

Equity Combo Utility

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Description

AmiBroker is a powerful tool for backtesting trading strategies. However, one thing that is not particularly straightforward in AmiBroker is combining multiple strategies into a single system. If you're trading your portfolio from a single brokerage account, then the most accurate way to model trading multiple strategies is to build all the logic into a single backtest. However, that approach presents several challenges, both from the trading logic perspective and from the coding perspective. If you're interested in more detail on that topic, you can read my [blog post at quantforhire.com](https://quantforhire.com).

The basic purpose of the Equity Combo Utility (ECU) is to use a simplified approach to estimate the combined performance of two or more strategies. This is achieved by saving the equity curve for each strategy of interest, and then combining those equity curves to produce a new equity curve representing the combined strategy performance. You can also save the exposure for each strategy, which allows ECU to report the combined exposure so you know how much of your capital was in use.

Features

- Combine equity curves from up to 10 individual strategies
- Automatically perform pairwise combinations of multiple variations of two different strategies
- Find optimal equity allocations for up to 10 different strategies
- Subtract performance and management fees from the results
- Select rebalance frequency
- Report combined CAR, Max DD, Exposure, Annual Volatility, Sharpe Ratio, and other metrics
- Report average, min, and max exposure (% of equity in use), as well as the frequency with which exposure exceeds various thresholds from 50% to 200%.
- Report Annual Return for each year in the test period
- Calculate correlation of returns between the primary and secondary strategies (Mode 2 only)
- Calculate correlation of combined returns with S&P 500 index and VIX
- Save the combined equity curve and exposure so that they can be combined with new strategies in the future

Assumptions

Although combining the equity curves from two or more strategies provides a good approximation of the combined performance of those strategies, it should be recognized that the process involves some underlying assumptions.

Overlapping Trades

When we combine equity curves, we no longer have visibility into the trades taken by each strategy. That means that there is no way to prevent (or even detect) if multiple strategies are trading the same symbol at the same time, either in the same direction (long-long or short-short) or even in opposite directions (long-short). In terms of live trading, the implication is that you will always take the signals from each system, without regard to trades that other systems may have entered.

No Cost for Rebalancing

At the end of each rebalancing period, the Equity Combo utility will “sell” each strategy’s equity curve and then “buy” the equity curve again using the prescribed allocation. Within the utility, there is no cost (commission) to perform this operation. If you are live trading a single account, you could easily “move” cash from one strategy to another without cost. But if you need to sell real positions to free up cash, then the “rebalance” will have a cost associated with it. This is likely a very small issue for longer rebalancing periods like quarterly and annually but could be a problem for daily rebalancing depending on how much capital is typically in use by each strategy.

Getting Started

Before we can combine equity curves, we need to generate equity curves and exposure data from each of the strategies of interest. The Equity Combo utility uses equity curves that have been stored in the AmiBroker database using new ticker symbols.

To store the equity curve and exposure data generated by your backtest, you will need to insert the code snippets from the Equity Combo Snippets AFL file into your strategy AFL. Instructions are included in the Snippets file and will vary slightly depending on whether your code already includes a Custom Backtest (CBT). The code provided supports running a single backtest that generates a single equity curve as well as running an optimization that generates an equity curve for every backtest that is part of the optimization.

After modifying your strategy AFL, run a backtest or optimization as you normally would, using the range of dates (or longer) that you intend to analyze with the Equity Combo utility. Repeat the process for a second strategy, and up to eight additional strategies if desired. Make sure to use a unique set of names (ticker symbols) for the equity curves from each different strategy. Also save your optimization results so that you can refer to them later.

Once all the equity curves have been generated and saved to the database, you’re ready to run the Equity Combo utility.

Global Options

All options are set via the Parameters dialog box available from the Analysis window. Global options which apply to all modes of operation include:

Mode of Operation: The utility includes two different modes of operation. These are described in the next section, along with the mode-specific parameters.

Initial Equity: The initial account balance (equity) to be used for the combined equity curve.

Rebalance Frequency: Each source equity curve (strategy) is allocated a percentage of total equity. The equity is reallocated at the end of each period specified by the rebalance frequency.

Fee Schedule: The utility has the ability to subtract management and/or performance fees on a monthly, quarterly, or annual basis.

% Annual Management Fee: The annual management fee, expressed as a percentage. For example, if this parameter is set to 2 (i.e. 2%) and the Fee Schedule is set to Quarterly, then at the end of each quarter the utility will subtract 0.5% (2% / 4x per year) of equity from the account.

% Performance Fee: The performance fee, expressed as a percentage. The performance fee is only assessed if the current period's closing equity (less management fees) is the highest closing equity ever. For example, if this parameter is set to 20% and the Fee Schedule is set to Quarterly, then at the end of each quarter the utility will subtract 20% x (current equity – previous max closing equity) from the account.

Fee Output File: The full path to a CSV file containing equity before and after fees as well as the fees themselves.

Combined Equity Symbol Base: The combined equity curve(s) will be saved as new symbols in your AmiBroker database. This allows you to combine a new strategy with an existing combination of strategies, for example to analyze the effect of adding a new trading strategy to your existing portfolio.

Modes of Operation

The Equity Combo utility includes two different modes of operation, each with a different purpose. These modes and their parameters are described below.

Mode 1: Combine up to 10 Equity Curves

Mode 1 will allocate a fixed percentage of total equity to a maximum of 10 different strategies (equity curves). When you select Mode 1 and run an AmiBroker **Backtest**, the strategy allocations will be the Default values shown in the Parameters (see below). Selecting Mode 1 and running an AmiBroker **Optimization** will test all strategy allocations from the Min to the Max value. To use Mode 1, all of the equity curve ticker symbols for the source strategies (e.g. ~EqStrategyA, ~EqStrategyB, etc.) must be placed in a watchlist, and that watchlist should be selected in the Apply To Filter. In addition, the symbols must be specified in the Parameters window as described below.

Parameters specific to Mode 1 include:

Equity Allocation Increment for Optimization: During an optimization, this value is the “step size” used to go from the Minimum to Maximum strategy allocation. For example, if the Increment is set to 10 and the Min and

Max are set to 10 and 90 respectively, then the optimization will test values of 10, 20, 30, ... 90. Smaller increment values will result in more variations being produced during the optimization.

Equity Symbol #N: The ticker symbol for the equity curve of each strategy 1-10. A blank symbol disables this slot.

Equity #N Default % Allocation: The percentage of equity allocated to strategy N at the at the start of the test and again at the end of each rebalance period when running a Backtest.

Equity #N Min/Max % Allocation: The Min and Max percentage of equity allocated to strategy N at the at the start of the test and again at the end of each rebalance period when running an Optimization.

Mode 2: Test all combinations of Primary Pool with Secondary Pool

Mode 2 performs pairwise combinations of multiple variations of two different strategies. Imagine that you have run an optimization on Strategy A that produced 500 different variations and 500 unique equity curves, ~EqStrategyA1 through ~EqStrategyA500. Similarly, your optimization on Strategy B produced 1000 different variations and equity curves, ~EqStrategyB1 through ~EqStrategyB1000. Mode 2 will combine ~EqStrategyA1 with ~EqStrategyB1, then with ~EqStrategyB2, ... ~EqStrategyB1000, then ~EqStrategyA2 with each Strategy B equity curve etc. In this example, the Equity Combo utility will automatically create 500 x 1000 = 500,000 combined equity curves and their respective metrics, allowing you to select the two variations whose combined performance best meets your goals.

To use Mode 2, specify the primary strategy using either of these methods:

1. If using multiple variations of the primary strategy, add all the equity curve symbols for the primary strategy variations to a watchlist, and select that watchlist in the Apply To Filter.
2. If using a single variation of the primary strategy (which could itself be a combined equity curve), simply select the equity curve symbol and use Apply To Current.

After specifying the parameters below, run an AmiBroker **Optimization** to create MxN combined equity curves and associated metrics.

Parameters specific to Mode 2 include:

Primary Equity % Allocation: The percentage of equity allocated to the primary equity curve (strategy) at the start of the test and again at the end of each rebalance period.

Secondary Equity % Allocation: The percentage of equity allocated to the secondary equity curve (strategy) at the start of the test and again at the end of each rebalance period.

Note that the sum of the Primary and Secondary allocations does not have to total 100%. The backtest report includes metrics to show the exposure of the combined equity curves, allowing you to determine if you have over or under allocated your strategies.

Secondary Equity Symbol or Watchlist Name: The name of a watchlist that contains all of the variations (equity curve symbols) of the secondary strategy. Alternatively, you can enter the name of a single equity curve symbol in this field, allowing the combination of many variations of Strategy 1 with a single variation of Strategy 2.

Reporting

Each combined equity curve is created by running an AmiBroker backtest, and therefore AmiBroker will calculate all its standard backtest metrics. However, care must be taken when interpreting these metrics.

Portfolio Metrics like Initial and Ending Capital, Net Profit, Annual Return (CAR), Risk Adjusted Return, and Max System Drawdown will accurately reflect the performance of the combined equity curves (strategies).

Trade Metrics like Number of Trades, Win Rate, Avg P/L, Avg Bars Held, Max Trade Drawdown, Sharpe Ratio of Trades, etc. will have no real meaning, because the “trades” during the process of combining equity curves are actually just AmiBroker rebalancing the equity to the prescribed allocations.

Custom Metrics have been included to provide useful information above and beyond AmiBroker’s standard capabilities. Additional custom metrics could be easily added by a user proficient in AFL, or I can add them for you for a fee. Custom metrics currently include:

- **Max Sys % Drawdown, CAR, CAR/MDD, RAR:** These are just duplicates of the standard AmiBroker metrics for max drawdown, compound annual return, and risk-adjusted return. They are grouped with the other custom metrics for convenience.
- **Annual Daily Volatility:** The annualized standard deviation of the daily returns of the combined equity curve (CEC).
- **Daily/Monthly Correl with SPX:** The correlation between the daily /monthly returns for the S&P 500 index and the daily/monthly returns of the CEC. You can easily change the symbol \$SPX to another symbol of your choice in this line:
`pSPX = Foreign("$SPX","C");`
- **Daily/Monthly Correl with VIX:** The correlation between the daily /monthly returns for the Volatility Index (VIX) and the daily/monthly returns of the CEC. You can easily change the symbol \$VIX to another symbol of your choice in this line:
`pVIX = Foreign("$VIX","C");`
- **Primary-Secondary Daily/Monthly Correl:** The correlation between the daily/monthly returns for the primary equity curve and the daily/monthly returns for the secondary equity curve. Note that this metric is only reported when using Mode 2.
- **Sharpe Ratio:** Monthly excess returns (return of the CEC less the T-Bill rate) divided by the volatility (annualized standard deviation) of excess returns. This calculation is consistent with the most widespread definition of Sharpe Ratio, but is quite different than AmiBroker’s “Sharpe Ratio of Trades” which does not take portfolio returns into account. Norgate uses the symbol %IRX for the T-Bill rate of return. If you use a different data provider, then you can either replace %IRX with an appropriate symbol from your database or you can allow the AFL to use the default value of 2% for the risk-free rate of return.
- **Avg, Min, Max % Exposure:** Exposure is the percentage of total equity that is invested in trades at the end of each bar. For example, if your account has \$100,000 of equity and currently has \$65,000 of open positions and \$35,000 in cash, then the exposure is 65%. These three metrics report the average exposure over the entire backtest date range, as well as the minimum and maximum exposure.
- **# of Bars with Exposure > X%:** A simple count of the number of bars for which the exposure is greater than the threshold of X%. One use of this metric is to determine how often you were trading on margin, i.e. how often your exposure was greater than 100%.

- **% Total Bars with Exposure > X%:** The count from the previous metric divided by the total number of bars in the date range.
- **% Months with Positive/Negative Return:** The number of months in which the CEC was higher/lower than the prior month, divided by the total number of months in the test period.
- **Annual Returns:** The percentage change in CEC from the end of the prior year to the end of the reported year. For example, 2015 Total % Return is the change in CEC from the end of 2014 through the end of 2015.
- **Equity Symbol, % Allocation, Leverage, Rebalance Frequency, Watch List, Start/End Date:** The selected parameters used for generating the CEC.