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.

The basic purpose of the Equity Combo Utility 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.

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 two different strategies
- Subtract performance and management fees from the results
- Select rebalance frequency
- Report combined CAR, Max DD, Annual Volatility, Sharpe Ratio, and other metrics
- Report Annual Return for each year in the test period
- Calculate correlation of returns between the primary and secondary strategies
- Calculate correlation of combined returns with S&P 500 index
- Save the combined equity curve so that it 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.

Fixed Allocation of Equity

At the beginning of the test period, and perhaps at regular intervals thereafter, a percentage of total equity will be allocated to each strategy. Even without leverage, in a live portfolio we might decide to use up to 75% of available equity for each of two strategies, because we know those strategies seldom use 100% of the capital available to them and they never use 100% of their allocation at the same time. Therefore, it would be a rare occurrence for the two strategies to consume 100% of total equity, and if that happened we would probably just stop taking trades until some capital freed up.

When combining equity curves, we don't have visibility into the individual trades taken by each strategy, which in turn precludes us from "sharing" total equity in any way. Instead, each strategy must be given a slice of the total pie.

Overlapping Trades

As mentioned in the previous section, 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 <u>combine</u> equity curves, we need to <u>generate</u> equity curves 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 generated by your backtest, you will need to insert the code snippets from the EquityComboSnippets.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 back 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 three 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 three 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). 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. Run an AmiBroker **Backtest** to create the combined equity curve and associated metrics.

Parameters specific to Mode 1 include:

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

Equity #N % 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.

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.

Note that the secondary strategy will automatically be allocated all equity not assigned to the primary strategy, e.g. if the primary strategy is allocated 60% of equity then the secondary strategy will be allocated 40%.

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.

Mode 3: Test all allocations of Primary and Secondary Equity Curve

Mode 3 allows you to find the optimal allocation of total equity for two equity curves (strategies). This mode will generate different combined equity curves by allocating the Primary equity curve 0%, 5%, 10%... 100% of total equity, with the remainder being allocated to the Secondary equity curve.

To use Mode 3, specify the primary strategy by selecting it as the current symbol and then setting the Apply To dropdown to “Current”.

Secondary Equity Symbol: Set this parameter to the symbol for the secondary equity curve (strategy).

Run an AmiBroker **Optimization** to create 21 unique combined equity curves and associated metrics.

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 Volatility**: The annualized standard deviation of the monthly returns of the combined equity curve (CEC).
- **Correl with SPX**: The correlation between the monthly returns for the S&P 500 index and the monthly returns of the CEC.
- **Primary-Secondary Correl:** The correlation between the monthly returns for primary equity curve and the monthly returns for the secondary equity curve.
- **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.
- **% 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.
- **Primary/Secondary Equity Symbol, Primary/Secondary % Allocation, Rebalance Frequency, Watch List, Start/End Date:** The selected parameters used for generating the CEC.