Leading	Moves To Weakening	Moves To Lagging	Moves To Improving
Leading	-	92%	4%	4%
Weakening	38%	-	62%	0%
Lagging	5%	5%	-	90%
Improving	68%	0%	32%	-

The statistics show us that once an equity is in the Leading or Lagging quadrants, the probability that it will continue on a standard clockwise rotation is very high. While the progression from the Weakening and Improving does not have the same level of certainty, the probability of standard rotation is still higher than random.

Note: This does not consider how long the security stays in each quadrant. That is a topic for more study.

Buy High and Sell Low

Now that we have set all the ground work, we can look at our assertion that many investors and advisors, who are trying to fill their portfolios with the best performing securities, are simply looking at historical performance as the basis for inclusion into their portfolio. It is the equivalent of only selecting the securities that are in the green Leading quadrant. The Relative Strength rotation that the RRG exposes tells us that there is a high probability those outperformers could soon rotate around and underperform.

Testing the Theories on S&P 500 Equities

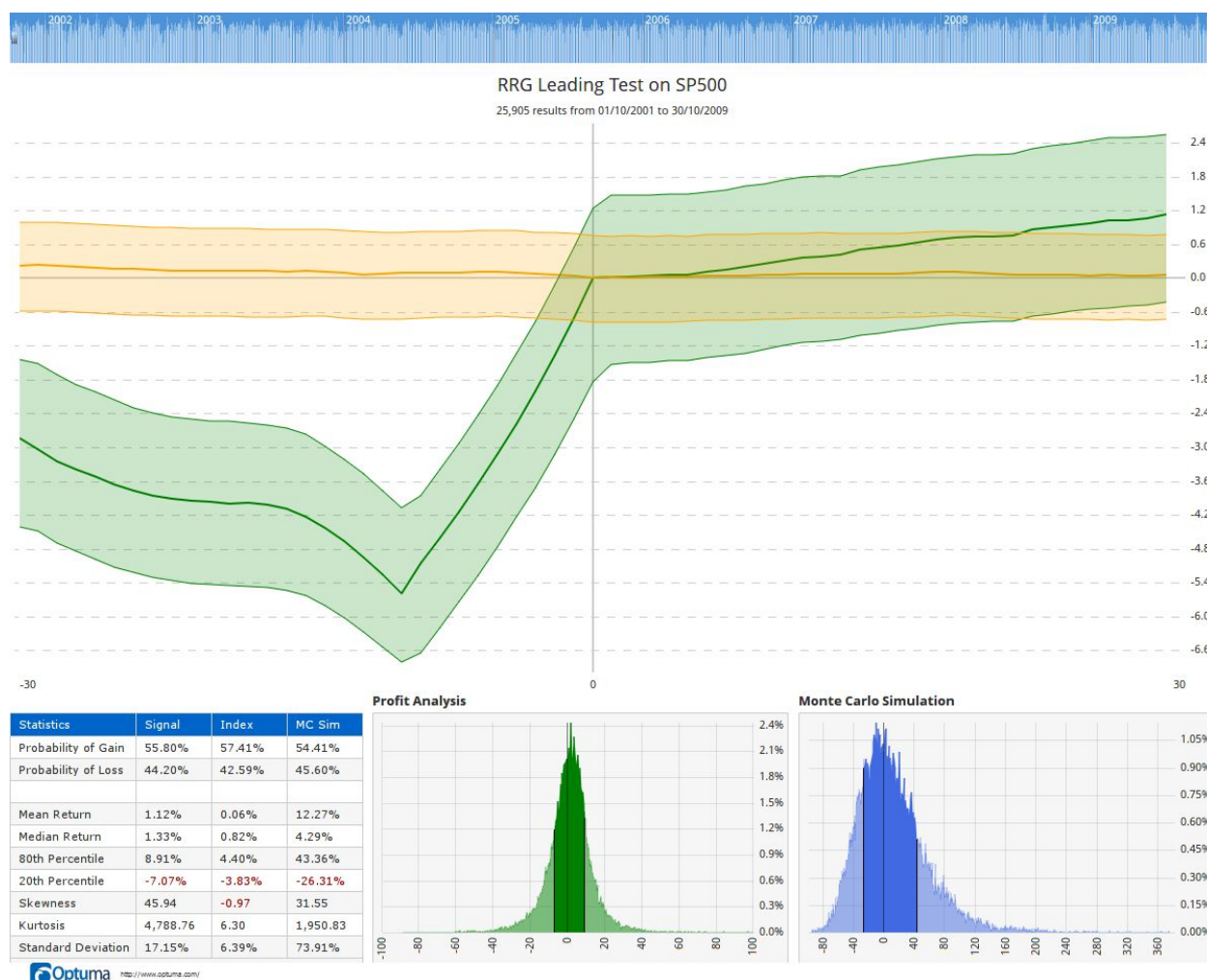
To examine this we set up a test on the S&P 500 constituents from October 2001 to October 2009. The testing framework that we use is fully explained in Appendix 1. At this point, it is important to understand that we are not doing traditional BackTests as the results are at the mercy of the portfolio construction rules. A Signal Test finds every single occurrence of the signal and then measures the security's performance from the signal.

In our tests, we display 21 periods forward and back which is approximately a calendar month. We like to keep the tests short to ensure that we do not overlap multiple signals. The same tests can be done on any timeframe.

In our first set of tests, we wanted to measure the performance if we simply took a position in one of the S&P 500 equities as it changed quadrant and then held it for one month. The following is an image of the Signal Tester output that we are using. The first test is testing the signal when any security enters the Leading quadrant.

Here is the Optuma script. The JDKRS function, which is set with the SPX benchmark, has the quadrant as one of its outputs. We want to know when it changes to the Leading (0) quadrant.

JDKRS(INDEX=SPX:WI).Quadrant ChangeTo 0

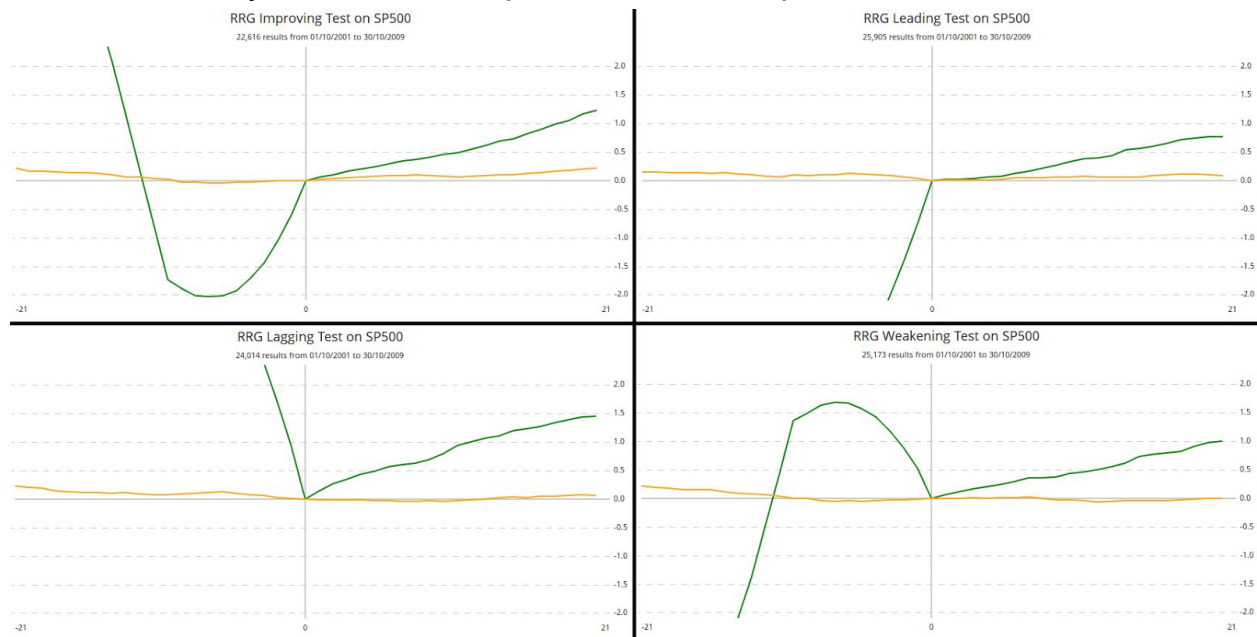


There are a number of observations that we can make about these results:

1. The blue bar at the top shows us the dispersion of the signals throughout our testing period. If all our signals were clustered at one time, our signal would not have practical use as it would be too dependant on a single event in time.
2. Under the title, we can see that there are nearly 26,000 signals that were tested in under 8 seconds. It is important in any test that we have a large sample set to work with.
3. The Green Band is the mean return from all the signals that have been analyzed. Note that this is the absolute return, not the relative returns. It shows the period 30 days prior and 30 days after the signal. It is interesting to see the strong move up into the signal. This is as expected, since the relative outperformer must have had a significant absolute rise to outperform the benchmark.
4. The Orange Band is the S&P 500 index for the same tests. Whenever we have a signal, we also take a sample of the Index and measure the returns over the same period. This allows us to see if we have Alpha over the index for our tests.

5. The “Profit Analysis” allows us to see inside the average. Since the average is made up of thousands of signals, it is important for us to know the dispersion of the signals around the average. This graphic shows us that the dispersion is “high and tight”, meaning that we can have a high level of confidence in the average.
6. The “Monte Carlo Simulation” is the result of taking random signals and measuring the compounded returns. This is done 20,000 times to give us a simulation of what we could expect if we used this strategy. Our goal is to see an increase in the Probability of Gain.
7. Finally, the Statistics Panel is full of important information that we need to examine. We will dig into that a lot more as we explore the results.

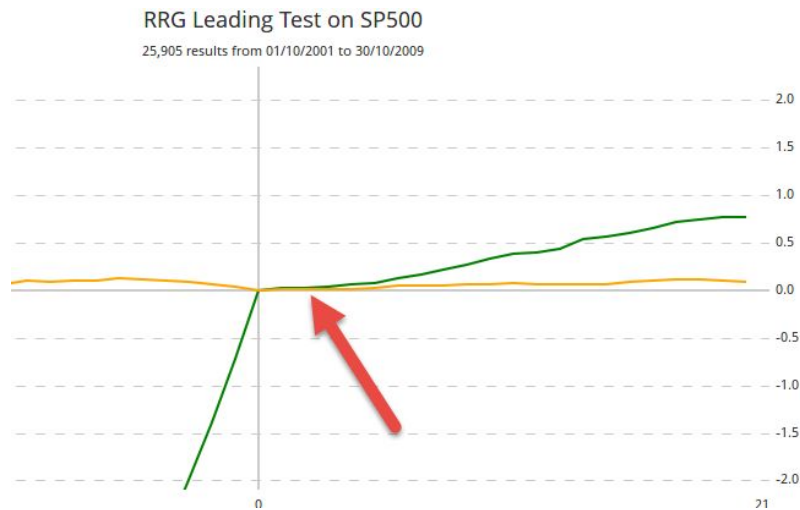
In this following image, we ran the tests for all four quadrants and arranged the four result sets so they are in the RRG quadrant that corresponds to their test.



What is immediately obvious is where the green line was prior to the change of quadrant. For example, with the lagging test (bottom left) the average price of the equities was falling before the signal. It should be noted that all quadrants are producing gains. These tests of Index constituents is subject to Survivorship Bias⁷ and further tests need to be done with Survivorship Bias free data.

⁷ Survivorship Bias occurs when we consider today's Index members over a timeframe in the past. Some of today's equities may not yet have been included. Others that were in the index at the time may have since underperformed and been removed from the index. The result of Survivorship Bias is that it gives the results a positive bias.

Another observation is the flat period on the Leading Test, seen on the image below. It shows the flat average performance for the first few days after the signal.



The next thing we need to do is dig into the statistics of our four tests. We are going to set them up a bit differently so we can compare them.

Statistic	Leading	Weakening	Lagging	Improving
Signal Count	25,905	25,173	24,014	22,616
Signal Probability of Gain	54.9%	55.1%	56.2%	56.6%
Signal Mean Return	0.76%	1.00%	1.44%	1.2%
Signal Annual Return ⁸	9.1%	12.0%	17.3%	14.7%
Signal Risk:Reward ⁹	1:1.26	1:1.29	1:1.46	1:1.42
Signal Standard Deviation	10.7%	18.7%	20.4%	12.0%
Monte Carlo Probability of Gain	54.3%	55.7%	58.7%	58.5%
Monte Carlo Mean Return	9.6%	12.5%	18.9%	15.6%
Monte Carlo Risk:Reward	1:1.64	1:1.79	1:2.23	1:2.16

Immediately we can see that historically, equities entering the Lagging quadrant—where they have negative relative trend—have the highest returns. They also offer the largest

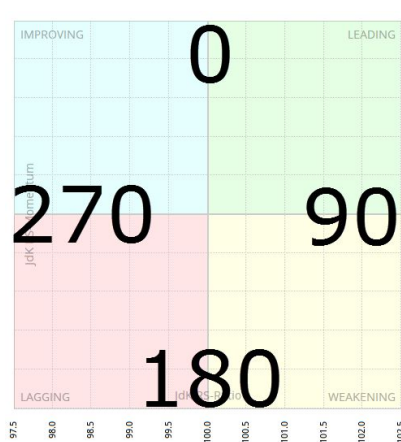
⁸ Annual Return is measured by taking the returns over the 30 day period and extrapolating to a year.

⁹ Risk Reward is defined by looking at the 20th and 80th percentiles in all of the returns since the majority of our observations will fall within that range.

units of reward for every unit of risk.

This is giving us the result, from over 25,000 observations, that we can gain incremental capital improvement by focusing on the underperformers. These are very simple tests. We need to ask if there is more that we can do to improve the results?

Introducing RRG Headings



One idea we have been working with is to consider the “angle” and “heading” of the arrows on the RRG. If we consider the RRG as a compass, with the angles on the image below, we can start to explore very different relative relationships. When we did this, one of the first things we noticed was that heading was very important. Any time the arrow was heading Northeast (45 degrees) on the chart it would give positive returns. Conversely, any time it was pointing Southwest (225 degrees) it was giving negative returns.

We know from our previous tests that selecting equities in the lagging quadrant gives the best results. In the next test we want to see if we can improve those results by only selecting the securities that are in the lagging quadrant and pointing Northeast on the RRG.

Following is the script that we used. Our goal is to only find the equities that are in the lagging quadrant (not just entering it like we did in the last test) and have rotated so that they have passed the 45 degree heading:

```
r1 = JDKRS(INDEX=SPX:WI);  
c1 = r1.Heading CrossesAbove 45;  
c2 = r1.Quadrant == 2;  
c1 and c2
```

Here are the results.

Statistic	Lagging and heading Northeast
Signal Count	10, 766
Signal Probability of Gain	57.7%
Signal Mean Return	1.6%
Signal Annual Return	19.5%
Signal Risk:Reward	1:1.57
Signal Standard Deviation	12.6%
Monte Carlo Probability of Gain	61.2%
Monte Carlo Mean Return	18.1%
Monte Carlo Risk:Reward	1:2.52

As you can see from this test, we can secure better returns with lower risk and volatility, by layering in the heading of the equity on the RRG. This extra condition filters out more than half the number of signals we had in our first set of quadrant tests. That is exactly what we want to see. Our goal is to use the probabilities and analysis to filter out the signals that have lower probability of gain, leaving us with the high probability signals. Can we take this further?

Another observation that we have made is that the securities that are further away from the 100,100 origin on the chart have the potential to create more alpha. To test that we add an extra condition to our script that the vector distance of the security from the origin must be greater than 2.

```
r1 = JDKRS(INDEX=SPX:WI);  
c1 = r1.Heading CrossesAbove 45;  
c2 = r1.Quadrant == 2;  
C3 = r1.Distance > 2;  
c1 and c2 and c3
```

Here are the results added to our table.

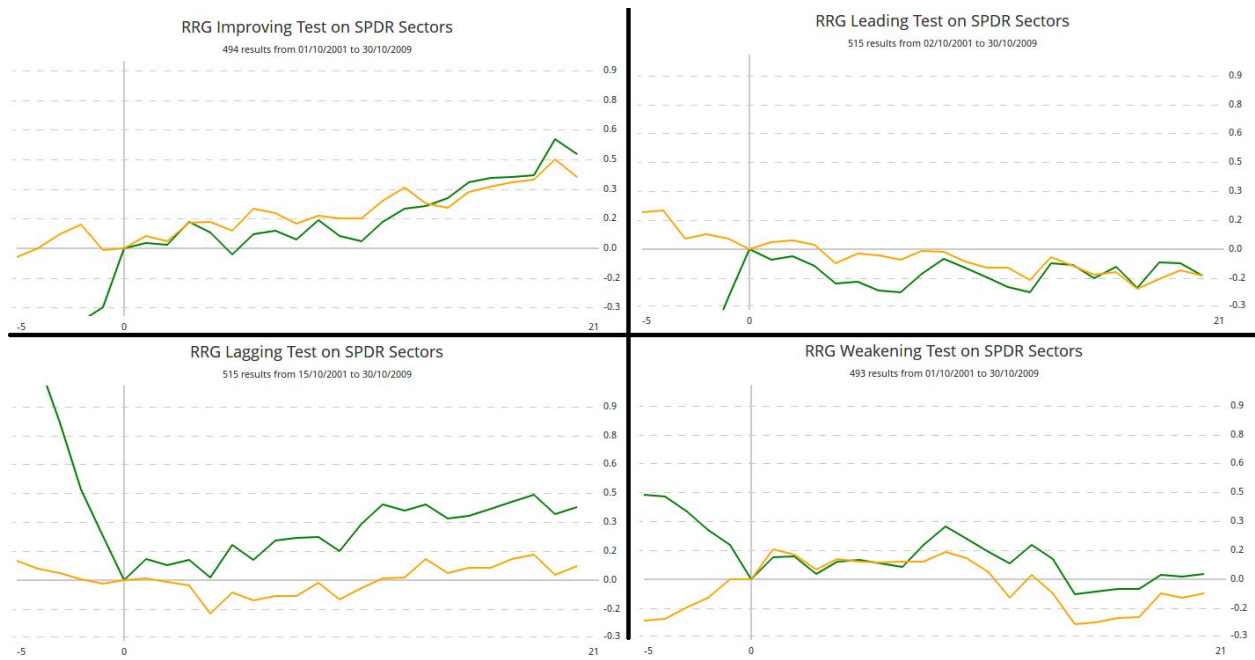
Statistic	Lagging and heading Northeast	Lagging, Heading NE and 2 units from Origin
Signal Count	10, 766	5,674
Signal Probability of Gain	57.7%	58.2%
Signal Mean Return	1.6%	2.1%
Signal Annual Return	19.5%	25.4%
Signal Risk:Reward	1:1.57	1:1.67
Signal Standard Deviation	12.6%	15.2%
Monte Carlo Probability of Gain	61.2%	61.0%
Monte Carlo Mean Return	18.1%	23.3%
Monte Carlo Risk:Reward	1:2.52	1:2.56

The volatility of this signal is a bit higher and we would expect that since the securities further from the origin on the RRG are more volatile. The results however show that the extra volatility is giving better results from almost half the number of signals.

SPDR Sectors

Another test to consider is the nine major SPDR ETFs over the same period. Using the SPDRs has some advantages—they mitigate the Survivorship Bias issues that we have with direct equity tests. Again we are looking for the results over a month to see if investing in the underperforming SPDR sector would give us alpha. As is expected, there are less signals which also reduces the volatility of the signals. The Monte Carlo analysis is not used because of the lower number of signals.

We'll add the images and the statistics (Including our 45 degree stats).



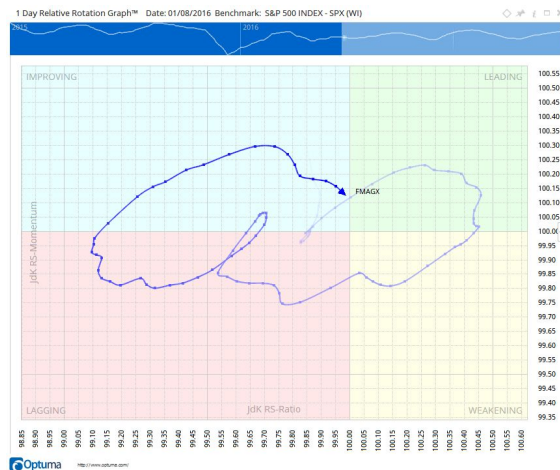
Statistic	Leading	Weakening	Lagging	Improving	45 deg
Signal Count	515	493	515	494	279
Signal Probability of Gain	56.4%	55.4%	58.1%	59.8%	63.9%
Signal Mean Return	-0.14%	0.02%	0.38%	0.48%	0.65%
Signal Annual Return	-1.7%	0.3%	4.5%	5.7%	7.8%
Signal Risk:Reward	1:1.12	1:1.05	1:1.33	1:1.57	1:1.35
Signal Standard Deviation	6.8%	6.0%	7.1%	7.2%	7.3%

Again, we are seeing confirmation that investing in the SPDRs when they are outperforming the SPY will give us negative returns. While the statistics show that there is a marginal improvement by waiting for the Sector to rotate into the Improving quadrant, the difference between the Green(sector) and Yellow(SPY) lines on the images above show us that we gain significant Alpha by investing in Sectors when they are in the Lagging quadrant.

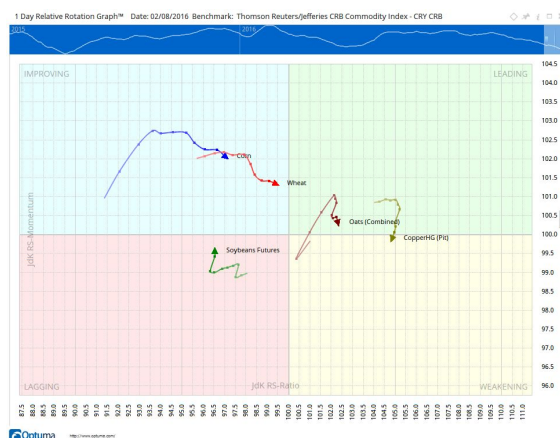
The final column in the Statistics table again shows that by layering the heading into the quantification of the signal yields even better results.

Does this only apply to equities?

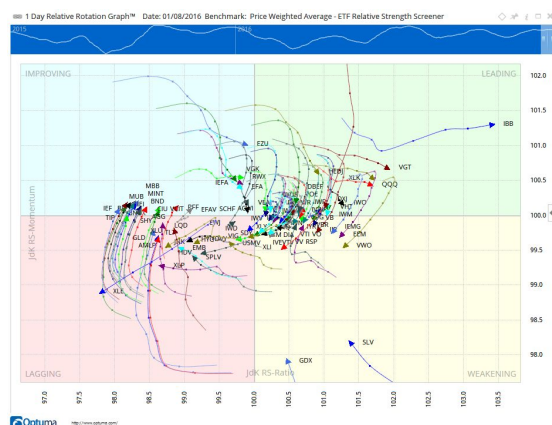
Our research has shown that this same behavior occurs in all asset classes.



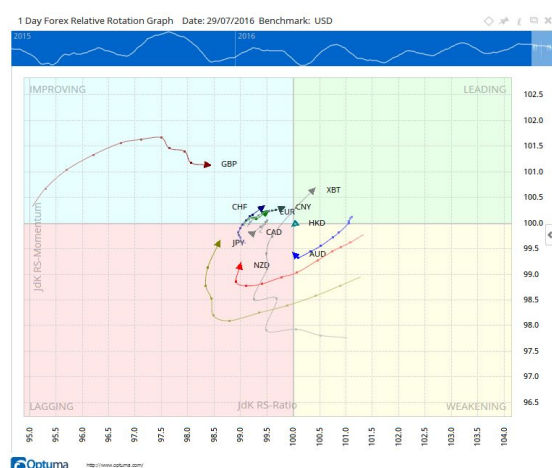
It could be argued that a fund, with an active Portfolio Manager, should mitigate this rotation effect. This chart shows the history of the Fidelity Magellan Fund against the S&P500. The chart reveals that there are periods where the fund's Relative Trend is positive and then rotates into underperformance.



This RRG chart contains a number of commodities with the CRB Index as the benchmark. The rotations hold in commodities.



This image shows the current top 100 US ETFs with the average of the 100 being calculated and used as the benchmark. While it is cluttered, the rotation of the ETFs is evident in the tails.



The same principle is evident in currencies. The calculation is a little different as the benchmark is the base currency.

Conclusion

We've been able to use the analysis of thousands of historical signals to show that the practice of investing in the highest relative performer will not, on average, yield the best results. All equities, currencies, commodities and even bond yields rotate around an appropriate benchmark and the probability of a standard clock-wise rotation is significant. Every relative outperformer will eventually rotate away and underperform. Our tests have shown that strategies that invest in the underperformers lead to marginally better results. Layering in other filters such as Heading and Distance continue to give incrementally better results.

We would not recommend that Relative Strength be used in complete isolation. Coupled with other strategies such as Trend, Momentum, Valuation, (etc.) Relative Strength and RRGs can provide the analyst significant advantages.

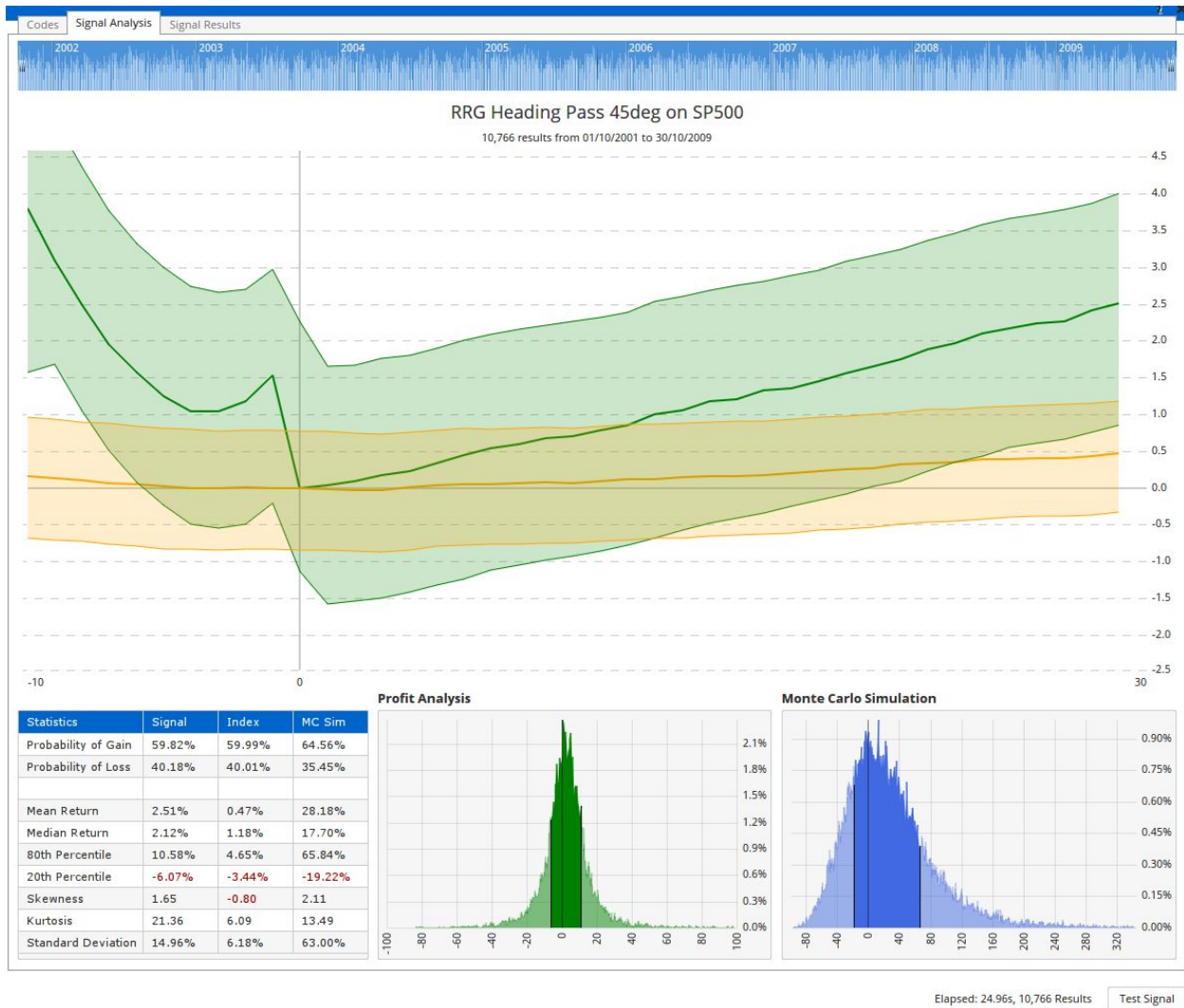
Appendix 1 - Optuma Signal Testing

At Optuma we are focussed on the testing of quantifiable signals to determine if a particular signal has a higher probability of leading to positive results. Many technicians rely on Backtesting a model portfolio to test their ideas. We believe that there are some flaws with that approach. Backtesting is very important, but it should not be used to benchmark a quantifiable signal.

The primary issue is that a Backtest is a multi-dimensional test. It tests a Buy Signal, a Sell Signal, Ranking and Capitalization. If signal optimization is included then it gets even more complex. We realized from early backtests of new quantitative signals that we were getting wildly different results when we made changes to the portfolio in the test. We now call that Portfolio Bias. The way the portfolio is set up has significant effect upon the results of the test. Some of the signals are ignored because the capital ran out. Those signals may have been critical to our understanding.

When we test a signal, we don't want to think about the best portfolio rules. At the early stage we just want to know how good the signal is. The only way we can do that is to get our tools to find every instance of the signal and then measure the returns from the signal for a set period of time. These results are then averaged and analyzed.

The first image below is the workbench that we use. This is the result after running a Signal Test. Some things to note, the tool allows us to test any data over any time frame. For consistency, we always do our initial tests on the S&P500 stocks using the SPX as our comparison index. We also limit our tests to the period from October 1, 2001 to October 30, 2009 because the SPX started and ended at the same level with two bull and two bear markets covered. This means that we have eliminated the general upward trend of markets in our results.



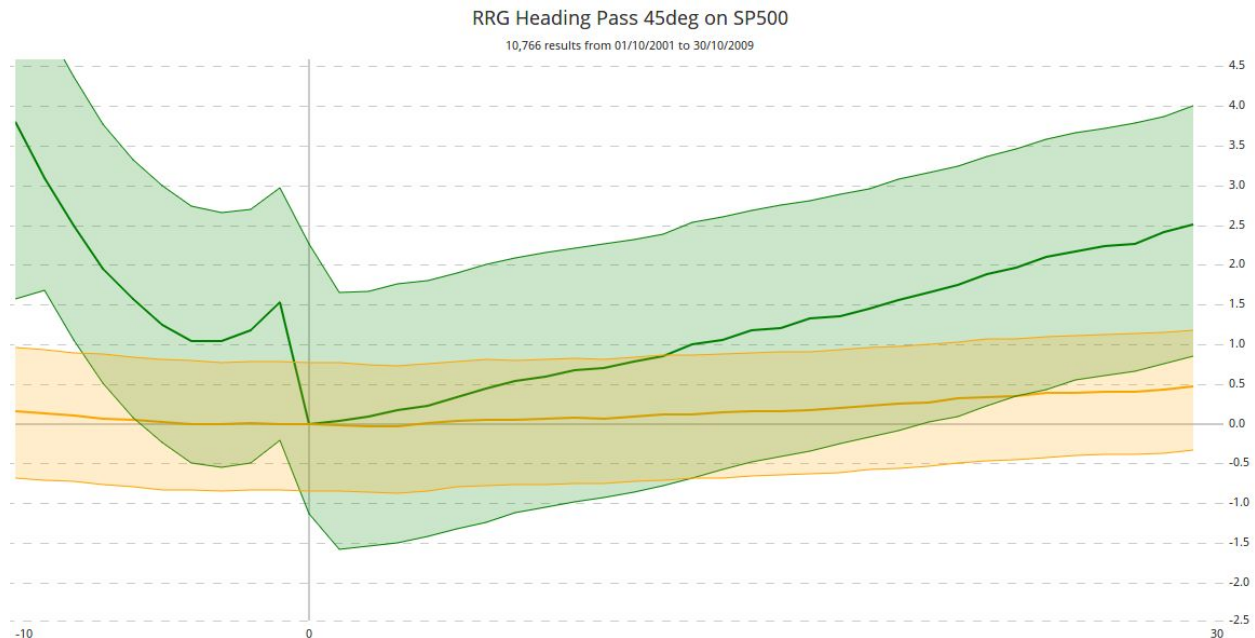
The main sections of the Signal Tester are as follows:

Signal Distribution



The Signal Distribution allows us to see the spread of the signals throughout the history of the test period. If the signals were clustered and only happened infrequently, then it would not be viable. We want to see signals that occur in all market conditions.

Signal Performance

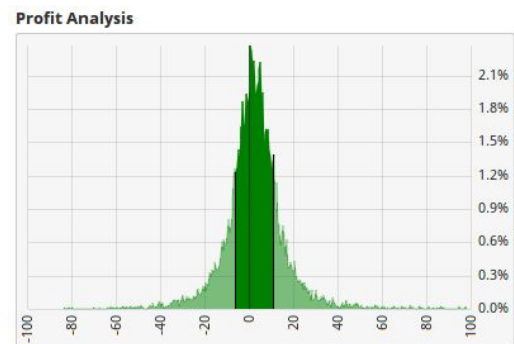


The main display is of the average performance of the securities before and after the signal, measuring the unmanaged forward returns for each day over this holding period. The green line is our signal and the yellow line is the average returns in the comparison index over the exact same signals. The bands, which can be hidden, show the range of the highs and lows of the data bars. It is important to note how many signals are being averaged. This is written in the subtitle on this chart.

Profit Analysis

It is easy to ignore that an average is made up of lots of values. The spread of those values determines how valid the average is. Eg These two number sets have the same average (49,50,51) and (0, 50, 100) but the first series gives us much more confidence that the next value will be close to the average.

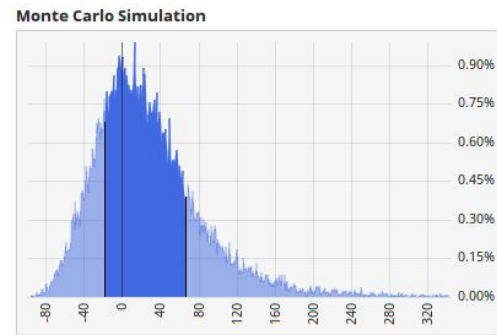
In the Profit Analysis chart, which counts how many signals resulted in the gain displayed on the x-axis, we want to see a “High and Tight” distribution. This is telling us that there is a significant number of signals that are supporting the average. If the distribution was “low and wide” then we know that the likelihood of future signals landing near the average is very low. The darker area on the distribution marks out the 20th and 80th percentiles of the signal returns. That will be explained more in the Statistics section below.



Monte Carlo Simulation

Monte Carlo allows us to run thousands of simulations to make sure that if we used our strategy multiple times in a row, the compounded returns would be better than the individual signal returns.

We tell the tools to run at least 20,000 tests where each time it selected 10 random signals from our results. The distribution has the same 20/80 zone as the Profit Analysis.



Statistics

The Statistics table gives us the information that we need to review the signal compared to the comparison index.

Probability of Gain/Loss tells us how many of the signals resulted in a profit/loss.

Mean Return and Median Return are the average returns our signal produced. We report both as the Median is less susceptible to outlier returns skewing our results. As a

trader though, outliers are some of the most profitable trades. We like to see a strategy where the two are in agreement. It means that our signal is not reliant on the outliers.

Statistics	Signal	Index	MC Sim
Probability of Gain	59.82%	59.99%	64.56%
Probability of Loss	40.18%	40.01%	35.45%
Mean Return	2.51%	0.47%	28.18%
Median Return	2.12%	1.18%	17.70%
80th Percentile	10.58%	4.65%	65.84%
20th Percentile	-6.07%	-3.44%	-19.22%
Skewness	1.65	-0.80	2.11
Kurtosis	21.36	6.09	13.49
Standard Deviation	14.96%	6.18%	63.00%

80th/20th Percentiles are the returns at each of these points. They are the boundaries of the darker shaded area on the Profit and Monte Carlo distributions. We use these as a measure of Risk to Reward. Eg, if the 80th percentile is at 10% and the 20th at 5%, we have a 1:2 risk:reward ratio. For every unit of risk, the signal gives me 2 units of reward.

Skewness and Kurtosis are mathematical measures used to describe the distribution plots. Skewness measures whether the peak of the distribution is offset from the breakeven point. Our goal is to have positive skewness and see that rise in the Monte Carlo. Kurtosis describes the shape of the distribution. Higher values are better.

Standard Deviation allows us to measure what the “average” distribution of the results around the average is. The higher the value, the more spread out the returns are. This means that the returns are much less predictable.