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Portfolio Back-Testing with Portfolio Maestro: Constraints and Portfolio Stops

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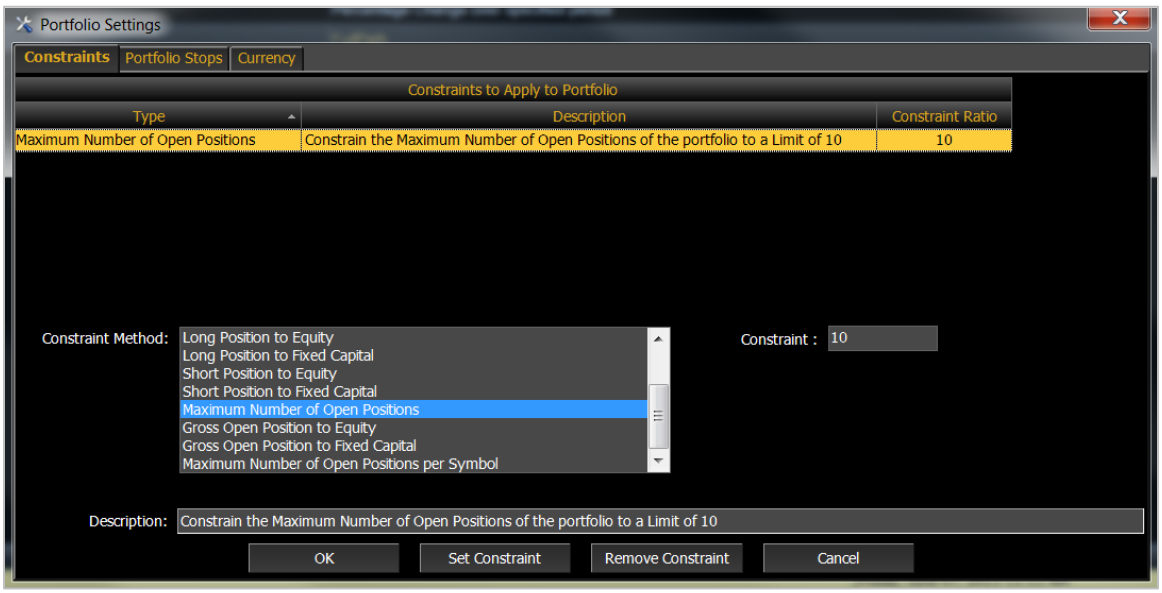
Summary

Portfolio Maestro provides advanced back-testing functionality to evaluate a portfolio of symbols, on one or more strategies, based on requirements and conditions that exist in real-world trading situations. In this third installment of our white paper series on Portfolio Maestro, we analyze constraints and portfolio stop techniques and explore practical examples.

Portfolio constraints allow you to better control portfolio testing based on one or more criteria: for example, by limiting the maximum amount of margin exposure based on the account equity. Portfolio stops allow you to manage risk at the portfolio level: for example, by closing all open positions if the portfolio equity decreases by a specified amount.

Figure 1: Maximum Number of Open Positions Constraint



Constraints Background

The goal of the constraints functionality is to take into account portfolio requirements that may happen in real trading situations. Constraints are set at a portfolio level and once set will limit trades from being taken. This means that constraints override other settings set at the Strategy Group level and omit trades when necessary. If multiple constraints are used for a portfolio, a trade will not be placed if even a single constraint is violated. Constraints may also omit exits under some circumstances. When this occurs, as in the example cited in the Constraint Example section below, an open position may be carried until the next time a trade is generated and is accepted under the constraints in use.

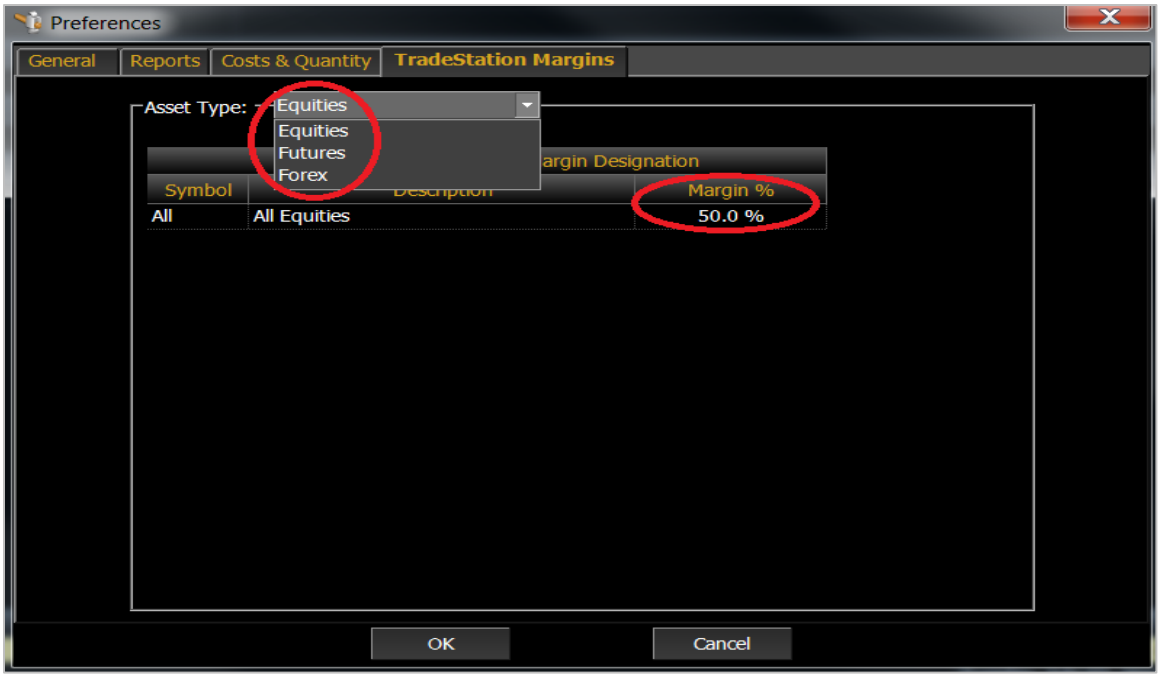
To access the different constraints, click on the Manage Portfolios icon in the Shortcut Bar. Then, click on the Portfolio Settings button to access the Portfolio Settings dialog. Click on the Constraints tab and select the desired constraint from the Constraint Method list. Enter the needed number in the Constraint box. Next, click on the Set Constraint button and repeat the process if additional constraints are needed. Finally, click OK to close the dialog when finished. The details about each selected constraint are displayed in the lower portion of the Constraints tab. There are 12 different constraints available in Portfolio Maestro (see table 1 below).

Table 1: Constraints Options

Constraint Methodology	Description
Margin to Equity	A trade is not taken if it would cause the margin to equity ratio (as of the time of the trade) to exceed the specified amount.
Margin to Fixed Capital	A trade is not taken if it would cause the margin to fixed capital ratio (as of the time of the trade) to exceed the specified amount. Fixed Capital is the initial capital of the back-test.
Net Open Position to Equity	A trade is not taken if it would cause the net open position to equity ratio (as of the time of the trade) to exceed the specified amount. The Net Open Position to Equity is the absolute difference between the sum of all long positions and the sum of the absolute value of all short positions, divided by equity.
Net Open Position to Fixed Capital	A trade is not taken if it would cause the net open position to fixed capital ratio (as of the time of the trade) to exceed the specified amount. The Net Open Position to Fixed Capital is the absolute difference between the sum of all long positions and the sum of the absolute value of all short positions, divided by fixed capital (i.e., initial capital).
Long Position to Equity	A trade is not taken if it would cause the long position to equity ratio (as of the time of the trade) to exceed the specified amount. Long Position is the sum of all long positions.
Long Position to Fixed Capital	A trade is not taken if it would cause the long position to fixed capital ratio (as of the time of the trade) to exceed the specified amount. Long Position is the sum of all long positions and Fixed Capital is the initial capital of the back-test.
Short Position to Equity	A trade is not taken if it would cause the short position to equity ratio (as of the time of the trade) to exceed the specified amount. The Short Position to Equity is the sum of the absolute value of all short positions divided by equity.
Short Position to Fixed Capital	A trade is not taken if it would cause the short position to fixed capital ratio (as of the time of the trade) to exceed the specified amount. The Short Position to Fixed Capital is the sum of the absolute value of all short positions divided by fixed capital (i.e., initial capital).
Maximum Number of Open Positions	A trade is not taken if it would cause the number of open positions to exceed the maximum number set in this constraint.
Gross Open Position to Equity	A trade is not taken if it would cause the gross open position to equity ratio (as of the time of the trade) to exceed the specified amount. Gross Open Position is the sum of all long positions and the absolute value of all short positions.
Gross Open Position to Fixed Capital	A trade is not taken if it would cause the gross open position to fixed capital ratio (as of the time of the trade) to exceed the specified amount. Gross Open Position is the sum of all long positions and the absolute value of all short positions. Fixed Capital is the initial capital of the back-test.
Maximum Number of Open Positions per Symbol	A trade is not taken if it would cause the number of open positions per symbol to exceed the maximum number set in this constraint.

Margin is a figure that is specified for each symbol in the Preferences section. To access the margin figures, go to File and select Preferences. Figure 2 below shows the initial margin designation for equities (i.e., 50%). To make a needed adjustment, click on the particular cell and insert the required margin. Notice also that the asset type can be selected in the top portion of the dialog.

Figure 2: Initial Margin Requirements for Equities



For each constraint methodology, the user can specify the constraint ratio or constraint number associated with the particular selection (e.g., number of positions for the Maximum Number of Open Positions Constraint).

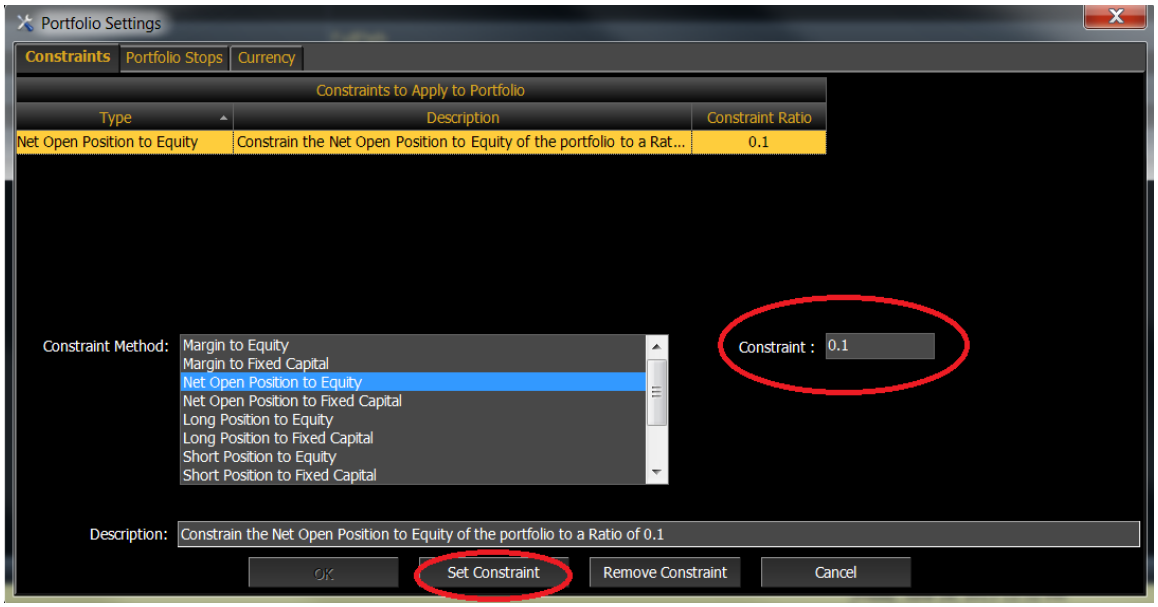
Lastly, if an applied constraint needs to be removed from a portfolio, select the constraint and click on the Remove Constraint button in the Constraints tab within the Portfolio Settings dialog.

Constraint Example

The Net Open Position to Equity constraint is selected for the following example. In order to highlight the functionality of this constraint with long and short entries, the supplied Bollinger Bands LE and Bollinger Bands SE are selected with their default settings. The Symbol List includes the components of the Dow 10 Index and no Ranking or Money Management techniques are included.

First, create a new Strategy Group and include the strategies and symbols listed above. The newly created Strategy Group is then added to a new Portfolio using the Manage Portfolios icon. In the Portfolio Settings dialog, click on the Constraints tab and select Net Open Position to Equity and type 0.1 in the Constraint box. Click on Set Constraint, then click on OK to close the dialog (see figure 3 below). 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.

Figure 3: Net Open Position to Equity Constraint Example



Different sections of interest from the Strategy Performance Report are highlighted below. Figure 4 below shows the Trades List tab from the Performance Report.

Figure 4: Trades List from the Strategy Performance Report Example (including Constraint)

Performance Report: Backtest 00265

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	Total Efficie...	Entry Efficie...
1	7/3/2012	4:00 PM	GE	Short Entry	20.38	100	$0.00			Bollinger Bands SE	BBandSE		
1	9/4/2012	4:00 PM	GE	Short Exit	20.63	100	$0.00	($25.00)	-1.23 %	Bollinger Bands SE	BBandLE	-13.66 %	55.74 %
2	7/5/2012	4:00 PM	MRK	Short Entry	41.67	100	$0.00			Bollinger Bands SE	BBandSE		
2	8/27/2012	4:00 PM	MRK	Short Exit	43.00	100	$0.00	($133.00)	-3.19 %	Bollinger Bands SE	BBandLE	-32.36 %	14.84 %
3	7/5/2012	4:00 PM	T	Short Entry	35.93	100	$0.00			Bollinger Bands SE	BBandSE		
3	7/26/2012	4:00 PM	T	Short Exit	35.90	100	$0.00	$3.00	0.08 %	Bollinger Bands SE	BBandLE	1.54 %	86.67 %
4	7/16/2012	4:00 PM	DD	Long Entry	47.38	100	$0.00			Bollinger Bands LE	BBandLE		
5	7/16/2012	4:00 PM	INTC	Long Entry	25.23	100	$0.00			Bollinger Bands LE	BBandLE		
5	1/4/2013	4:00 PM	INTC	Long Exit	21.36	100	$0.00	($387.00)	-15.34 %	Bollinger Bands LE	BBandSE	-50.46 %	21.77 %
6	7/20/2012	4:00 PM	JNJ	Short Entry	69.35	100	$0.00			Bollinger Bands SE	BBandSE		
6	10/15/20...	4:00 PM	JNJ	Short Exit	68.18	100	$0.00	$117.00	1.69 %	Bollinger Bands SE	BBandLE	40.34 %	86.21 %
7	7/26/2012	4:00 PM	T	Long Entry	35.90	100	$0.00			Bollinger Bands LE	BBandLE		
7	8/2/2012	4:00 PM	T	Long Exit	37.52	100	$0.00	$162.00	4.51 %	Bollinger Bands LE	BBandSE	66.12 %	97.14 %
8	7/27/2012	4:00 PM	HPQ	Long Entry	18.16	100	$0.00			Bollinger Bands LE	BBandLE		
8	1/7/2013	4:00 PM	HPQ	Long Exit	15.15	100	$0.00	($301.00)	-16.57 %	Bollinger Bands LE	BBandSE	-33.78 %	23.57 %
9	8/2/2012	4:00 PM	T	Short Entry	37.52	100	$0.00			Bollinger Bands SE	BBandSE		
9	10/18/20...	4:00 PM	T	Short Exit	35.85	100	$0.00	$167.00	4.45 %	Bollinger Bands SE	BBandLE	44.53 %	71.73 %
10	8/27/2012	4:00 PM	MRK	Long Entry	43.00	100	$0.00			Bollinger Bands LE	BBandLE		
10	10/22/20...	4:00 PM	MRK	Long Exit	46.66	100	$0.00	$366.00	8.51 %	Bollinger Bands LE	BBandSE	68.28 %	93.28 %
11	8/27/2012	4:00 PM	VZ	Long Entry	43.08	100	$0.00			Bollinger Bands LE	BBandLE		
11	9/17/2012	4:00 PM	VZ	Long Exit	44.44	100	$0.00	$136.00	3.16 %	Bollinger Bands LE	BBandSE	43.31 %	81.53 %
12	9/4/2012	4:00 PM	GE	Long Entry	20.63	100	$0.00			Bollinger Bands LE	BBandLE		
12	6/20/2013	4:00 PM	GE	Long Exit	23.63	100	$0.00	$300.00	14.54 %	Bollinger Bands LE	BBandSE	65.50 %	83.41 %
13	9/10/2012	4:00 PM	PFE	Short Entry	24.23	100	$0.00			Bollinger Bands SE	BBandSE		
13	11/6/2012	4:00 PM	PFE	Short Exit	24.61	100	$0.00	($38.00)	-1.57 %	Bollinger Bands SE	BBandLE	-15.45 %	24.39 %
14	9/12/2012	4:00 PM	MCD	Short Entry	91.41	100	$0.00			Bollinger Bands SE	BBandSE		
14	10/26/20...	4:00 PM	MCD	Short Exit	87.46	100	$0.00	$395.00	4.32 %	Bollinger Bands SE	BBandLE	54.94 %	61.75 %

By comparing the Trades List in figure 4 to the signals generated for each symbol in TradeStation charts (see figure 5), we see that the trades do not match when a constraint is utilized. The selected constraint filtered various trades for the time period covered. For instance, notice that for GE, a number of trades did not take place between 9/04/2012 and 6/20/2013. The first trade skipped was on 9/17/2013 since the Net Open Position to Equity ratio exceeded 0.1. The Net Open Position at the time equaled the difference between the sum of all long positions and the sum of the absolute value of all short positions (i.e., 15,926 – I -26,659 I = -10,733). The Net Open Position to Equity ratio at the time was 0.106621 (i.e., I -10,733 / 100,665 I = 0.106621), which is greater than the 0.10 constraint. The different figures above were obtained from different sections of the Performance Report (mainly from the Trades List and the Equity Table).

Figure 5: GE with the Bollinger Bands LE and Bollinger Bands SE Strategy Components in TradeStation

In the example above, the portfolio constraint only takes into account market exposure versus portfolio equity as of the time the different trades are generated from strategies within the back-tested portfolio. As table 1 illustrates, there are many additional constraints from which to choose, but the general principal is the same. If one of the selected constraints is met, the generated trades are not taken. It's also important to remember that a portfolio can include various constraints at the same time.

In the Performance Report, various tools are readily available that can shed light on the impact of the utilized constraint on a portfolio. One of the easiest ways to view the impact of a constraint is to compare the Performance Report of the portfolio to the Performance Report of an identical portfolio without the constraint. For instance, figures 6 and 7 show the maximum drawdown for each trade with its associated closing profit or loss, with and without the inclusion of the Net Open Position to Equity constraint. In this particular example, the inclusion of the constraint not only reduced drawdowns for the back-tested period, but also helped close some positions at a higher profit. Notice also that the number of trades is significantly reduced with the inclusion of the constraint.

The overall advantage of including the selected constraint in this particular example is the normalization of equity exposure for the portfolio during the back-test period. The main drawback in this case was to forego a number of trades. However, in this particular case, avoiding certain trades helped the overall performance. Keep in mind that constraints may not automatically have a positive impact on performance.

Figure 6: Maximum Adverse Excursion (%) with the Net Open Position to Equity Constraint

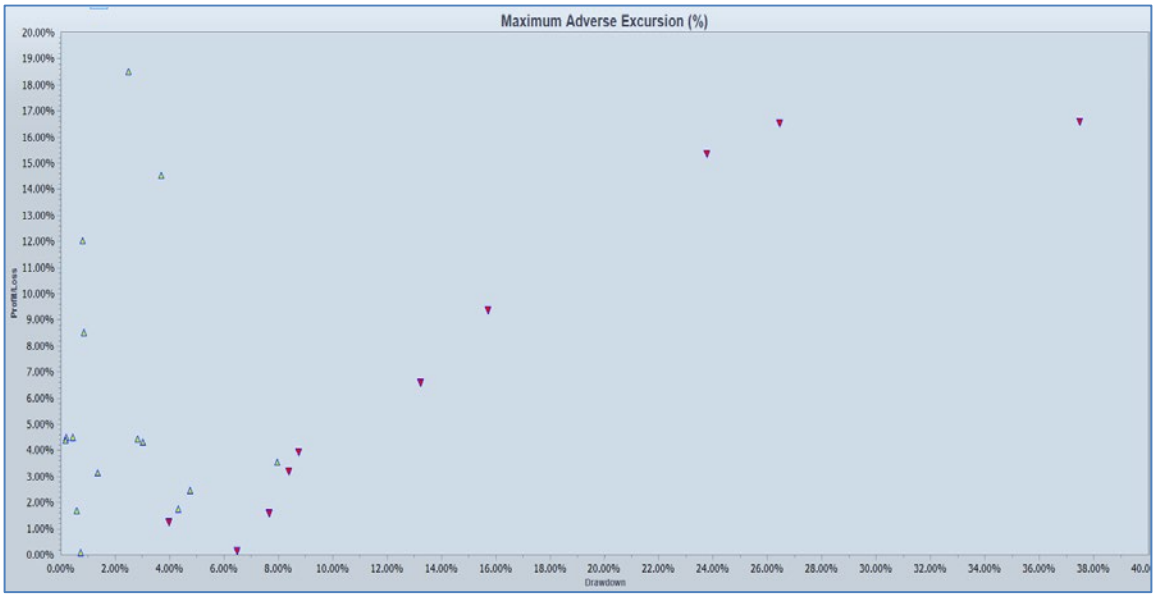
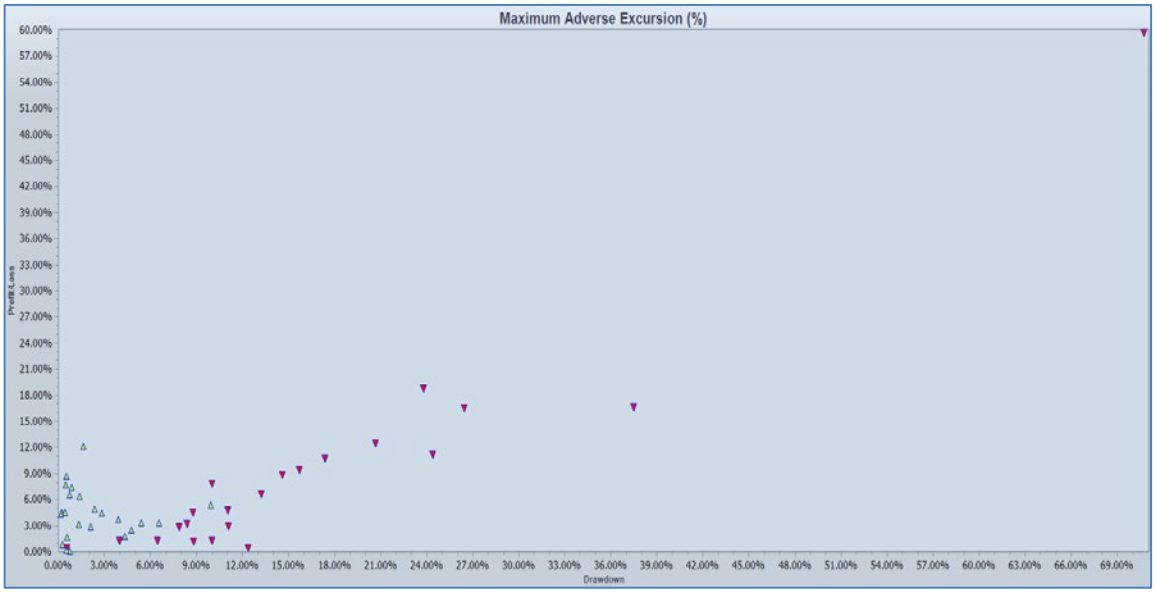
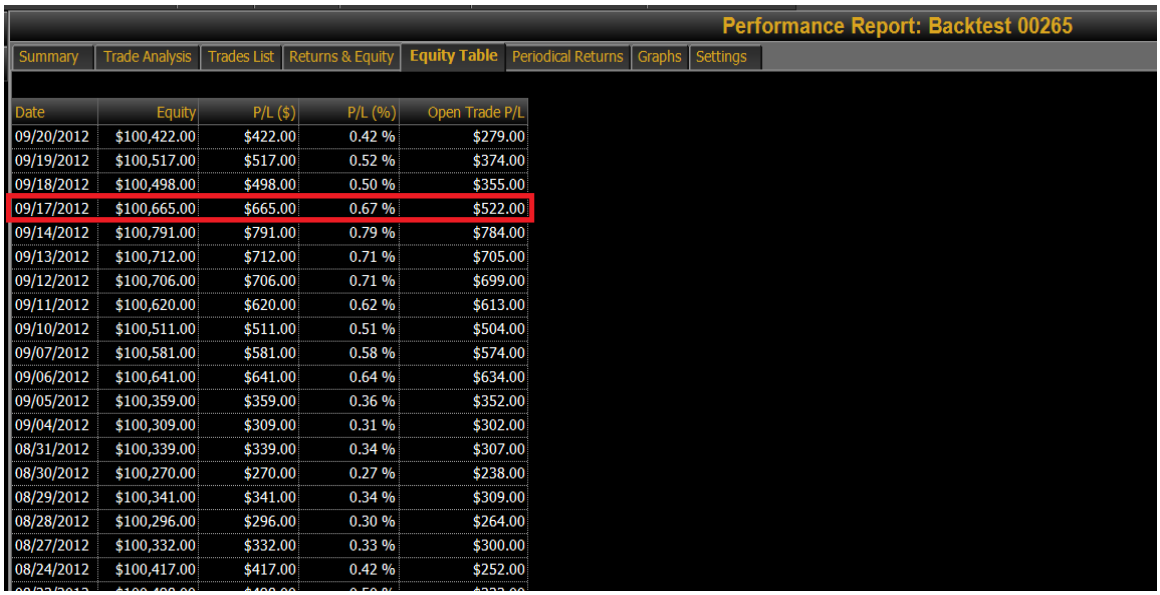


Figure 7: Maximum Adverse Excursion (%) without the Net Open Position to Equity Constraint



Lastly, in the previous example, the data in the Equity Table can be very helpful in keeping track of the portfolio equity historically, which is a component of the selected constraint (see figure 8). By keeping track of these figures, the user can monitor when the conditions of the different constraints are triggered and when strategy orders are being filtered.

Figure 8: Equity Table from the Performance Report



Date	Equity	P/L ($)	P/L (%)	Open Trade P/L
09/20/2012	$100,422.00	$422.00	0.42 %	$279.00
09/19/2012	$100,517.00	$517.00	0.52 %	$374.00
09/18/2012	$100,498.00	$498.00	0.50 %	$355.00
09/17/2012	$100,665.00	$665.00	0.67 %	$522.00
09/14/2012	$100,791.00	$791.00	0.79 %	$784.00
09/13/2012	$100,712.00	$712.00	0.71 %	$705.00
09/12/2012	$100,706.00	$706.00	0.71 %	$699.00
09/11/2012	$100,620.00	$620.00	0.62 %	$613.00
09/10/2012	$100,511.00	$511.00	0.51 %	$504.00
09/07/2012	$100,581.00	$581.00	0.58 %	$574.00
09/06/2012	$100,641.00	$641.00	0.64 %	$634.00
09/05/2012	$100,359.00	$359.00	0.36 %	$352.00
09/04/2012	$100,309.00	$309.00	0.31 %	$302.00
08/31/2012	$100,339.00	$339.00	0.34 %	$307.00
08/30/2012	$100,270.00	$270.00	0.27 %	$238.00
08/29/2012	$100,341.00	$341.00	0.34 %	$309.00
08/28/2012	$100,296.00	$296.00	0.30 %	$264.00
08/27/2012	$100,332.00	$332.00	0.33 %	$300.00
08/24/2012	$100,417.00	$417.00	0.42 %	$252.00

Portfolio Stops Background

The portfolio stops functionality in Portfolio Maestro is also designed to address portfolio requirements that may arise in real trading situations. For instance, if the overall portfolio equity goes up or down by a set percentage, all positions may need to be closed and no trade may be accepted until the following period. Portfolio stops are also called equity filters in that they act as circuit breakers if the portfolio equity falls outside a given parameter.

To access the different portfolio stops, click on the Manage Portfolios icon in the Shortcut Bar. Then, click on the Portfolio Settings button to access the Portfolio Settings dialog. Click on the Portfolio Stops tab and select the desired stop from the Stop Strategies list. Enter the needed parameters in the Set/Change Stop Strategy Inputs table. Next, click on the Set Stop button and repeat the process if additional stops are needed. Finally, click OK to close the dialog when finished. The details about each selected stop are displayed in the middle portion of the Portfolio Stops tab.

A complete list of the available portfolio stops is shown in table 2 below. Multiple parameters are available for each selection. For example, the period can be set to daily, weekly or monthly.

Table 2: Available Portfolio Stops Options

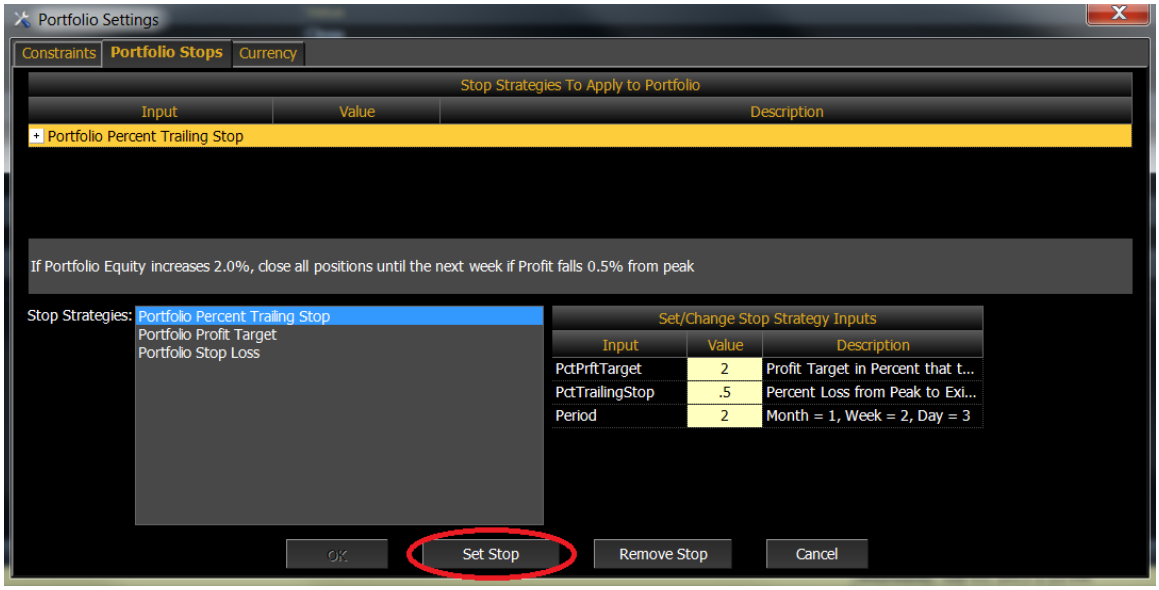
Portfolio Stops Selection	Description
Portfolio Percent Trailing Stop	All positions are closed and no trade is taken until the next period if the portfolio equity increases by a specified amount and then falls by another specified amount from the peak.
Portfolio Profit Target	All positions are closed and no trade is taken until the next period if the portfolio equity increases by a specified amount.
Portfolio Stop Loss	All positions are closed and no trade is taken until the next period if the portfolio equity decreases by a specified amount.

Portfolio Stop Example

In the following example, the Portfolio Percent Trailing Stop is included in a new Strategy Group comprised of the Nasdaq-100 index components. The strategy components within the Strategy Group include the MovAvg Cross LE and MovAvgCross SE components in order to take both long and short entries.

First, create a new Strategy Group and include the strategies and symbols listed above. The default Length input values are adjusted to 5 for the LE strategy component and to 21 for the SE strategy component. The newly created Strategy Group is then added to a new Portfolio using the Manage Portfolios icon. In the Portfolio Settings dialog, click on the Portfolio Stops tab and select Portfolio Percent Trailing Stop and keep the default settings unchanged. Click on Set Stop, then on OK to close the dialog (see figure 9 below). The Portfolio is then ready to back-test. In this example, the back-test type is set to Standard and the Portfolio is tested for 18 months.

Figure 9: Portfolio Percent Trailing Stop Example



One of the easiest ways to view the impact of a stop is to compare the Performance Report of the portfolio to the Performance Report of an identical portfolio without the stop. For instance, figures 10 and 11 show the Strategy Group Cumulative P/L by Date for our example with and without the trailing stop. Notice the positive impact of the trailing stop in this example with a more linear P/L curve.

Figure 10: Strategy Group Cumulative P/L by Date with the Portfolio Percent Trailing Stop

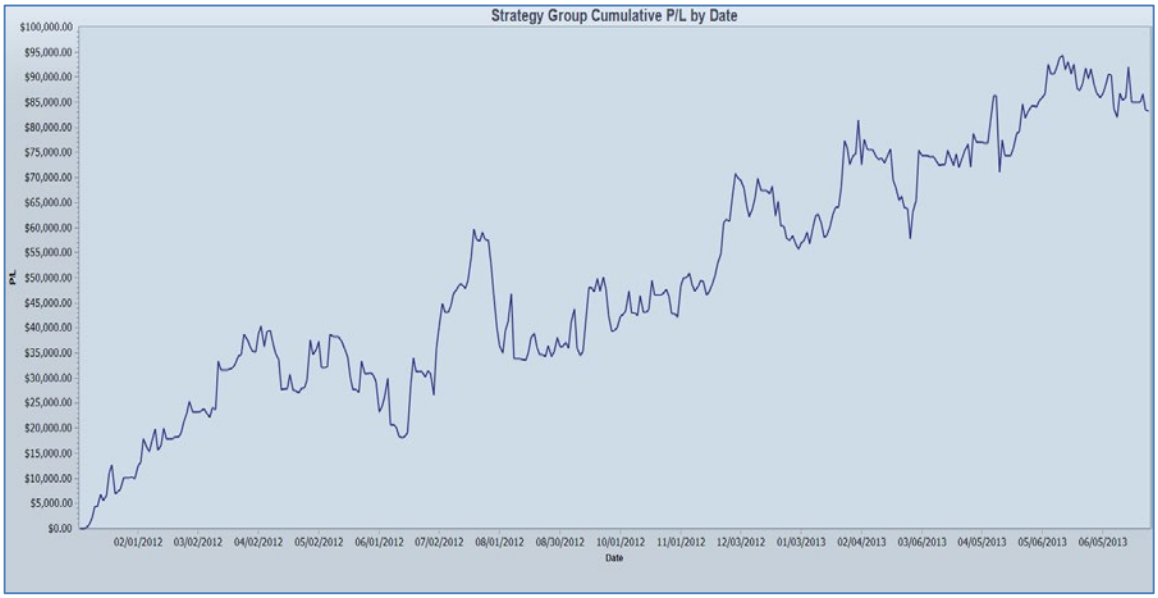
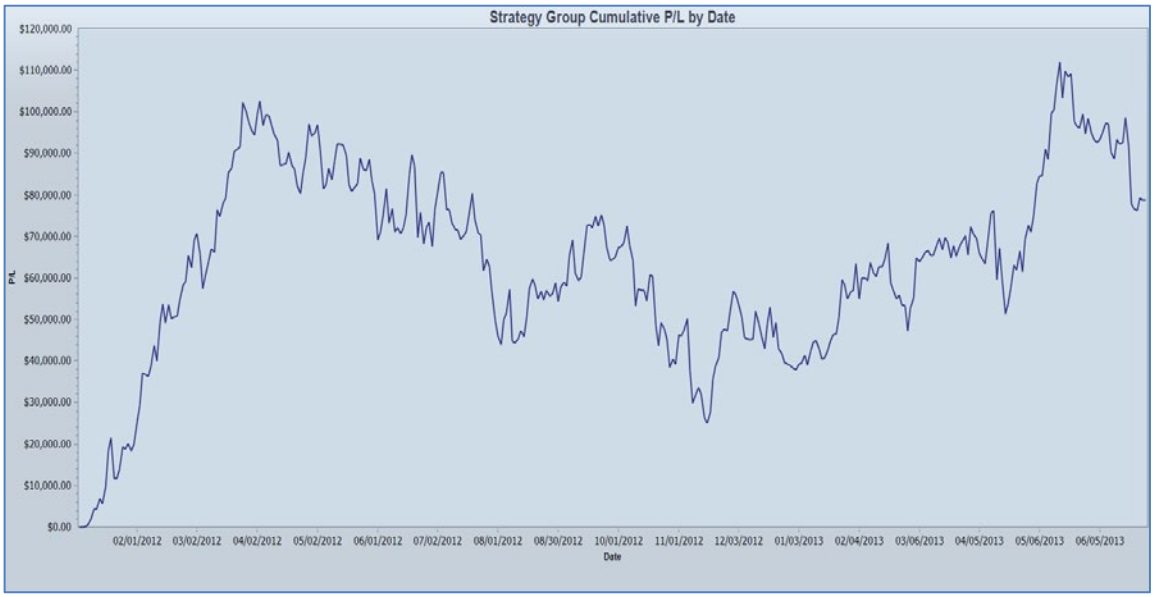
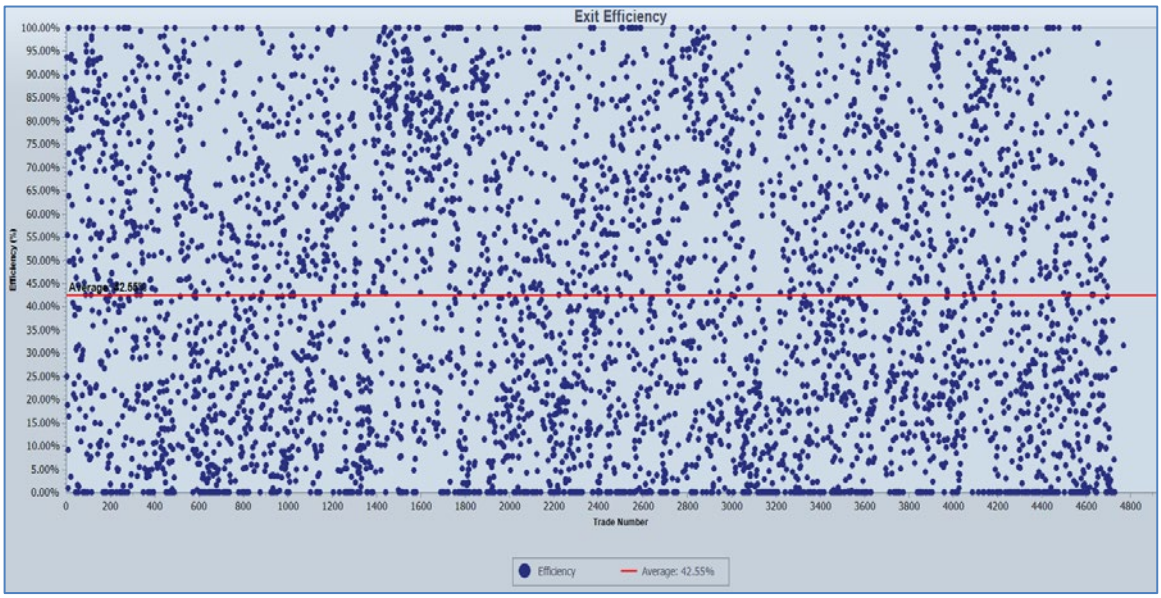


Figure 11: Strategy Group Cumulative P/L without the Portfolio Percent Trailing Stop



Another graph available in the Performance Report that is particularly interesting in our example is the Exit Efficiency graph, which captures how good the strategy components are to exit trades. In this example, there's a significant improvement with the inclusion of the trailing stop: the average exit efficiency improved by over 10 percentage points (see the red line in figure 12 below).

Figure 12: Exit Efficiency with the Portfolio Percent Trailing Stop



Keep in mind that stops may not automatically have a positive impact on performance. For example, the inclusion of a portfolio stop loss may hinder performance by not allowing strategies time to turn around after experiencing equity drawdowns. The decision to include or exclude portfolio stops may depend on the characteristics of the individual portfolio.

Conclusion

Portfolio Maestro offers different advanced features at a portfolio level that can override settings at a Strategy Group level, such as constraints and portfolio stops, to more realistically replicate portfolio requirements in a back-test. 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 address "Portfolio Optimization using Portfolio Maestro."

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." For more information about Portfolio Maestro's other advanced features, please see the second installment of the series, "Portfolio Back-Testing with Portfolio Maestro: Ranking and Money Management."

Disclosures