

MACHINE DESIGNED TRADING SYSTEMS FOR FUTURES TRADERS

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REQUIRED DISCLAIMER

HYPOTHETICAL PERFORMANCE RESULTS HAVE MANY INHERENT LIMITATIONS, SOME OF WHICH ARE DESCRIBED BELOW. NO REPRESENTATION IS BEING MADE THAT ANY ACCOUNT WILL OR IS LIKELY TO ACHIEVE PROFITS OR LOSSES SIMILAR TO THOSE SHOWN.

IN FACT, THERE ARE FREQUENTLY SHARP DIFFERENCES BETWEEN HYPOTHETICAL PERFORMANCE RESULTS AND THE ACTUAL RESULTS ACHIEVED BY ANY PARTICULAR TRADING PROGRAM. ONE OF THE LIMITATIONS OF HYPOTHETICAL PERFORMANCE RESULTS IS THAT THEY ARE GENERALLY PREPARED WITH THE BENEFIT OF HINDSIGHT. IN ADDITION, HYPOTHETICAL TRADING DOES NOT INVOLVE FINANCIAL RISK, AND NO HYPOTHETICAL TRADING RECORD CAN COMPLETELY ACCOUNT FOR THE IMPACT OF FINANCIAL RISK IN ACTUAL TRADING. FOR EXAMPLE, THE ABILITY TO WITHSTAND LOSSES OR TO ADHERE TO A PARTICULAR TRADING PROGRAM IN SPITE OF TRADING LOSSES ARE MATERIAL POINTS WHICH CAN ALSO ADVERSELY AFFECT ACTUAL TRADING RESULTS.

THERE ARE NUMEROUS OTHER FACTORS RELATED TO THE MARKETS IN GENERAL OR TO THE IMPLEMENTATION OF ANY SPECIFIC TRADING PROGRAM WHICH CANNOT BE FULLY ACCOUNTED FOR IN THE PREPARATION OF HYPOTHETICAL PERFORMANCE RESULTS AND ALL OF WHICH CAN ADVERSELY AFFECT ACTUAL TRADING RESULTS.

TRADING AND ALGORITHMS

- In 2009, High Frequency Algorithmic trading accounts for 73% of all US equity trading volume, but is conducted by only 2% of the firms
- The High Frequency Hedge Fund category is now the **most profitable** on Wall Street
- Futures and options:
 - Easy to integrate algos.
 - 20% of options volume expected to be algo by 2010
- CME quote time is now ~ 6 milliseconds

Clearly, the Futures markets are moving firmly towards Algorithmic trading as we have seen in the equities

References:

Advanced Trading, Sept/Oct. 2009

http://en.wikipedia.org/wiki/Algorithmic_trading

http://www.informationweek.com/news/hardware/data_centers/showArticle.jhtml?articleID=219700577&cid=RSSfeed_IWK_All#

WORLD MARKETS AVAILABLE TO ALGORITHMS

- Size of world derivatives market: \$791 Trillion
(11 times the size of the entire world economy)
- Size of world bond market (2008): \$67 Trillion
- Size of world stock market: \$36.6 Trillion
- US Hedge funds (2009): \$977B
- China's US Treasury's holdings: \$767B (March, 2009)
- Funds of Funds (2009) : \$550B

References:

BarclayHedge

http://en.wikipedia.org/wiki/Stock_market

http://en.wikipedia.org/wiki/Bond_market

THE TRADERS DILEMMA: SAME SETUPS, DIFFERENT RESULTS

- So, we look for additional causative factors
- We optimize entries*, exits and stop losses
- We add parameters, inputs and conditions
- We try to increase accuracy, or
- We try to decrease drawdown, and
- We run the chance of curve-fit
-and most will fail at this work
- What problem are we really solving?

*
Note: Search space must include entry tactic

WHY DO WE WANT TRADING SYSTEMS?

- Performance
- Emotional Control
- Convenience
- Portability
- Consistency
- How good are your indicators or patterns?
- Can you believe in and follow a discretionary system?

COMPUTERS & TRADING

Which camp are you in?

- Discretionary-Minimal trading simulations
- Systematic

Predictive: Minimal trading simulations

Algorithmic: Extensive trading simulations

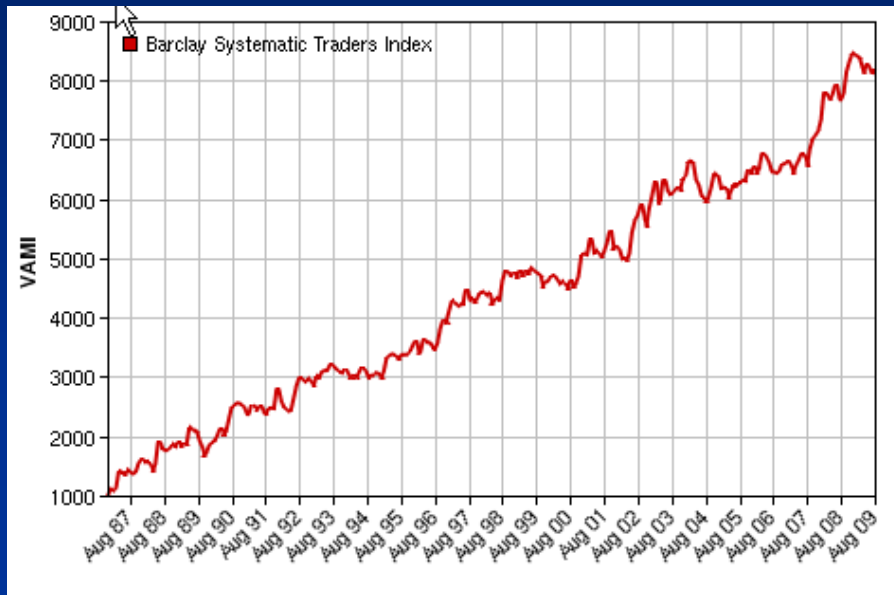
1. Best Execution (Algos)
2. Alpha Generation (Strategies/Systems)

For now, we will focus on Alpha Generation

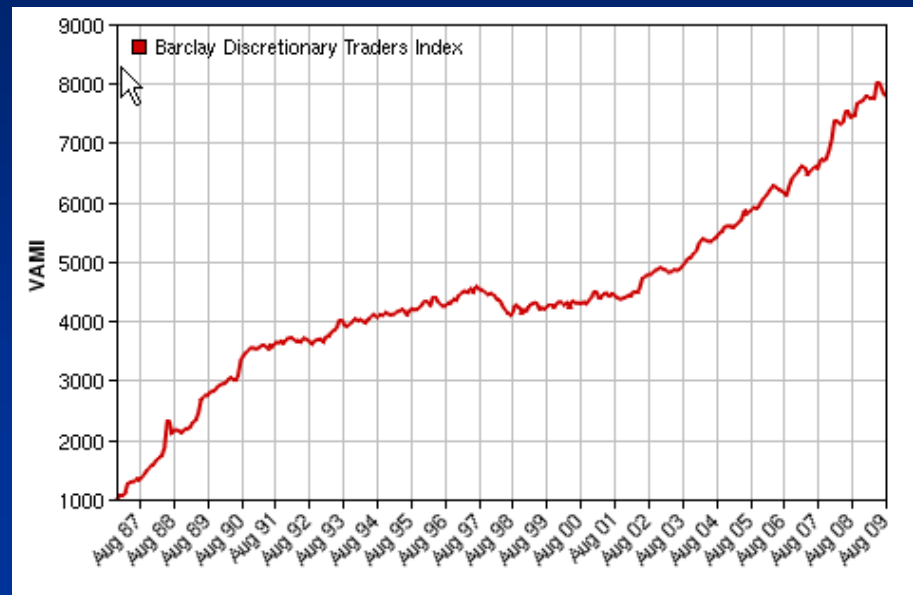
SYSTEMATIC VERSES DISCRETIONARY

VAMI

1987-2009



448 programs, \$149B



155 programs, \$15B

Source: BarclayHedge

BENEFITS OF FUTURES TRADING SYSTEMS

- Easy to initiate long or short via algorithms
- Hedging strategies may generate return
- Plenty of possible alpha capture
- Rapid execution of models
- Minis are fungible and similar to full size
- Standardized contract for testing
- Large efficient exchange
- Long trading hours
- How are Futures P&L's treated as far as tax?

ARE WE COMFORTABLE WITH MACHINES YET?

- Computers land airliners when pilots are not allowed to land them (Cat III)
- Control/Monitor Life Support in critical and non critical situations
- Engineering, Pharmacology, Research
- National Defense

SO WHY ARE WE STILL MANUALLY DESIGNING TRADING SYSTEMS?

- Software crisis-s/w costs are >10 times hardware costs
- 99% of CPU cycles are not used
- Lack of Industry Focus
- Past AI in Finance Failures
- Lack of confidence or understanding: fear?
- Note: Very few Futures Truth Trading Systems using AI

<http://www.tradingsystemlab.com/files/CISC%20Architectures.pdf>

MACHINE DESIGNED TRADING SYSTEM TECHNOLOGY

A Blend Of:

- Technical (and/or Fundamental) Analysis
- Data Mining
- Evolutionary Algorithms
- Trading Simulators

Note: This is not possible with standard backtesting platforms

WHAT ARE MACHING DESIGNED TRADING SYSTEMS (MDTS)?

- Trading Systems that are designed by a computer, not a human.
- The Trading System equations and code are written by a computer, not a human
- Includes: Options Trading Systems, Daytrading, Pairs, Portfolios, Hedging, any type that can be simulated
- Is current TA knowledge relevant here? Arbitrary?
- Classical TA was written before automatic Trading System design

BENEFITS OF MTDS

- Push Button Design (assists the developer)
- Improved Robustness
- Faster Design and Implementation
- Many markets may be targeted
- Lower Cost Per Line of Code (~\$15/SLOC)
- More Exploitations Possible
- Deeper Data Mining
- Enhanced Research Opportunities

ALGORITHM COMPARISON

	FAST?	ACCURATE?	WRITES CODE?	CREATE NEW MODELS?
Neural Networks	NO	YES	NO	NO
Case Based Reasoning	YES	YES	NO	NO
Classification	YES	YES	NO	NO
Regression	MAYBE	MAYBE	NO	NO
Expert Systems	MAYBE	MAYBE	NO	NO
Intelligent Agents	NO	YES	NO	NO
Genetic Algorithms	YES	YES	NO	NO
Genetic Programming	YES	YES	YES	YES

Genetic Programs are fast, accurate, produce something new and write code

WHAT IS A L-AIM-GP?

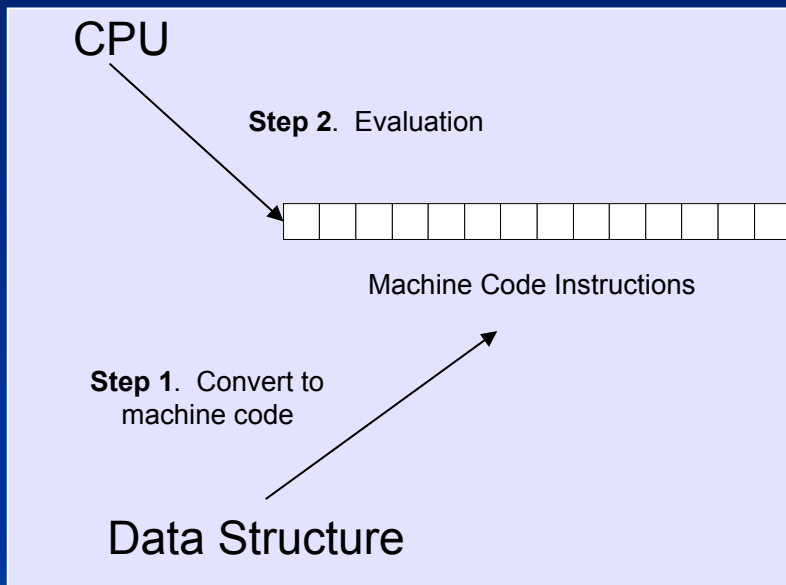
(Previously called Compiling Genetic Programming System)

- Uses Intel hardware registers (low level)
- Sequential Binary Machine Instructions
- Operators: Crossover, Reproduction and Mutation
- 56+ Inputs, 30+ functions>Evolved Structure
- Decompiles to C, JAVA, Assembler, Other Languages
- 60-200 times faster than interpreting systems

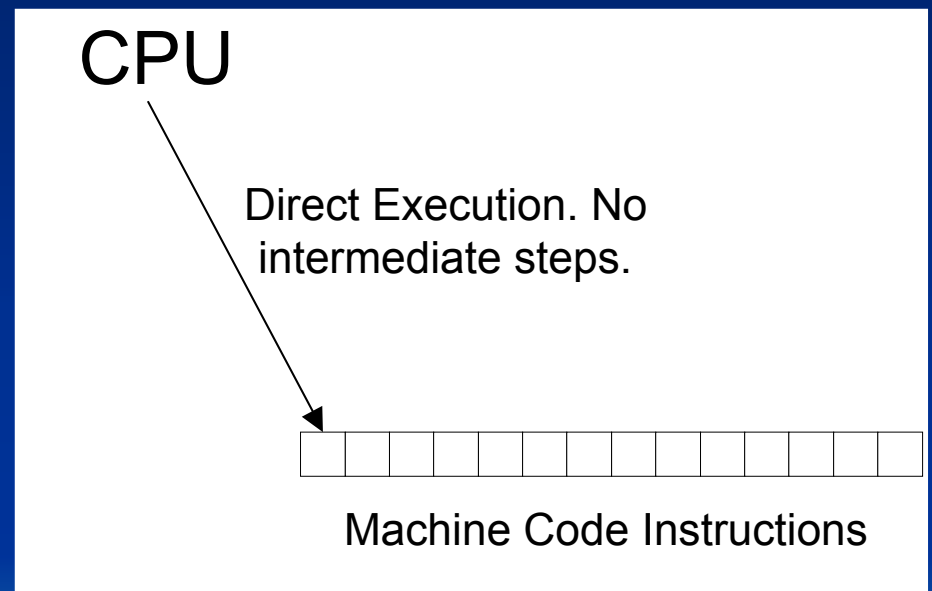
<http://www.tradingsystemlab.com/files/Discipulus%20How%20It%20Works.pdf>

INDUCTION OF MACHINE CODE

Past: Slow



Present: Fast



GP's FIND CLOSED FORM SOLUTIONS, FIT FUNCTIONS AND PRODUCE CLASSIFICATIONS

Inputs

2 4

3 9

4 16

5 25

Output

$y = x^2$



We target a Fitness Function like SR

GENETIC PROGRAMMING TERMS

- Preprocessor: Extracts Patterns, Indicators, COT, Inter-market Data, Breadth Data, VIX, Put/Call, etc.
- Terminal Set: Preprocessed Facts
- Function Set: Mathematical Operators
- Genetic Operators: Crossover, Reproduction, Mutation

PREPROCESSING

(Boolean or Numeric Patterns and Indicators)

- Very important aspect of Machine Design
- Example Preprocessing:
 ? Close >= Close[1]
 Result: 0 or 1 (True or False, natural language of machines)

Categories:

Volatilities

Short term patterns

Intermediate term patterns

Long term patterns

Oscillators-OBOS

Filters and Indicators

Regression and deviations

Transforms

Channels

Intermarket/Fundamentals

Domain Expertise-Systems/Ind.

56-64 Total Inputs. Only a few will be Selected and used in the final design by the machine



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TERMINAL SET

- Flat file of all preprocessed facts
- Consumed fact set is subset of universe

FUNCTION SETS

- Boolean Functions: AND, OR, NOT, XOR
- Arithmetic Functions: +, -, *, ÷, ABS, SQRT, CHS, SCALE
- Transcendental Functions: Trig, Log
- Variable Assignment Functions
- Indexed Memory Functions
- Conditional Statements
- Control Transfer Statements
- Loop Statements
- Subroutines

GENETIC OPERATORS

- Crossover: Child shares parents genes
- Reproduction: Parent allowed to birth
- Mutation: Child genes altered
- Demes: Species Interbreed



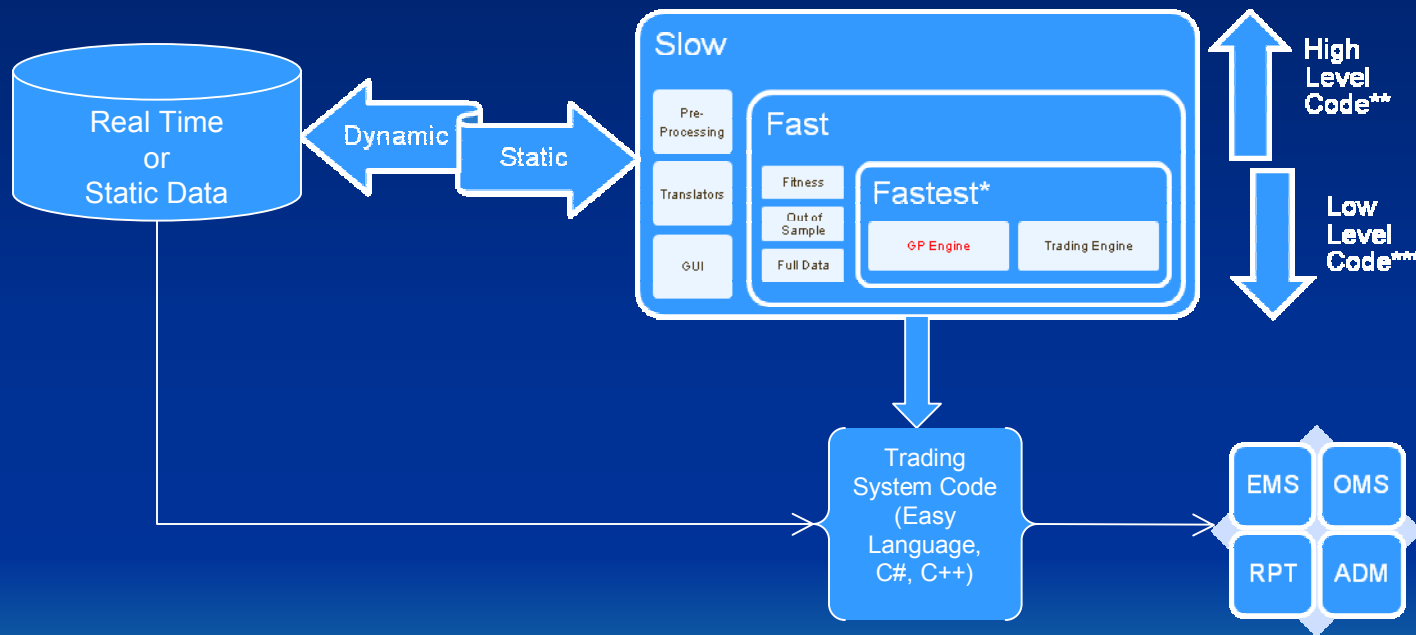
SPEED IS VERY IMPORTANT FOR MDTs

- Higher Level Languages are too slow
- Targeted Fitness is an ENTIRE Trading System
- 20,000-100,000 Trading Systems needed/run
- 2.3 Million System-Bars/Second*
- ~21 Sec (10 yrs EOD) ~3.6 Min (20 yrs EOD)
- Large Terminal Sets are accessed
- Large Function Sets are accessed

Intel Core i7 975 15% O.C. Single Thread. N-2NX Core Speedup Possible

BASIC MDTs ARCHITECTURE

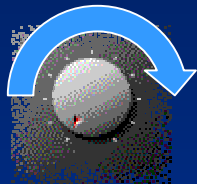
Our development followed no specific model since no specific model is readily available



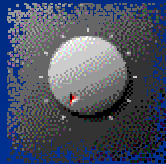
- *GPU/G80, EP or Many Core Implementations
- **VC++.NET, VB, C#, EL
- ***Assembler, C, C++

FITNESS CAN BE MULTI GOAL

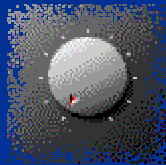
Machine Design Allows Us to Adjust Critical System Metrics as Targeted Fitness Function



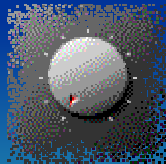
Net Profit



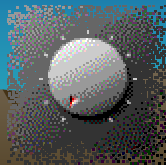
Drawdown



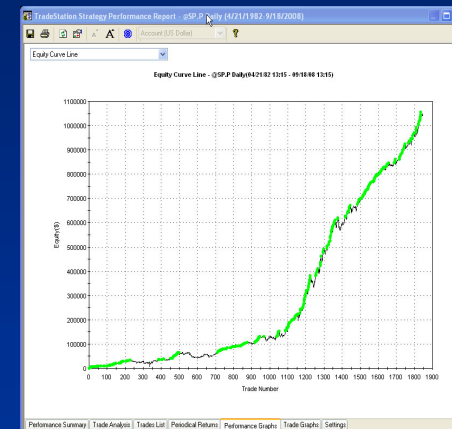
Percent Accuracy



Profit Factor



Average Trade



PRODUCES
CODE



Trading System Lab®

EVOLUTIONARY TRADER DESIGN

- Traders must trade profitably or they are deleted
- Profitable traders compete with other profitable traders
- Profitable traders are allowed to reproduce
- Some will be subject to random mutations
- Offspring will be subject to crossover
- Traders will be tested on Out Of Sample* continually

* Blind sample testing during run may reflect “direction” of process

SUMMARY OF EVOLUTIONARY ALGORITHMS

Source: Banzhaf, Nordin, Keller, Francone
“Genetic Programming, An Introduction”

YEAR	INVENTOR	TECHNIQUE	INDIVIDUAL
1958	Freidberg	Learning Machine	Virtual Assembler
1959	Samuel	Mathematics	Polynomial
1965	Fogel, Owens and Walsh	Evolutionary Programming	Automation
1965	Rechenberg, Schwefel	Evolutionary Strategies	Real-Numbered Vector
1975	Holland	Genetic Algorithms	Fixed Size Bit String
1978	Holland and Reitmann	Genetic Classifier Systems	Rules
1980	Smith	Early Genetic Programming	Var-Size Bit String
1985	Cramer	Early Genetic Programming	Tree
1986	Hicklin	Early Genetic Programming	LISP
1987	Fujiki and Dickinson	Early Genetic Programming	LISP
1987	Dickmanns, Schmidhuber and Winklhofer	Early Genetic Programming	Assembler
1992	Koza	Genetic Programming	Tree

IMPORTANT!

- Evolution is NOT the same as Parameter Optimization
- Genetic Programs are NOT the same as Genetic Algorithms



PARAMETER OPTIMIZATION

- High risk of overfitting data
- Very, very slow
- Limits search to preprogrammed sets
- Requires an Existing System



GENETIC PROGRAMS ARE SUPERIOR TO GENETIC ALGORITHMS

- GP's creates actual computer programs (Trading Systems). GA's simply optimize the existing parameter set which the user must supply
- GP's use variable length genomes and vary their size through non-homologous crossover. Thus the Trading Systems grow and shrink in size during evolution. GA's use fixed length genomes.
- GP's discover new mathematical relationships. GA's just optimize what is already present and discover nothing new
- LAIMGP can mine much larger data sets, much faster than GA's

HOW FAST CAN WE EXPECT?

- Preprocessing takes seconds
- Trading Systems should be created in < 60 seconds to be viable: 20K-40K systems
- Implementation code should run in milliseconds
- Allows Low and High Frequency Trading



WHAT ABOUT PORTABILITY?

- Many languages in trading used
- Need language translators: C++ to EL
- Need to be platform agnostic
- Need to be universally accepted
- Problem: No Industry Standard Platform

WHAT ABOUT SOLUTION UNIQUENESS?

- Stochastic solutions are variable
- Randomized parameters and multi-run in EA
- Access large trading tactic sets
- Access large unbiased terminal sets
- However: There is “The Eve Effect”

Robustness

(Over Fit Avoidance)

- Blind Testing (walk forward)
- Run Path Logs (path intelligence)
- Unbiased Terminal Set (directionless inputs)
- Multi-Run, Randomized Criteria (global optimum)
- Zero Point Origin (no predefined initial point)
- Parsimony Pressure (Occam's razor-m.d.l.)



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WHICH SYSTEM SHOULD YOU TRADE?

- Trader 1:
35% accurate
Average Win is 180% of Average Loss
- Trader 2:
90% accurate
Average Win is 10% of Average Loss

Choices: Trader 1, Trader 2, Both Traders, Neither Trader

WHAT EQUATION PRODUCES ANY TRADING SYSTEM'S EXPECTATION?

$$EV = PW * AW - PL * AL$$

EV = expected value or average trade

PW = probability of a win

PL = probability of a loss

AW = amount won in winning trades

AL = amount lost in losing trades

FOR OUR 2 TRADERS:

Trader 1: EV = -.02

Trader 2: EV = -.01

So, neither Trader has a positive expectation

Note:

A system that is 90% accurate can have a negative EV

A system that is 30% accurate can have a positive EV

SO WHAT ARE TRADING SYSTEMS MATHEMATICALLY?

- Trading Systems are solutions to the Expected Value Equation

So, I need to know what the theoretically
“Perfect” Trading System looks like

A THEORETICALLY PERFECT TRADING SYSTEM

S&P 500 1982-2009

TradeStation Strategy Performance Report - @SP.P Daily (4/21/1982-9/25/2009)

Display: Table View

Account (US Dollar)

TradeStation Performance Summary Expand

All Trades

Total Net Profit	\$10,472,625.00	Profit Factor	n/a
Gross Profit	\$10,472,625.00	Gross Loss	\$0.00
Total Number of Trades	3531	Percent Profitable	100.00%
Winning Trades	3531	Losing Trades	0
Even Trades	0		
Avg. Trade Net Profit	\$2,965.91	Ratio Avg. Win:Avg. Loss	n/a
Avg. Winning Trade	\$2,965.91	Avg. Losing Trade	\$0.00
Largest Winning Trade	\$69,500.00	Largest Losing Trade	\$0.00
Max. Consecutive Winning Trades	3531	Max. Consecutive Losing Trades	0
Avg. Bars in Winning Trades	2.94	Avg. Bars in Losing Trades	0.00
Avg. Bars in Total Trades	2.94		
Max. Shares/Contracts Held	1	Account Size Required	\$0.00
Return on Initial Capital	10472.63%	Annual Rate of Return	17.14%
Return Retracement Ratio	0.19	RINA Index	14319.92
Trading Period	27 Yrs, 2 Mths, 10 Dys	Percent of Time in the Market	100.00%
Max. Equity Run-up	\$10,473,925.00		
Max. Drawdown (Intra-day Peak to Valley)		Max. Drawdown (Trade Close to Trade Close)	
Value	(\$25,875.00)	Value	\$0.00
Net Profit as % of Drawdown	40473.91%	Net Profit as % of Drawdown	n/a
Max. Trade Drawdown		(\$11,625.00)	

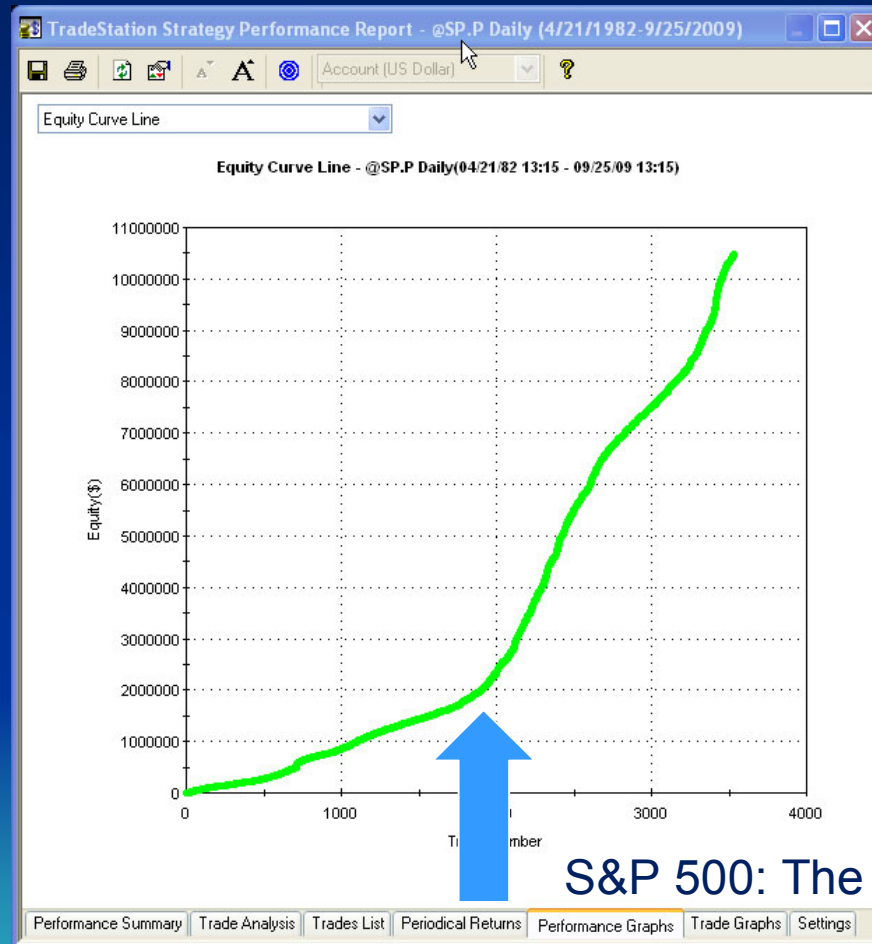
Performance Summary Trade Analysis Trades List Periodical Returns Performance Graphs Trade Graphs Settings

Drawdown



Trading System Lab®

SO WHY ARE YOU TARGETING A STRAIGHT LINE?



S&P 500: The 1996 "Knee"

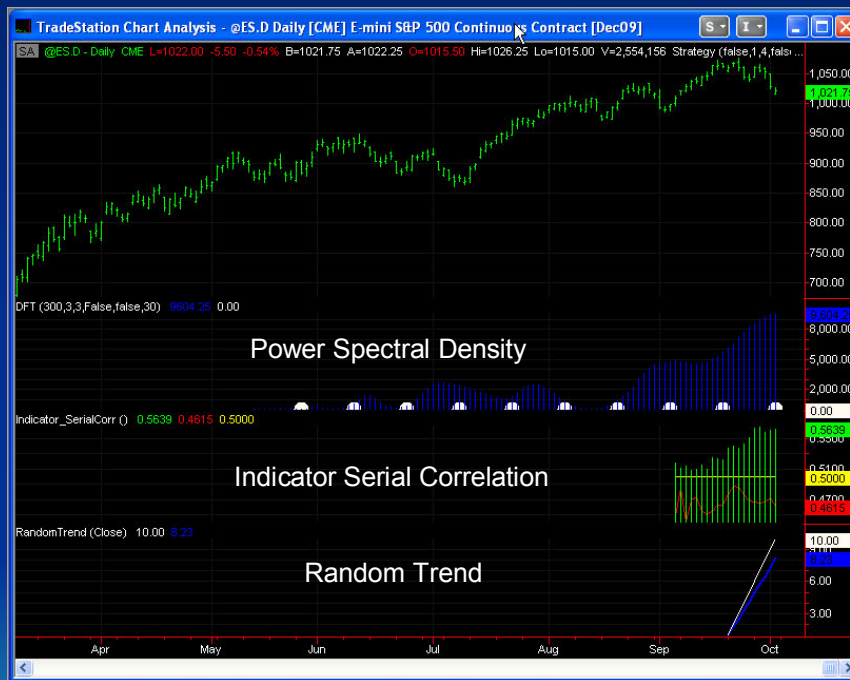
ES THEORETICAL TRADE PERFORMANCE

For a 1 minute bar, Theoretical EV ~ tick size
However, the period alpha is inverse to interval

Bar Size, Minutes	405	135	60	15	1
Expected Value, \$	463	297	188	47	15
Total Trades/Day	0.6	0.75	1.6	5.7	77
Drawdown	8300	5225	4837	3062	1375
Period Alpha	277.8	222.75	300.8	267.9	1155
Reward/Risk	0.03	0.04	0.06	0.09	0.84

MARKETS HAVE DIFFERENT DESCRIPTIVE STATISTICS

So Why Design Symmetrical Systems?



CME:E-MINI S&P



CBOT:WHEAT

EACH MARKET-MODEL-TIME FRAME HAS A SYSTEM DESIGN SET POINT

- Don't force the Market outside its box
- Don't over constrain learning-give it room
- Don't under constrain Terminal or Function Sets
- Use Theoretical Equity Curve as a Shape Guide
- Search for the Market's Set Point then "Stress Test"

LOW FREQUENCY MACHINE DESIGN (70-80 trades/yr)

TradeStation Strategy Performance Report - @SP.P Daily (4/21/1982-10/9/2009)

Display: Table View

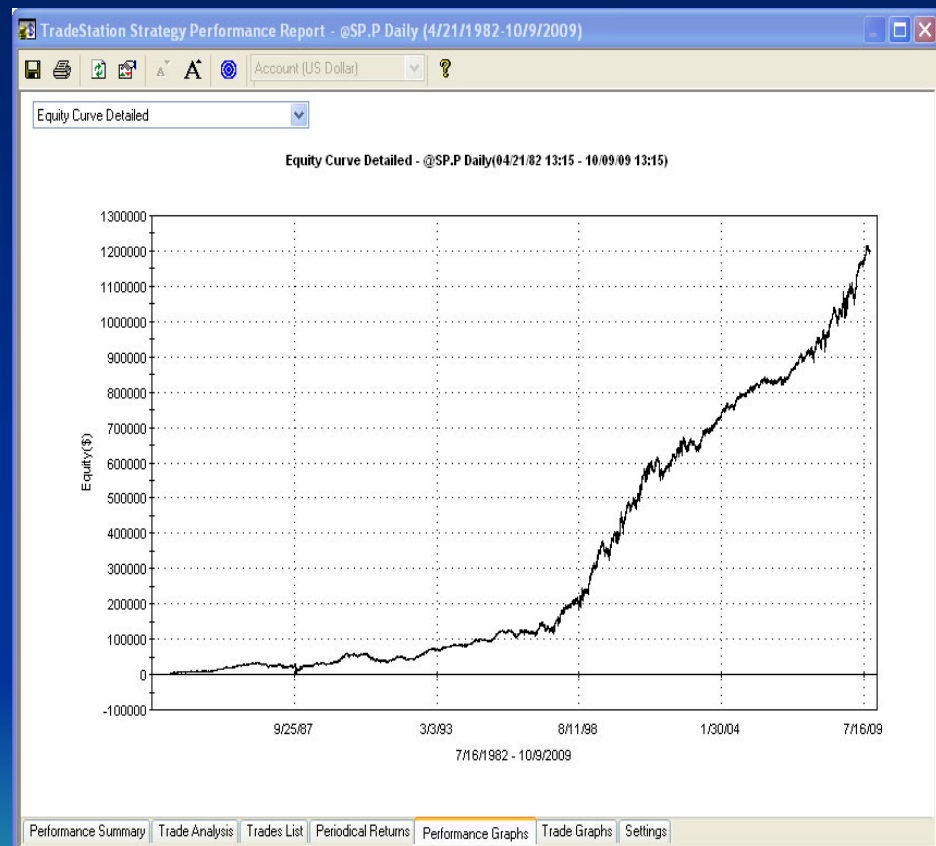
Account (US Dollar)

TradeStation Performance Summary Expand

All Trades

Total Net Profit	\$1,201,125.00	Profit Factor	1.74
Gross Profit	\$2,834,987.50	Gross Loss	(\$1,633,862.50)
Total Number of Trades	1930	Percent Profitable	65.54%
Winning Trades	1265	Losing Trades	651
Even Trades	14		
Avg. Trade Net Profit	\$622.34	Ratio Avg. Win:Avg. Loss	0.89
Avg. Winning Trade	\$2,241.10	Avg. Losing Trade	(\$2,509.77)
Largest Winning Trade	\$24,500.00	Largest Losing Trade	(\$51,250.00)
Max. Consecutive Winning Trades	16	Max. Consecutive Losing Trades	6
Avg. Bars in Winning Trades	3.84	Avg. Bars in Losing Trades	5.80
Avg. Bars in Total Trades	4.50		
Max. Shares/Contracts Held	1	Account Size Required	\$60,675.00
Return on Initial Capital	1201.12%	Annual Rate of Return	9.42%
Return Retracement Ratio	0.11	RINA Index	331.93
Trading Period	27 Yrs, 2 Mths, 24 Dys	Percent of Time in the Market	98.47%
Max. Equity Run-up	\$1,214,862.50		
Max. Drawdown (Intra-day Peak to Valley)		Max. Drawdown (Trade Close to Trade Close)	
Value	(\$76,075.00)	Value	(\$60,675.00)
Net Profit as % of Drawdown	1578.87%	Net Profit as % of Drawdown	1979.60%
Max. Trade Drawdown	(\$67,450.00)		

Performance Summary | Trade Analysis | Trades List | Periodical Returns | Performance Graphs | Trade Graphs



S&P 500 1 contract 1982-2009. OOS begins 2005. Jan 2008 FT Release

MID FREQUENCY MACHINE DESIGN (100-200 trades/yr)

Mid Cap Index Swing Trader-SAR

TradeStation Strategy Performance Report - @MD.P Daily (1/4/1993-10/1/2009)

Display: Table View

Account (US Dollar)

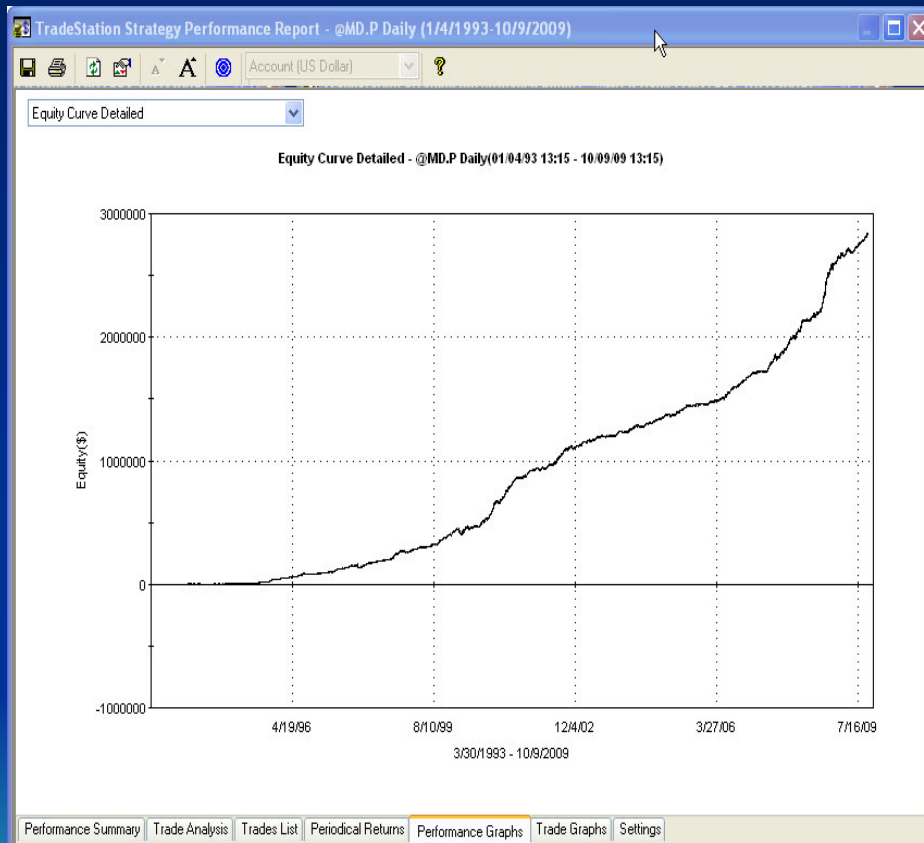
TradeStation Performance Summary

Expand

All Trades

Total Net Profit	\$2,824,875.00	Profit Factor	2.14
Gross Profit	\$5,300,600.00	Gross Loss	(\$2,475,725.00)
Total Number of Trades	2545	Percent Profitable	57.13%
Winning Trades	1454	Losing Trades	1083
Even Trades	8		
Avg. Trade Net Profit	\$1,109.97	Ratio Avg. Win:Avg. Loss	1.59
Avg. Winning Trade	\$3,645.53	Avg. Losing Trade	(\$2,285.99)
Largest Winning Trade	\$38,450.00	Largest Losing Trade	(\$22,050.00)
Max. Consecutive Winning Trades	11	Max. Consecutive Losing Trades	8
Avg. Bars in Winning Trades	2.85	Avg. Bars in Losing Trades	2.31
Avg. Bars in Total Trades	2.62		
Max. Shares/Contracts Held	1	Account Size Required	\$47,550.00
Return on Initial Capital	2824.88%	Annual Rate of Return	20.45%
Return Retracement Ratio	0.24	RINA Index	1566.30
Trading Period	16 Yrs, 6 Mths, 2 Dys	Percent of Time in the Market	99.49%
Max. Equity Run-up	\$2,843,500.00		
Max. Drawdown (Intra-day Peak to Valley)		Max. Drawdown (Trade Close to Trade Close)	
Value	(\$52,575.00)	Value	(\$47,550.00)
Net Profit as % of Drawdown	5373.04%	Net Profit as % of Drawdown	5940.85%
Max. Trade Drawdown	(\$29,525.00)		

Performance Summary Trade Analysis Trades List Periodical Returns Performance Graphs Trade Graphs



MD 1 contract 1993-2009 OOS begins 2005. Jan 2008 FT Release

HIGH FREQUENCY MACHINE DESIGN (200 + trades/day)

TradeStation Strategy Performance Report - @ES.D 200 Tick Bar (9/25/2009-10/9/2009)

Display: Table View

Account (US Dollar)

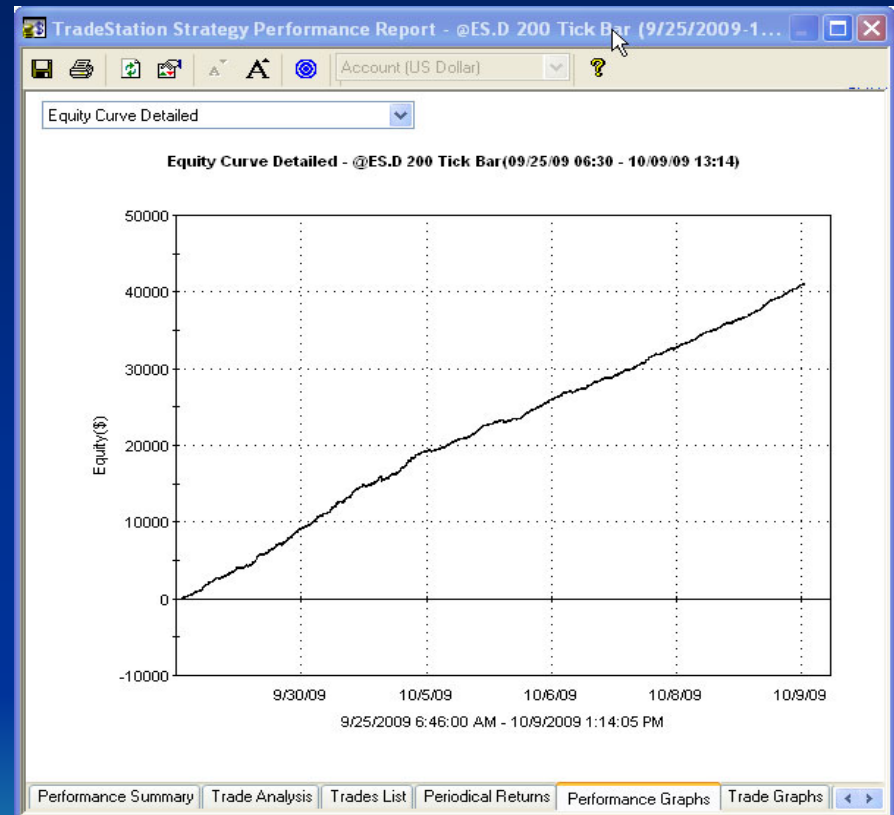
TradeStation Performance Summary

Expand

All Trades

Total Net Profit	\$41,125.00	Profit Factor	3.05
Gross Profit	\$61,187.50	Gross Loss	(\$20,062.50)
Total Number of Trades	3506	Percent Profitable	66.89%
Winning Trades	2345	Losing Trades	648
Even Trades	513		
Avg. Trade Net Profit	\$11.73	Ratio Avg. Win:Avg. Loss	0.84
Avg. Winning Trade	\$26.09	Avg. Losing Trade	(\$30.96)
Largest Winning Trade	\$225.00	Largest Losing Trade	(\$575.00)
Max. Consecutive Winning Trades	15	Max. Consecutive Losing Trades	4
Avg. Bars in Winning Trades	3.55	Avg. Bars in Losing Trades	7.32
Avg. Bars in Total Trades	4.39		
Max. Shares/Contracts Held	1	Account Size Required	\$587.50
Return on Initial Capital	41.13%	Annual Rate of Return	881.74%
Return Retracement Ratio	11.70	RINA Index	1913.49
Trading Period	14 Dys, 6 Hrs, 28 Mins, 5 secs	Percent of Time in the Market	99.94%
Max. Equity Run-up	\$41,150.00		
Max. Drawdown (Intra-day Peak to Valley)			
Value	(\$637.50)	Max. Drawdown (Trade Close to Trade Close)	
Net Profit as % of Drawdown	6450.98%	Value	(\$587.50)
		Net Profit as % of Drawdown	7000.00%
Max. Trade Drawdown	(\$612.50)		

Performance Summary | Trade Analysis | Trades List | Periodical Returns | Performance Graphs | Trade Graphs



E-Mini S&P 9/25/09-10/09/09 1 contract (Limit Based)

HOW CAN I ENHANCE ROBUSTNESS IN MACHINE OR MANUALLY DESIGNED TRADING SYSTEMS?

- Prune unused or infrequently used inputs (reduce parameters)
- Prune equations down in size (minimal description length)
- Target high trade to parameter ratios (enhances information ratio)
- Test Out of Sample (to verify blind testing)
- Make sure entry tactic is standard (or you cannot implement)
- Eliminate Order/Exit violations (entire project is flawed)
- Avoid overfitting stops and targets (warps natural set point)
- Use unbiased terminal sets (limited design assumptions)
- Assume null starting point (unbiased starting point)

THE SYSTEM TRADERS DYSFUNCTION

- System is on fire! Broker talks it up.
- Clients pile on only to suffer an immediate drawdown
- Clients stop trading the system just as it recovers and enters a new equity high
- System is on Fire! Broker talks it up.

SOLUTION TO THE SYSTEM TRADERS DYSFUNCTION

- Trade with enough capital
- Investigate the System's drawdown
- Don't start trading following a huge rise in equity
- Don't pyramid positions outside of system envelope
- Diversify over markets, time frames and systems
- Start trading following a equity curve pullback
- Don't stop trading at the first drawdown

DATA HEAVY INDICATORS

- Moving Averages use 1 time series: Close
- Stochastics use 3 time series: H, L, C

What Indicator uses all 5 standard time series?

Open

High

Low

Close

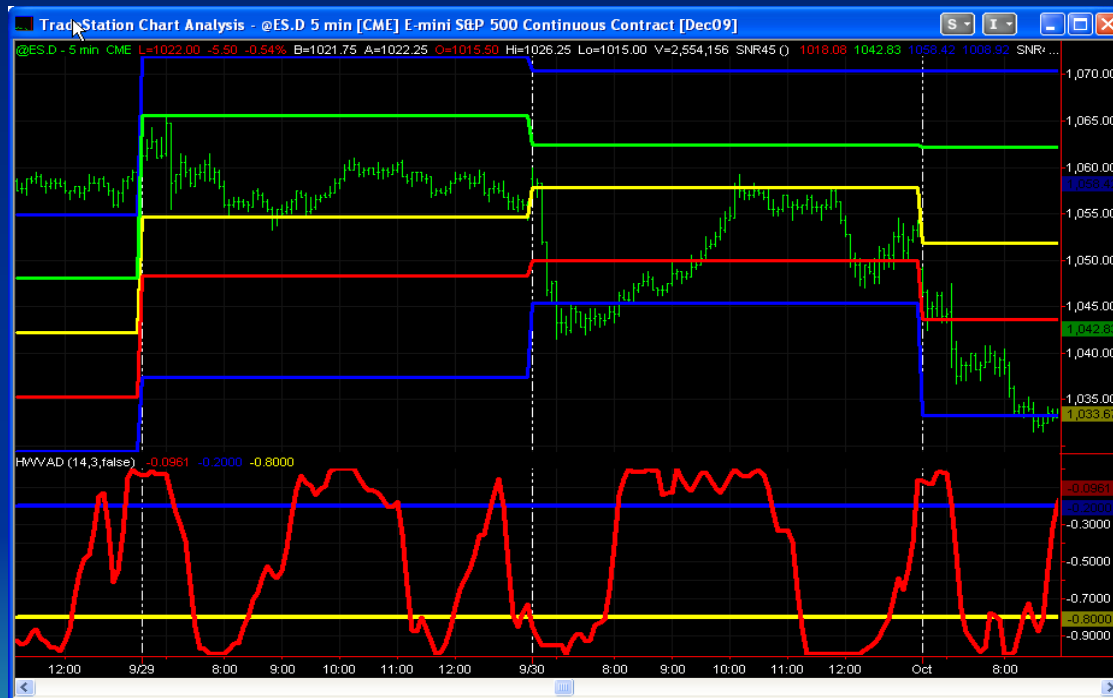
Volume or Tick Volume

We will take this indicator and adapt it with the Hilbert Dominant Cycle

Hilbert Adaptive Williams Variable Accumulation Distribution

$$WVAD = \sum_{n=0}^i Volume[i] * \frac{Close[i] - Open[i]}{High[i] - Low[i]}$$

n~HilbertDC



Hilbert DC: Ehlers, MESA Software

SUMMARY

- TSL is patented, licensed, restricted and exclusive
- TSL technology is unavailable anywhere else
- TSL strategies are #1, #2 and #3 per Futures Truth
- TSL speed grows with CPU speed
- TSL can design many different types of strategies
- TSL produces code in a variety of languages
- TSL terminal set is customizable
- TSL sets a paradigm shift in strategy design
- TSL is used in many different countries and on many different markets

MACHINE DESIGNED TRADING SYSTEMS

THIRD PARTY TESTING

RELEASE: 1/1/2008*

- #1 Since Release Date (also #6)
- #2 For past 12 months
- #2 S&P Trading System

*Machine Designed in December 2007

Source: Futures Truth Issue #4 October 2009

EASY STEPS

1. Select Market and Preprocess
2. Evolve System and code
3. Translate and Implement into platform

CONCLUSION

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