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# Overview

Build high return vs low drawdown portfolios from robust strategies.

Strategies robustness, its ability to deliver consistent performance across market conditions and market conditions.

* Strategies
* Diversification
  + Markets
  + Timeframes
  + Duration
  + Sessions

# Robust Strategies

Robustness testing determines the uncertainty of the candidate and tests the sensitivity to changes in optimized parameters.

## Discovery

* Utilize genetic algorithms to generate strategy candidate form a database of entry, exit, filters, and market internal ideas.
* Filter these candidates by in-sample and out-of-sample results
  + Number of trades
  + Net profit
  + Drawdown
  + Out-of-sample robustness
  + …
* From this baseline system

## Candidate Testing

* Confirm if optimized parameters perform when shifted to nearby values – robustness check.

## Idea Generation & Prototyping

* Idea sources
* Switch/case statements for prototyping
* Output: prototype code

## In-sample, Out-of-sample testing

* Genetic algorithm
  + Fitness test:
  + Params:
* 80/20 in-sample, out-of-sample testing
* Output: in-sample & out-of-sample optimization data
* n-Sample / Out-Of-Sample Filter
  + Criteria
    - Average trade
    - Number of trades
* Candidate generation

## Validation 1 – Walk Forward Analysis

* Determine: forward trading ability,
  + potential to make $ after optimization
* Check overfitting, curve fitting
* Note: an overfitted strategy may survive 1-2 walk-forward tests, but unlikely to survive multiple tests
* Parameters:
  + 10 windows
  + Rolling windows
  + 10+ years historical data
  + 20/80% in sample / out of sample data
  + > 40-50 in-sample trades per window
  + > 15-20 out-of-sample trades per window
  + Min 400-500 trades
* Result: greater statistical validation
  + Larger sample size, and out-of-sample period
  + Robustness measure: compare & measure OOS vs IS profit
  + Empirically determine re-optimization period

## Validation 2 – Cluster Analysis

* Check strategy performance across run count and sample size
* Criteria:
  + Annual profitability
  + Consistency
  + Efficiency
* Output: robustness level
  + 0: failed
  + 1: OK
    - Add these to monitored strategies, explore further with market internals or other filters. Check position sizing strategies
  + 2: Good
    - X% of tested strategies
    - Tradeable strategies
  + 3: Strong
    - X% of tested strategies
    - Basis for portfolio building
    - X% profitable after 1 year of trading

## Stress test

* Maximum Adverse Excursion analysis determines $ stop loss
* Code:
  + 100% out-of-sample strategy
  + Add transaction costs (commissions, slippage)
  + Dollar stop-loss
* Test across similar markets
* Test across timeframes
* Confirm satisfactory results across majority within group

# Market Internals

* TICK
* UVOL
* DVOL
* VIX

# Portfolio Development

## Parameters

* Leverage
* Risk per position
* Risk of ruin
* Drawdown tolerance

## Prerequisites

* A set of robust strategies
* Diverse strategies, measured by return correlation. Purpose: improve linearity of portfolio equity curve
  + Markets
  + Sessions
  + Styles: intraday & swing
  + Entry / Exit
  + Bar size

## Criteria

* 2 or more strategies with robust level 1-3
* Prioritize strategies with lower correlation
* Test each strategy with portfolio
  + Monte Carlo simulations
  + Decreasing drawdown
  + Increasing Reward-Risk Ratio (RRR)
  + Strategy selection criteria
    - Portfolio Annual Return / Portfolio MC Max DD > 4
    - Higher portfolio SQN

## Money Management

Position Sizing / Money Management – control risk, maximize reward, meet objectives

Diversification – smooth the equity curve

* Position Sizing
  + Risk 0.5-2% available equity per position. (leverage is parameter of portfolio
  + Monte Carlo analysis
  + After system development, during optimization

## Trade Management

### Risk of Ruin

## Portfolio Maintenance

* Parameters:
  + Strategy Drawdown Threshold ……..50%
  + Portfolio Drawdown Threshold … 20%
  + SQN …. 1.5
  + Minimum Robust Level … 1
  + Minimum strategies …. 3
  + Maximum strategies … 99
* Smooth portfolio equity curve; maximize return / Monte Carlo max drawdown ratio
* Add strategies as long as return/DD ratio improves
* Criteria: MC Max DD < Portfolio DrawDown Threshold

# Bio

* Education
  + BS Computer Science, Applied Math, LIU CW Post
  + MS Computer Science, NY Polytechnic
  + MBA Finance, Hofstra University
* Experience
  + Software Engineer, Grumman Aerospace
    - Conformal radar
  + Programmer Analyst, Merrill Lynch
    - Treasury Desk, Bloomberg developer
    - MBS/ABS Desk
  + Lead Developer, Sakura Global Capital
    - Swap administration system
  + Software Developer

Every transition from in-sample to out-of-sample increases our confidence

Given a smooth equity curve, add leverage as desired to the point where drawdown becomes limiting

Entries / Exits – establish the edge

Ideas come from everywhere

Ideas

1. Momentum & Big Range – go with momentum after big range
   1. Rrange = high – low;
   2. If rrange . 2\*stddev(rrange,xr) + average(rrange,xr) and
   3. Close > close[daysback] then buy next bar at market;
   4. If rrange > 2 \* stddev(rrange,xr) + average(rrange,xr) and
   5. Close < close[daysback] then sellshort next bar at market;
   6. Vars: xr, daysback
2. Breakout – report play: go with trend after a regular report
   1. If time = xxx then begin
   2. Buyprice = high + 0.01;
   3. Sellprice = low – 0.01;
   4. End;
   5. If time = xxx then begin
   6. Buy next bar at buyprice stop;
   7. Sellshort next bar at sellprice stop;
   8. End;
   9. Vars: xxx
3. Mean Reversion – look for low volume reversal points
   1. If v < average(v,5) then begin
   2. If close = lowest(close,len) then buy next bar at market;
   3. If close = highest(close,len) then sellshort next bar at market;
   4. End;
   5. Vars: len
4. Simple Breakout – go with the trend
   1. If close >= Highest(close,length) then buy next bar at market;
   2. If close <= Lowest(close,length) then sellshort next bar at market;
   3. Vars: length
5. Dueling Momentum – go with short momentum, against long momentum
   1. If c > c[sl] and c < c[slx] then buy next bar at market;
   2. If c < c[sl] and c > c[slx] then sellshort next bar at market;
   3. Vars: sl, slx

# Trading

## Metrics

Win % :

Largest expected winning streak

R multiple: $ amount risking to lose if I am wrong about the trade

% total trading capital per trade

Risk / Reward Ratio

Expected Max DrawDown

Expected Annual Return

## System Health:

Is the system working? Or broken?

deteriating health:

* Reduce postion sizing
* Trade through the drawdown
* Take offline
* Higher confidence with higher trade number

# Appendix

## What’s Next

## Entries

### Mean Reverting:

* Buy dips, short spikes

## Strategy Qualification

* Validation – phase 1 passed
* Validation – phase 2 passed
* Robust level 1-3
* Stress test held
* SQN > %%
* MC Max DD < Strategy Portfolio Threshold

## Quotes:

Lincoln – “I know not how to aid you, save in the assurance of one of mature age, and much severe experience, that you can not fail, if you resolutely determine, that you will not.”

# Optimization

Then, naturally, there are other questions on how to work with optimization inputs properly:

*How should we set the optimization ranges and steps?*

*What fitness function should we use?*

*What kind of optimization method is the best?*

*How many iterations is acceptable?*

*And then, after we figure all of this out, what's the best way to regularly re-optimize all these input parameters?*

## Servers

### Processors:

* Core i5-8400
* Intel i7-8700k
* Intel i9-7980xe

Processor speed check:

* Eztradingcomputers.net/cpu

Sources

* http://TradingComputersNow.com

Pre-Validation

MAE

Stress

Test

Market

Filter

Portfolio

Building

Validate

Prototype