



# TradeStation® University

## STRATEGY TRADING SERIES

Part 2

Wednesday, June 12, 2013

## Portfolio Back-Testing with Portfolio Maestro: Ranking and Money Management

**Frederic Palmliden, CMT**

Senior Quantitative Analyst

TSLabs@TradeStation.com

### Summary

Portfolio Maestro offers advanced back-testing functionality, including ranking and money-management techniques. Ranking is used to filter symbols within a Strategy Group, whereas money-management settings specify position size.

In this second installment of this white paper series on Portfolio Maestro, ranking and money-management techniques will be analyzed and practical examples will be explored. For instance, we will look closely at the impact of a specific ranking method on an existing portfolio. Future papers will examine the Portfolio Maestro's other advanced features, such as portfolio constraints and optimization.

For more information about Portfolio Maestro's basic functionality, please see the first installment of the series, "Portfolio Back-Testing with Portfolio Maestro: An Introduction to Portfolio Back-Testing."

Figure 1: Percent Change Ranking Technique within a Strategy Group

Input	Value	Type	Description
RankLimit	-1000	Numeric	Minimum Rank Value (or Max if RankHighToLow...)
RankHighToLow	True	TrueFalse	Rank Values in Descending Order
PriceLimit	1.50	Numeric	Minimum Price required for a trade to be taken
Period	30	Numeric	Lookback Period for Prices

## Ranking Background

Ranking is a technique used within a Strategy Group to filter the symbols specified in the Symbol Lists tab. For more information on the Symbol Lists tab, please refer to the Portfolio Maestro paper, "Portfolio Back-Testing with Portfolio Maestro: An Introduction to Portfolio Back-Testing." In the filtering process, the symbols are sorted in a specified order and only the top number of symbols or the top percentile will be used in the strategy. In other words, a ranking technique is basically a strategy within a strategy.

To access the ranking functionality, click on the Manage Strategy Groups icon in the Shortcut Bar. Then click on the Ranking tab and select the needed ranking type from the Ranking drop-down lists. The details about each ranking technique are displayed in the Contents panel.

There are 12 different ranking techniques available in Portfolio Maestro (see table 1).

Table 1: Ranking Options

Ranking Technique	Description
None	No ranking technique applied to the Strategy Group.
Avg Price Periods	The ranking value is based on the ratio of the average prices of two non-overlapping periods.
Momentum (%)	The ranking value is based on the ratio of the average change in price for a near period and that of a far period.
Percent Change (%)	The ranking value is based on the percent change in price for a specified look-back period.
Performance Return	The ranking value is based on the profit return (in currency terms) from trades in the underlying symbols.
Performance Return - Pct	The ranking value is based on the profit return (in percentage terms) from trades in the underlying symbols.
RSI High Values	The ranking value is solely based on Relative Strength Index (RSI) values over the selected period that are above a specified criterion.
RSI Low Values	The ranking value is solely based on the Relative Strength Index (RSI) values over the selected period that are below specified criteria.
RSI Values	The ranking value is based on the Relative Strength Index (RSI) over the selected period.
Volatility Std Dev	The ranking value is based on the Volatility Standard Deviation indicator over the selected period.
Weighted Momentum (%)	The ranking value is based on the ratio of the weighted percent change in price of a near period divided by the weighted change in price of a far period.
Williams R	The ranking value is based on the Williams R indicator over the selected period.
XLS Ranking Import	The ranking values are imported from an Excel spreadsheet

For each ranking technique, the user can use a specified top number of symbols or a top percentile number of symbols (see figure 1). The frequency to rank the symbols can also be specified (from an intraday interval to a monthly interval) as well as the Price Interval to use for Ranking calculations (from an intraday interval to a monthly interval).

Moreover, different parameters are available depending on which technique is selected. For instance, when the Percent Change (%) Ranking Technique is selected, symbols can be sorted from high to low, or from low to high, by using the RankHighToLow input.

## Ranking Example

The Percent Change (%) ranking technique is selected for the following example. In order to highlight the functionality of this ranking technique, the supplied Custom Strategy LE is utilized, which by default simply

buys the symbols in the Strategy Group if the closing price is greater than zero without any other condition. Therefore, the ranking technique will be the only driver in the Strategy Group determining which symbols to buy. Moreover, the back-tested Portfolio will only include the Strategy Group described above, which is to say that the Strategy Performance Report will only reflect the performance of the selected ranking technique.

First, click on the Manage Strategy Groups icon and create a new Strategy Group. Then add the needed Strategy and symbols using the Strategies tab and the Symbol Lists tab, respectively. The custom Strategy is selected as well as the Dow 10 Index components. Next, use the Ranking tab to select Percent Change (%) from the drop-down list. Then choose the Select the Top Ranked Symbols option and type "1" in the Ranking Limit field (see figure 2 below). The Ranking Interval is set to Monthly, and the Calculation Interval is set to Daily. The different Ranking Strategy Inputs are kept with their default values.

Figure 2: Inputs for the Percent Change (%) Ranking Example

Ranking Strategy Inputs			
Input	Type	Description	
RankLimit	Numeric	Minimum Rank Value (or Max if RankHighToLow...)	-1000
RankHighToLow	TrueFalse	Rank Values in Descending Order	True
PriceLimit	Numeric	Minimum Price required for a trade to be taken	1.50
Period	Numeric	Lookback Period for Prices	30

The newly created Strategy Group is then added to a new Portfolio using the Manage Portfolios icon. The Portfolio is then ready to back-test. In this example, the back-test type is set to Standard and the Portfolio is only tested for one year.

Different sections of interests from the Strategy Performance Report are highlighted below, as well as a TradeStation chart to better understand the functionality of the selected Ranking technique.

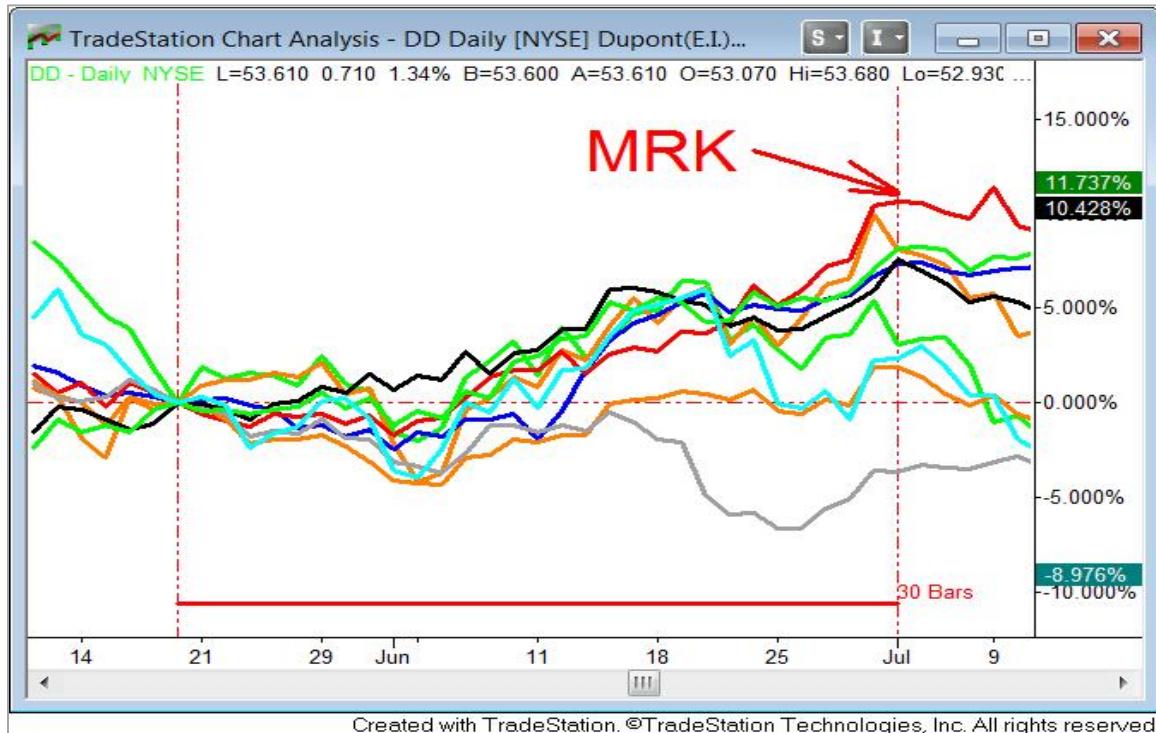
Figure 3 below shows the Trades List tab from the Strategy Performance Report. Notice that the first trade was entered on 3/30/2012. This is because the Ranking technique is first evaluated on the first trading day specified in the back-test look-back period. Moreover, since the Monthly Ranking Interval was selected, the second trade takes place on 4/03/2012. This trade takes place on the second trading day of April 2012, since the custom strategy buys at market on the next trading day. In other words, the strategy is evaluated on the first trading day of the month, but the order is not filled until the second trading day.

Figure 3: Trades List from the Strategy Performance Report Example (including Ranking Technique)

Performance Report: Backtest												
Summary	Trade Analysis		Trades List		Returns & Equity		Equity Table		Periodical Returns		Graphs	Settings
#	Date	Time	Symbol	Type	Price	Quantity	Commissi...	Profit (\$)	Profit (%)	Strategy	Signal Name	
1	3/30/2012	4:00 PM	DD	Long Entry	53.01	100	\$0.00			Custom Strategy LE	CustomLE	
2	4/3/2012	4:00 PM	PFE	Long Entry	22.55	100	\$0.00			Custom Strategy LE	CustomLE	
3	5/2/2012	4:00 PM	T	Long Entry	33.06	100	\$0.00			Custom Strategy LE	CustomLE	
4	7/3/2012	4:00 PM	MRK	Long Entry	41.70	100	\$0.00			Custom Strategy LE	CustomLE	
5	9/5/2012	4:00 PM	PG	Long Entry	67.21	100	\$0.00			Custom Strategy LE	CustomLE	
6	10/2/2012	4:00 PM	GE	Long Entry	22.95	100	\$0.00			Custom Strategy LE	CustomLE	
7	11/2/2012	4:00 PM	JNJ	Long Entry	71.58	100	\$0.00			Custom Strategy LE	CustomLE	
8	3/4/2013	4:00 PM	VZ	Long Entry	46.69	100	\$0.00			Custom Strategy LE	CustomLE	

The question now becomes, why were the symbols bought in the particular order shown in figure 3? Since the Percent Change (%) Ranking technique was selected with the top one symbol, the Symbols List is evaluated monthly and the symbol that performed best for the last 30 bars is selected. Figure 4 below shows MRK was bought on 7/03/12 because it was the best-performing symbol over the last 30 bars.

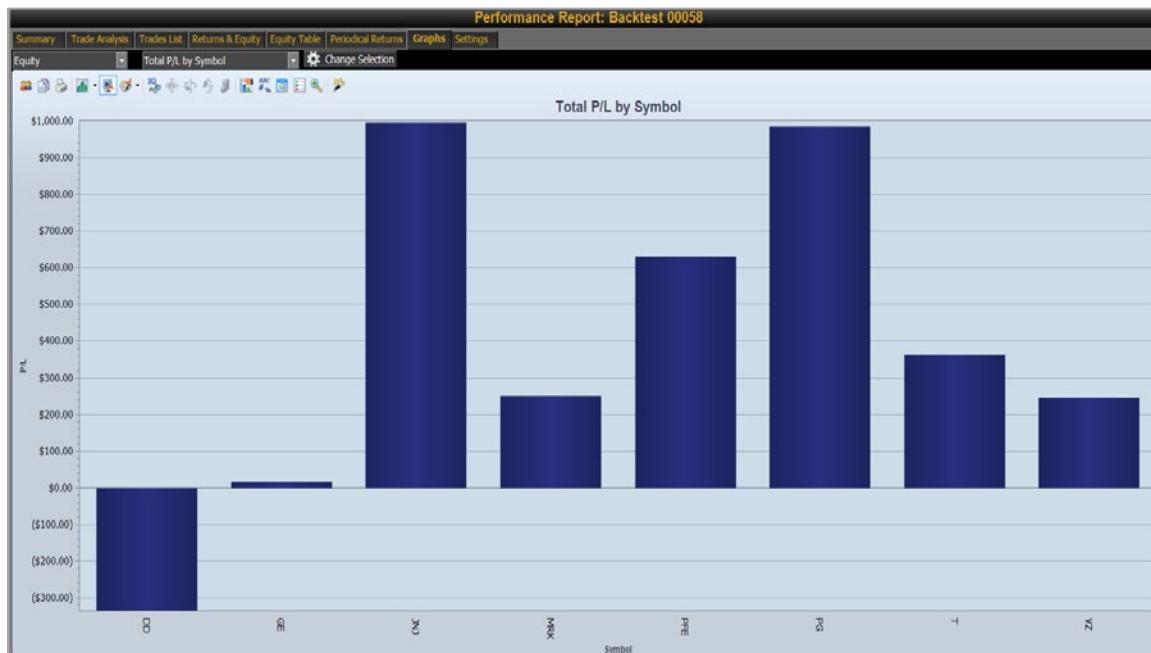
Figure 4: MRK Symbol Selection Using the Percent Change (%) Ranking Technique as of 7/02/12



It is important to note that if the symbol or symbols that meet the ranking technique condition are currently held, then no symbol will be bought at that particular time. That is, the ranking technique will skip currently held securities and only evaluate potential new buys. Notice in figure 3 above that no symbol was bought in June 2012 because the symbol that met the ranking criteria was already held as of that date.

In the Performance Report, various graphs are readily available that can shed light on the utilized strategy and on the selected ranking techniques. Different options within each type of graph are also available. For instance, within the equity-based graphs, the user can also choose between various options using drop-down menus. Figure 5 below reveals the total profit and loss by symbol for the back-tested portfolio. In this particular example, notice that JNJ and PG contributed the most to the positive performance, whereas DD was the worst performer over the back-test.

Figure 5: Total P/L by Symbol Graph Example from the Performance Report



## Money-Management Background

Money-management strategy settings specify the size of each position within a Strategy Group as a form of risk control. By default, the position size is set to a fixed number of shares (100 shares). The symbol's price therefore has a large impact on the risk that is taken per position. For instance, consider the impact on a portfolio from a 50% decline in a traded symbol if it was bought at \$10 versus \$100. The percentage decline would equal a \$500 loss in the first case and a \$5,000 loss in the second! A trade-size method can help normalize the risk taken per position and function as a defensive trading mechanism. The position size can be based on various factors, including equity and volatility factors. A complete list of the available money-management strategies is shown in table 2 below. Multiple parameters are available for each selection (not shown).

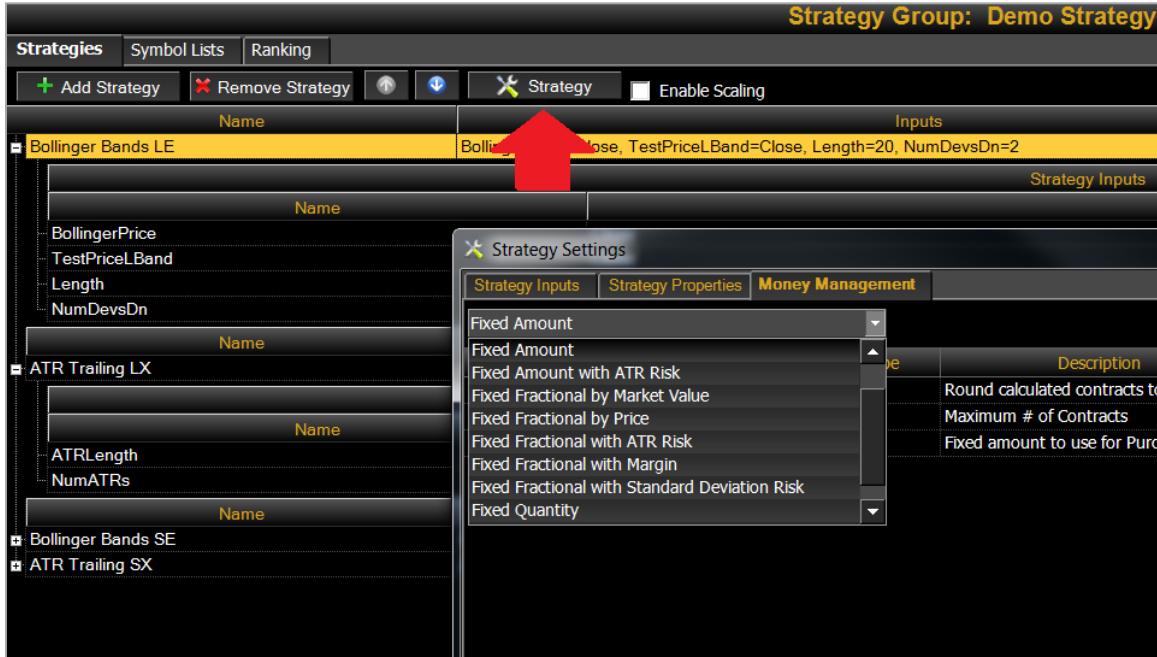
**Table 2: Available Money-Management Strategy Options**

Money-Management Strategies	Description
None	No money-management strategy applied to the Strategy Group.
EasyLanguage	The position size is based on a custom EasyLanguage strategy.
Fixed Amount	The position size is based on a fixed amount of money per trade and rounded down using a user-specified input.
Fixed Amount with ATR Risk	The position size is based on a fixed amount of money per trade, adjusted by an average true range (ATR) factor and rounded down using a user-specified input.
Fixed Fractional by Market Value	The position size is based on a percentage of the portfolio equity and the current market value of the traded symbol (this is especially useful for leveraged instruments).
Fixed Fractional by Price	The position size is based on a percentage of the portfolio equity and the current price of the traded symbol.
Fixed Fractional with ATR Risk	The position size is a percentage of the portfolio equity based on the distance to the stop from the entry point of the trade, where the distance is a multiple of the average true range (ATR) over some specified look-back period.
Fixed Fractional with Margin	The position size is based on multiple factors, including the amount of portfolio equity to be risked and the margin required per unit traded.
Fixed Fractional with Standard Deviation Risk	The position size is a percentage of the portfolio equity based on the distance to the stop from the entry point of the trade, where the distance is a multiple of the standard deviation of price moves over some specified look-back period.
Fixed Quantity	The position size is set to a fixed number of shares for equities, or a fixed number of contracts for futures.
Quantity per Amount	The position size is set according to a user-specified amount of equity required to purchase each share or contract.

To access the money-management strategies, click on the Manage Strategy Groups icon from the Shortcut bar. Then, within the Strategies tab, click the Strategy button (see figure 6 below). From the Strategy Settings dialog, click on the Money Management tab and select the needed money-management strategy from the drop-down list.

Once selected, a money-management strategy is applied to all symbols within the Strategy Group for a particular strategy component. That is, when a Portfolio is back-tested, the trade size for each symbol will be dictated by the chosen money-management strategy across the covered time period. Also, if money management is needed when using multiple Strategy Groups with multiple strategy components, then each strategy component would require its own money-management strategy.

Figure 6: Accessing the Money-Management Strategies



## Money-Management Example

In the following example, the Fixed Fractional by Price money-management strategy is added to the supplied two moving average cross strategy components (i.e., MovAvg2Line Cross LE and MovAvg2Line Cross SE) in a new Strategy Group. The different settings for the strategy components are kept at their default values and the Nasdaq 100 index components are selected as the new Symbol List. Moreover, the back-tested Portfolio will cover three years of data and will only include the described Strategy Group; in other words, by turning the money-management functionality on and off, the Performance Report will only reflect the impact of money management.

The purpose of a Fixed Fractional method is to incorporate a risk component in the trade-size calculation. There are several Fixed Fractional money-management techniques to choose from (see table 2), but the underlying principle is the same, which is to specify a certain equity exposure for a selected metric (e.g., the price of the underlying symbol). The main advantage is to roughly have the same type of risk exposure across positions. A possible drawback is to forego potential profits by trimming equity exposure using Fixed Fractional versus having a larger equity exposure using a fixed number of shares when a position is moving in the right direction. Keep in mind that this drawback can become an advantage by possibly limiting losses if a position goes against expectations.

In order to add the Fixed Fractional by Price strategy, click on the Manage Strategy Groups icon, create a new Strategy Group and add the strategy components and the symbols referenced above. Then click on the Strategy button and select the Money Management tab. In the drop-down list, select Fixed Fractional by Price. The default setting of 5% is adjusted to 2% for this example, meaning that 2% of equity will be risked per position.

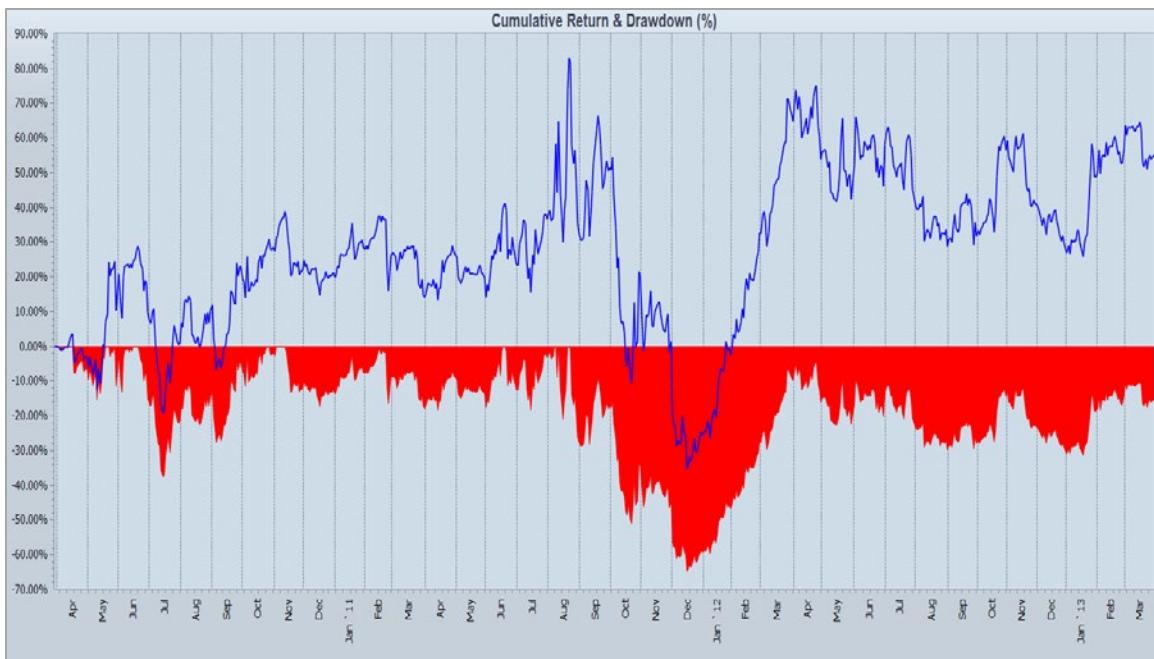
A section of the updated Performance Report is shown in figure 7 below. Notice that the share amounts traded vary greatly versus being fixed at 100 shares. The Money-Management strategy specifies risking 2% of the portfolio equity per position (\$100,000 of equity x 2% / stock price). At first the portfolio equity is the initial capital, but then it becomes the portfolio equity as of the time the Strategy Group is evaluated. Also, keep in mind that the stock price used in the money-management calculation is different from the price in the Trades List from the Performance Report (i.e., the price used in the evaluation versus the theoretical price when the symbol was bought in the simulated back-test).

Figure 7: Trades List from the Strategy Performance Report Example (including Money-Management Strategy)

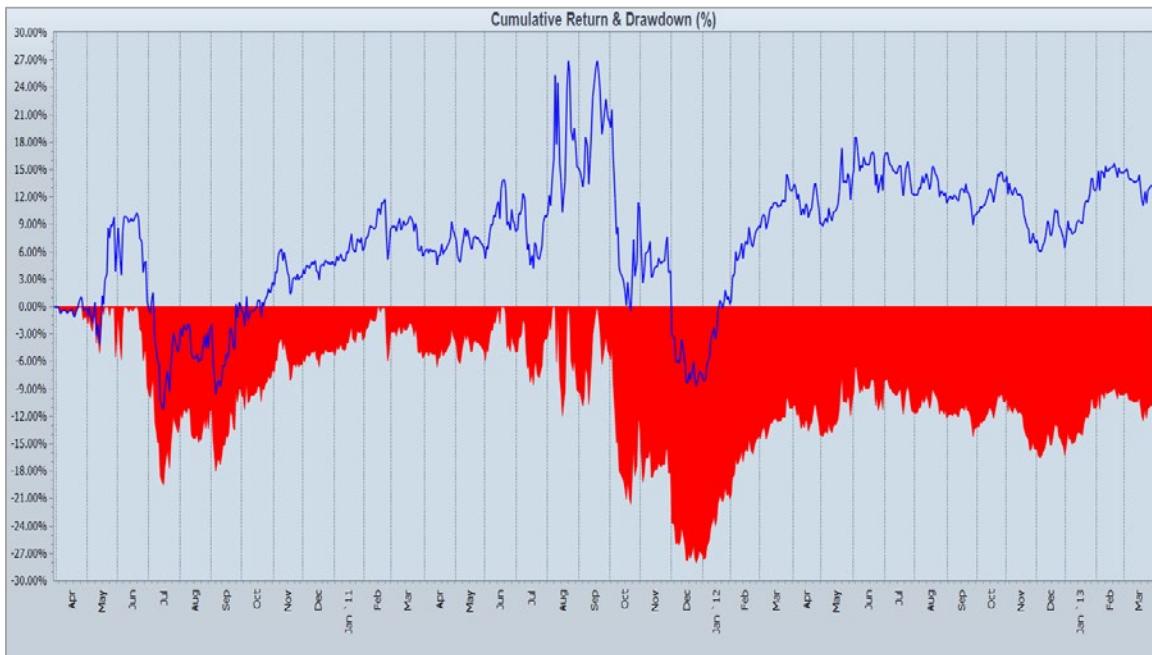
Performance Report: Backtest 00254													
Summary	Trade Analysis		Trades List		Returns & Equity		Equity Table		Periodical Returns		Graphs		Settings
#	Date	Time	Symbol	Type	Price	Quantity	Commission	Profit (\$)	Profit (%)	Strategy	Signal Name	To	
514	7/26/2010	4:00 PM	ROST	Long Entry	27.83	68	\$0.00			MovAvg2Line Cross LE	MA2CrossLE		
514	7/29/2010	4:00 PM	ROST	Long Exit	26.77	68	\$0.00	(\$72.08)	-3.81 %	MovAvg2Line Cross LE	MA2CrossSE		
515	7/26/2010	4:00 PM	VRTX	Long Entry	32.89	57	\$0.00			MovAvg2Line Cross LE	MA2CrossLE		
515	7/28/2010	4:00 PM	VRTX	Long Exit	33.88	57	\$0.00	\$56.43	3.01 %	MovAvg2Line Cross LE	MA2CrossSE		
516	7/27/2010	4:00 PM	AAPL	Long Entry	260.87	7	\$0.00			MovAvg2Line Cross LE	MA2CrossLE		
516	8/16/2010	4:00 PM	AAPL	Long Exit	247.58	7	\$0.00	(\$93.03)	-5.09 %	MovAvg2Line Cross LE	MA2CrossSE		
517	7/27/2010	4:00 PM	MAT	Short Entry	21.93	89	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
517	8/9/2010	4:00 PM	MAT	Short Exit	22.20	89	\$0.00	(\$24.03)	-1.23 %	MovAvg2Line Cross SE	MA2CrossLE		
518	7/27/2010	4:00 PM	SNDK	Short Entry	42.89	45	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
518	8/5/2010	4:00 PM	SNDK	Short Exit	45.92	45	\$0.00	(\$136.35)	-7.06 %	MovAvg2Line Cross SE	MA2CrossLE		
519	7/27/2010	4:00 PM	WDC	Short Entry	28.95	67	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
519	9/3/2010	4:00 PM	WDC	Short Exit	26.48	67	\$0.00	\$165.49	8.53 %	MovAvg2Line Cross SE	MA2CrossLE		
520	7/28/2010	4:00 PM	NVDA	Short Entry	10.29	184	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
520	8/24/2010	4:00 PM	NVDA	Short Exit	9.50	184	\$0.00	\$145.36	7.68 %	MovAvg2Line Cross SE	MA2CrossLE		
521	7/28/2010	4:00 PM	STX	Short Entry	13.13	145	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
521	9/13/2010	4:00 PM	STX	Short Exit	10.85	145	\$0.00	\$330.60	17.36 %	MovAvg2Line Cross SE	MA2CrossLE		
522	7/28/2010	4:00 PM	VRTX	Short Entry	33.88	56	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
522	8/4/2010	4:00 PM	VRTX	Short Exit	36.17	56	\$0.00	(\$128.24)	-6.76 %	MovAvg2Line Cross SE	MA2CrossLE		
523	7/28/2010	4:00 PM	YHOO	Short Entry	13.91	138	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
523	8/13/2010	4:00 PM	YHOO	Short Exit	13.81	138	\$0.00	\$13.80	0.72 %	MovAvg2Line Cross SE	MA2CrossLE		
524	7/29/2010	4:00 PM	COST	Short Entry	49.74	38	\$0.00			MovAvg2Line Cross SE	MA2CrossSE		
524	8/2/2010	4:00 PM	COST	Short Exit	50.06	38	\$0.00	(\$12.16)	-0.64 %	MovAvg2Line Cross SE	MA2CrossLE		

It is important to remember that money-management strategies can have a significant impact on performance. Figures 8 and 9 below show the Cumulative Return & Drawdown (%) graphs before and after the money-management strategy was added, respectively. First, notice that the overall shape of the performance is similar, including the timing of the worst drawdown during the back-test. However, the performance seems "smoother" overall when Money Management is included (compare the blue lines in figures 8 and 9). Notice also that the worst cumulative drawdown was cut in half, from roughly 60% to 30% (see the red area in figures 8 and 9). However, the overall performance was also cut significantly, from roughly 50% to 15% (see the ending value of the blue lines in figures 8 and 9). Money management may not always have a positive impact on overall performance.

Figure 8: Cumulative Return & Drawdown (%) before Inclusion of Money-Management Strategy



**Figure 9: Cumulative Return & Drawdown (%) after Inclusion of Money-Management Strategy**

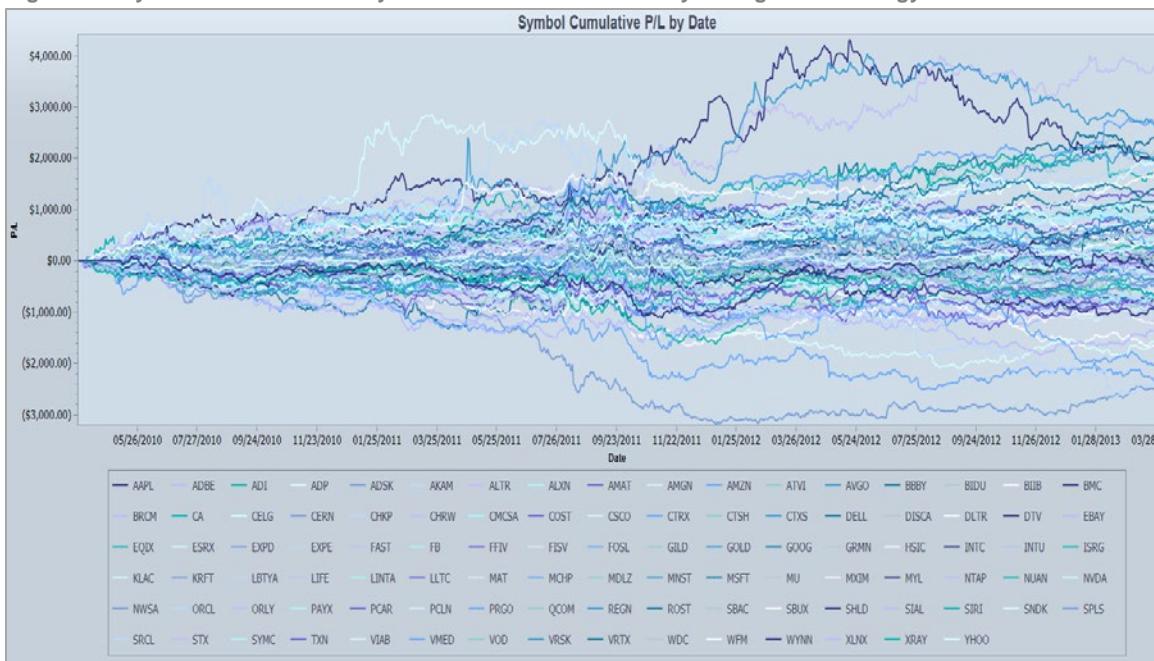


The Symbol Cumulative P/L by Date graphic, which is also available in the Performance Report, dramatically reveals the impact of position sizing. Figure 10 below reflects the performance of individual symbols and their contribution to the portfolio when no money-management strategy is included. Notice how a selected number of symbols (e.g., AAPL) become the key drivers behind the portfolio performance. The large majority of symbols are confined to a much smaller performance range, trumped by the outliers. Figure 11 shows the same chart when the Fixed Fractional by Price money-management strategy is added to the mix. Notice how relatively consistent the contribution per symbol is to the portfolio performance versus the previous chart.

**Figure 10: Symbol Cumulative P/L by Date before Inclusion of Money-Management Strategy**



Figure 11: Symbol Cumulative P/L by Date after Inclusion of Money-Management Strategy



## Conclusion

Portfolio Maestro offers advanced features at the Strategy Group level, such as ranking techniques and money-management strategies. For each of these advanced techniques, many different parameters are available for users to explore. It is important to keep in mind that these options can have a significant impact on a Portfolio's performance. Back-testing these advanced features in a simulated environment – without risking capital – is a major benefit of Portfolio Maestro. The next white paper in this series will focus on the software's functionality with regard to Portfolio Constraints and Portfolio Targets/Stops.

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