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Laws

Building Trading Systems

- ***Building Trading Systems – Laws and Flaws***
- Based upon the principles established and presented in
- *The Design, Testing and Optimization of Trading Systems* by Robert Pardo, published by J. Wiley & Sons
- Each of the stages in the trading strategy development process are formulated and illustrated in a comprehensive, step-by-step format therein. To be consulted for further reference and detail.

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- *The Laws of Trading System Design, Evaluation and Optimization*

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- **Formulate the Trading Strategy**
 - **State the Trading Idea or Theory**
 - For instance – the trend is my friend
 - Then, trade in the direction of the dominant trend
 - **Formulate mechanism to implement trading theory**
 - For instance – a moving average (MA) measures trend
 - Longer MA tracks longer term trend
 - Go long if MA today is greater than MA 10 days ago by an amount equal to Daily Volatility (DV) x 2
 - Reverse for Sell
 - **Create specific formulae for**
 - MA
 - MA_x greater than MA_y by Z-Volatility

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- **Formulate the Trading Strategy (cont'd)**
 - **The Principle components of trading strategy**
 - **Entry**
 - *Buy when condition is true*
 - *Sell when reverse condition is true.*
 - **Exit**
 - *For example -- Exit on opposite signal*
 - *Exit on risk stop*
 - *Exit on shorter MA trailing stop*
 - **Risk Management**
 - *Set non-volatile risk stop at $1.5 \times 3DV$*
 - **Position Sizing**
 - *Set number of contracts equal to margin divided by 5% of account equity*

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- ***Determine What Resources Are Needed***
 - Testing software must be capable of testing every aspect of your strategy accurately
 - Testing software must be able to handle length of data, type of data and multiple data streams, for example, that is needed
 - Assemble necessary price data
 - Daily
 - Intraday if testing such strategies
 - Multiple data series if needed

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- ***Specify the Trading Strategy in a Computer Testable Format***
 - Translate formulae specified in previous step into testing language of chosen testing platform
 - May require creation of custom functions and indicators where needed
 - May require creation of custom functions for stops and profit stops
 - May require creation of custom functions for contract sizing algorithms

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- **Test the Trading Strategy**
 - First test determines that the coded logic expresses the trading strategy as originally conceived
 - If yes, then continue
 - If no, correct coding to conform to strategy
 - Second test determines how it performs on a selected basket of markets with a *guesstimated* value for the key strategy variables
 - If performance is significantly less than anticipated, perhaps the idea is not as good as expected and should be discarded
 - If performance acceptable at this stage, then continue

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- **Optimize the trading strategy**
 - Perform an optimization on key variables on a selected basket of markets
 - Should be on a significant piece of history
 - Certainly no less than five years if daily data
 - Preferably ten years
 - If strategy shows better performance than in Preliminary Testing Stage then continue
 - If no, re-evaluate,
 - Optimization should provide significant performance improvement
 - However, if performance in the Second Stage of testing is deemed to be acceptable, then go to next stage

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- **Optimize the trading strategy (cont'd)**
- **Perform walk-forward analysis™ to determine**
 - final feasibility of strategy
 - provides insight into trading performance by interval
 - provides insight into whether optimization is more beneficial on smaller data segments
 - and if periodic re-optimization of variables is necessary and desirable
- Determine and record the final risk and statistical profile of strategy
 - Key are -- Annualized rate of return
 - and Maximum drawdown
 - However, profile can and should be more detailed

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- **Trade the Strategy**
- If profitable, be sure that it is conforming within historical profile
 - If less than profile, why?
 - There should be a reason
 - If greater than profile, why?
 - There should be a reason
- If unprofitable, be sure it is acceptable and within historical profile
 - If it is, then continuing is a management decision
 - If it is not,
 - Is there a good reason
 - Unprecedented high volatility
 - Unprecedented low volatility
 - Different market condition
 - If yes, continuing is a management decision
 - If no and if divergence is large
 - Trading of strategy should be stopped
 - Review of testing procedure and current market action must be done
 - If modification cannot be accomplished, strategy should be abandoned
 - If modification is successful, go back to 2 and start again

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- ***Compare Real-Time Performance with Historical Testing Profile***
 - This should be done on a continuous basis
 - Always be alert for divergence
 - Whether profitable or unprofitable
 - Look for ideas to enhance the strategy

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- ***Refine the Trading Strategy***
 - Trader should always be looking for ways to enhance strategy based upon observation of real-time trading performance
 - Trader should also always be researching new ideas and exploring their relevance to the currently traded strategy
 - If enhancements are achieved, go back to the Design Stage and go through full design, testing and optimization of improved strategy

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- *The Fatal Flaws During the Process of Trading System Design, Evaluation & Optimization*

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- **Unrealistic Assumptions and Simulations**
 - **Slippage and commissions (S&C) must be accurate**
 - One of *the* biggest mistakes made
 - Better to overstate – err on the side of caution
 - if S&C are better in real-time, P&L is just bigger
 - Understatement – overly optimistic and unrealistic – can be fatal to the trader
 - if S&C are worse in real-time a strategy that was profitable in testing can be **unprofitable in real-time**

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- ***Unrealistic Assumptions and Simulations (cont'd)***
 - **Average trade (AT) should be very robust**
 - **At least 3 times the size of S&C**
 - **The bigger the better**
 - **Critical performance measure**
 - **Too small AT another big mistake**

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➤ **Unrealistic Assumptions and Simulations (cont'd)**

➤ **Be sure there are no holes in your testing**

- For example, if your strategy requires a risk stop on day of entry, some testing platforms cannot do this
- For example, if your strategy uses volume, be sure to enter at a time when the information is available in real-time trading

➤ **Limit Orders**

- Research has shown that a significant number of limit orders do not get filled.
- Testing of limits should either include
 - expanded S&C to factor in unfilled limit orders and trades not taken
 - better to test limit orders by exceeding the price by, for example, three ticks to insure that it is filled

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- **Unrealistic Assumptions and Simulations (cont'd)**
 - **Inadequate Search Functions used to select top parameters**
 - Net profit commonly used, one of the very worst search functions
 - Better measure is some form of risk-adjusted return
 - Best "publicly" available measure is Pessimistic Return on Margin (PROM)
 - More sophisticated search functions available and desirable

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- ***Curve-fitting or Over-Optimization***
 - Biggest problem facing the trading strategy builder
 - In the extreme case of curve-fitting --
 - A curve fit model will look great in testing and collapse into loses from the start of real-time trading
 - In less extreme cases of curve-fitting --
 - A curve fit model will have real-time performance at a far lesser rate than it exhibited in testing

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- ***Curve-fitting or Over-Optimization (cont'd)***
- ***How to Avoid Curve Fitting***
 - Use a large sample size
 - Test over a broad range of markets
 - Get a statistically significant number of trades
 - At least thirty
 - The more the better

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- ***Curve-fitting or Over-Optimization (cont'd)***
- ***How to Avoid Curve Fitting (cont'd)***
 - Limit the number of variables to be optimized to the bare minimum, say two to four
 - Avoid over-optimization of risk management rules
 - tendency to overfit due to the elimination of a small number of large losses skewing results
 - Use reasonable step size when optimizing a variable
 - For example, when scanning a percentage of average daily range volatility
 - Scan .50 to 2.50 at .25
 - Not .10 to 5.00 at .05

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- ***Curve-fitting or Over-Optimization (cont'd)***
- ***How to Avoid Curve Fitting (cont'd)***
 - Be highly skeptical when evaluating results
 - look for consistency over time
 - look for reasonably equal contribution from long and short trades
 - look for reasonably equal performance in the three major market types
 - uptrend
 - downtrend
 - trading range
 - examine robustness of optimization space
 - Look for some consistency from market to market unless strategy tailored to a particular market – S&P -
- or market class – currencies.

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➤ *Curve-fitting or Over-Optimization (cont'd)*

- There are only two sure way to avoid curve-fitting
 - Do not optimize anything
 - Even this does not guarantee its elimination
 - Do Walk-Forward Analysis™
 - Must be done over as long a data sample as possible
 - Include as many Out of sample tests as the data and walk-forward parameters permit
 - Examine for consistency
 - Examine for robustness
- A sound *walk-forward analysis* is highly dependent on the search function and the method used for automatic parameter selection in each in-sample window

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- ***The Trader Does Not Follow his Strategy***
 - As Larry Williams cogently observed "Trading systems work, traders don't."
 - A trading strategy must be followed to the letter to make it work
 - Most common flaws
 - Taking profits prematurely
 - Letting losses run beyond their specified stop
 - Not taking a trade because it looks too "risky" or "iffy."
 - Overtrading the strategy by varying the position size on a "hunch" and overriding the sizing principles that is part of the tested strategy

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- ***The Trader Does Not Follow his Strategy (cont'd)***
 - A trading strategy must be followed to the letter to make it work (cont'd)
 - Biggest trader weakness
 - Overriding the trading strategy by not taking the next signal during a drawdown
 - Periods of drawdown are inevitable
 - Important to know the characteristics of strategies drawdown behavior
 - Important to be properly capitalized so as to be able to weather drawdown and emerge into new high equity
 - One never knows what a trade is going to do
 - Cherry picking the trades
 - Destabilized the fine balance achieved between risk and reward by a successful strategy
 - Almost always wrong

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I Flaws

B Building Trading Systems

- ***The Trader Does Not Follow his Strategy (cont'd)***
- A trading strategy must be followed to the letter to make it work (cont'd)
 - Many trading strategies earn the bulk of their profit in a minority of their trades.
 - Some of the most profitable trades are the ones that look the most "risky."
 - Cherry picking trades greatly increases the likelihood of missing or prematurely exiting one of these big wins.

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➤ *In Conclusion*

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- ***In Conclusion***
- Caution, Excellence, Thoroughness and Good-Craftsmanship during strategy development *essential* to success
- Realistic Assumptions during the development process essential
- Must exert tremendous caution to avoid Curve-Fitting
- Best and most fool-proof way to do final testing and optimization is *Walk-Forward Analysis™*
- Understand the character and behavior – risk and reward -- of your Trading Strategy
- Monitor Real-Time Trading Performance in light of strategy profile essential
- Trade your well-researched and Walk-Forward Tested strategy ***RELIGIOUSLY***.
- Remember, “Trading systems work, traders don’t”

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