John Ehlers

ANTICIPATING TURNING POINTS

Left-Brained Concepts for Traders in their Right Minds

This Session is an excerpt from my Runner Up Paper for the MTA Charles H. Dow Award

www.mta.org

Activities Tab – Charles H. Dow Award

also available at

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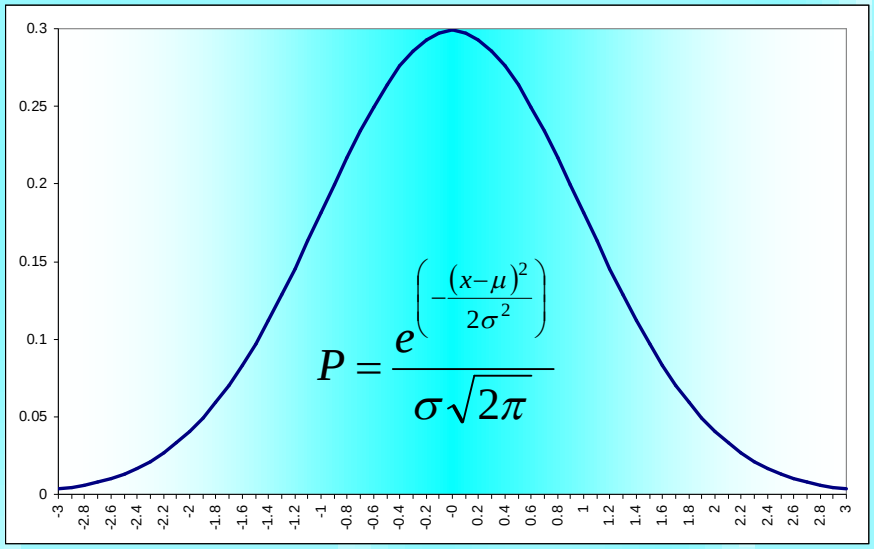
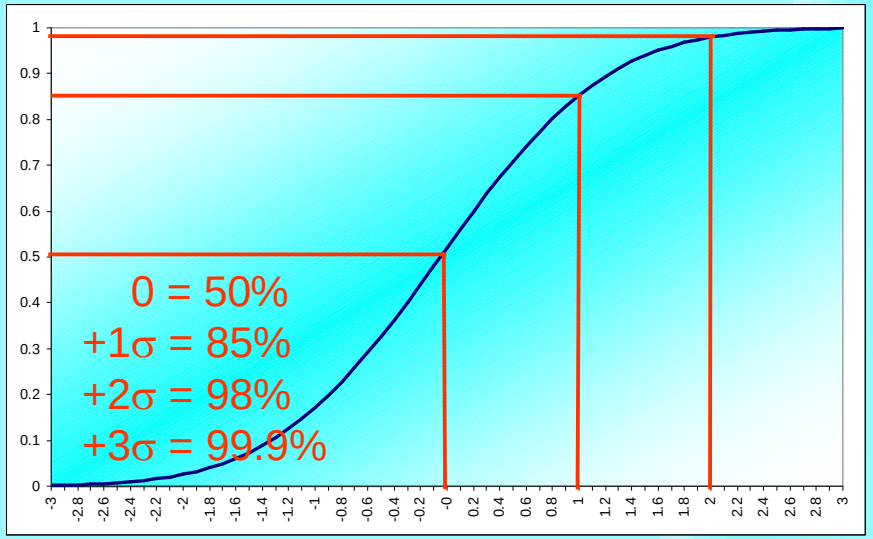
Normal (Gaussian) Probability Distribution Function (PDF) is Commonly Assumed for Market Data

John Ehlers

Normal PDF



Cumulative Normal PDF



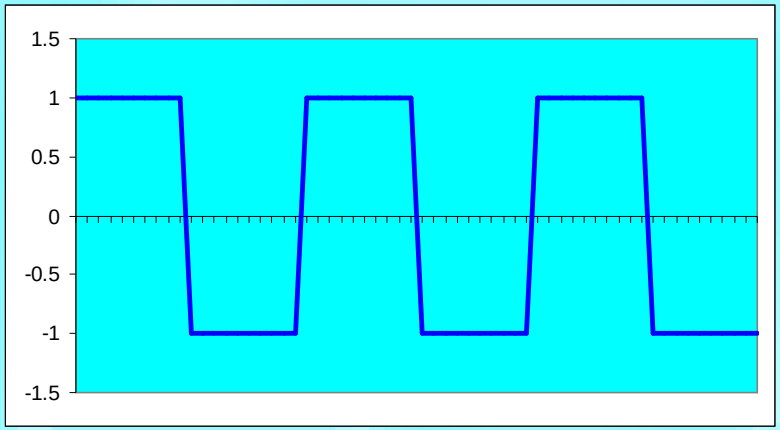
Normal PDF is attractive because it can be achieved using several random variables due to the central limit theorem

But is Normal the right PDF for market data?

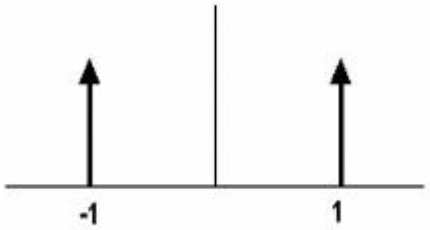
CONSIDER A THEORETICAL SQUAREWAVE

John Ehlers

Square Wave



Binary PDF of Square Wave

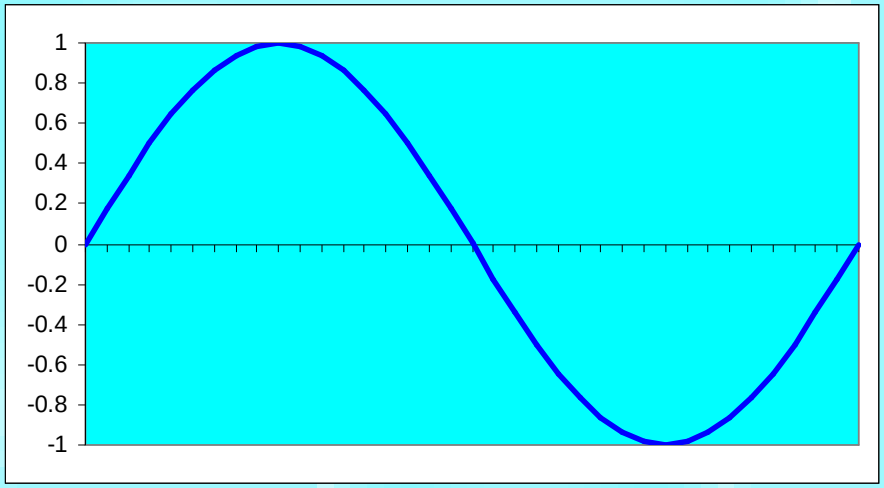


A Square Wave cannot be traded with conventional indicators because the move is over before any indicator can show the move

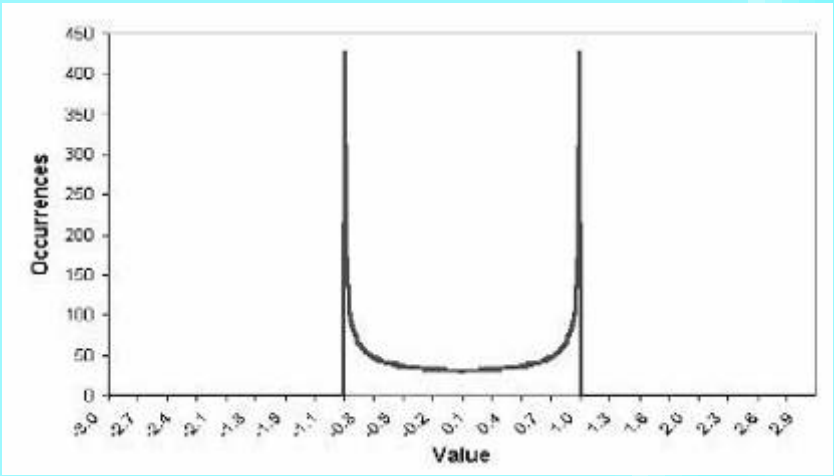
NEXT - CONSIDER A SINEWAVE

John Ehlers

Sine Wave



Sine Wave PDF



The Probability Distribution of a Sinewave is similar to that of a Squarewave

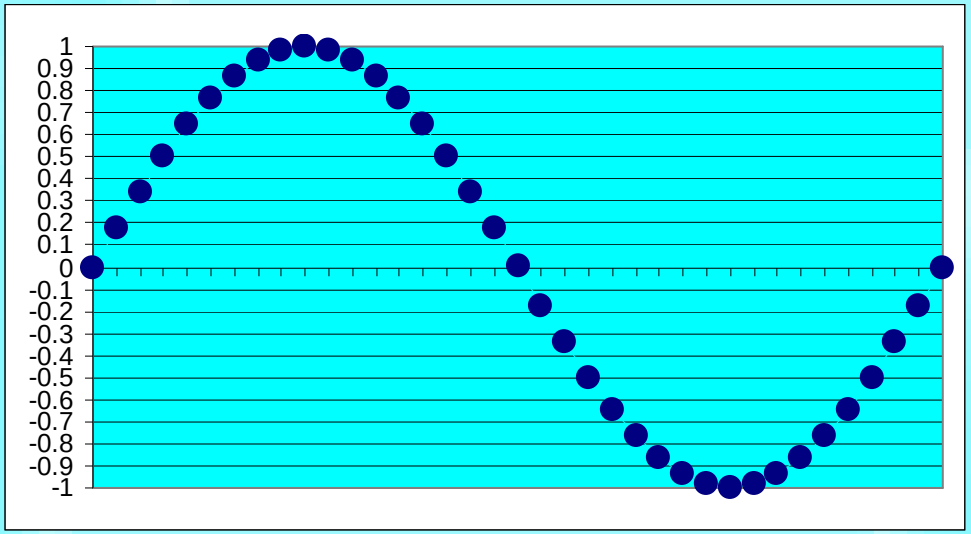
This is why most traders have trouble trading with cycles

The cyclic turning point must be anticipated

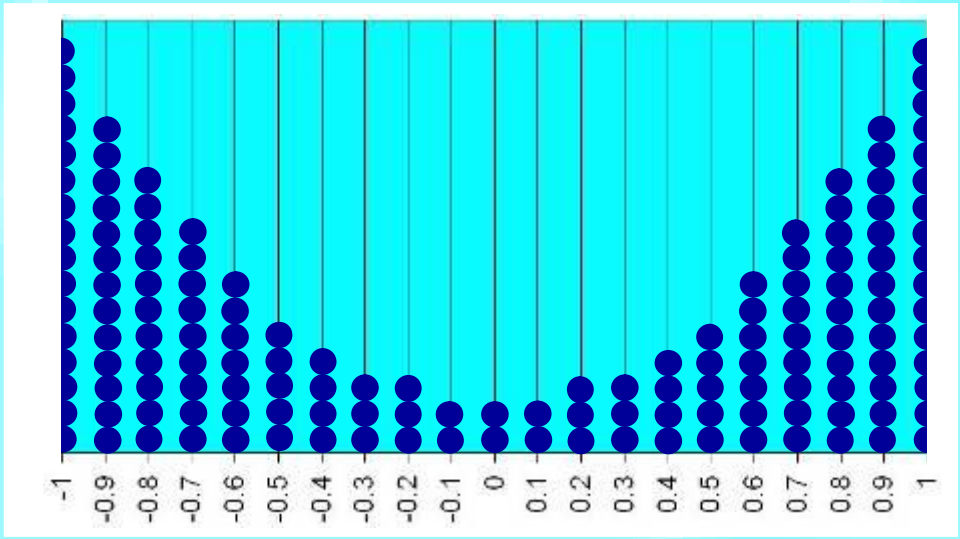
How Do We Determine the Market PDF?

John Ehlers

Create the waveform by stringing beads on a horizontal wire frame



Rotate wire frame to enable beads to stack up



Height of the bead stacks is the PDF of the Waveform

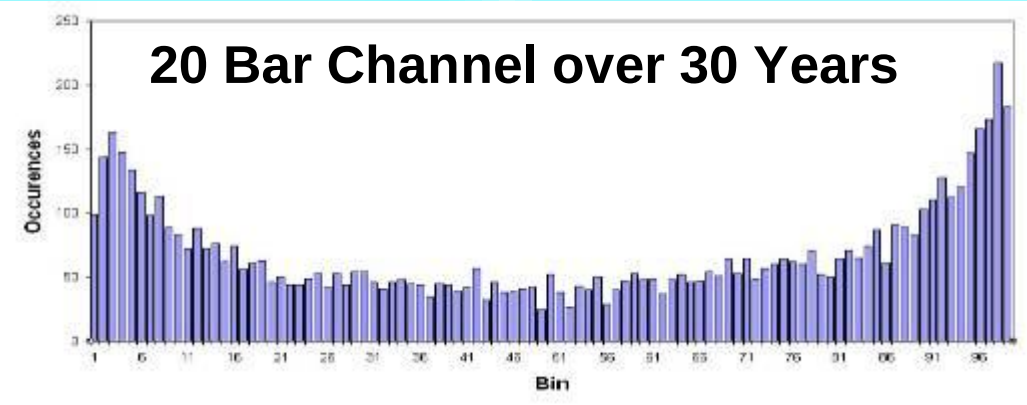
Channel Limited PDF Generator Code

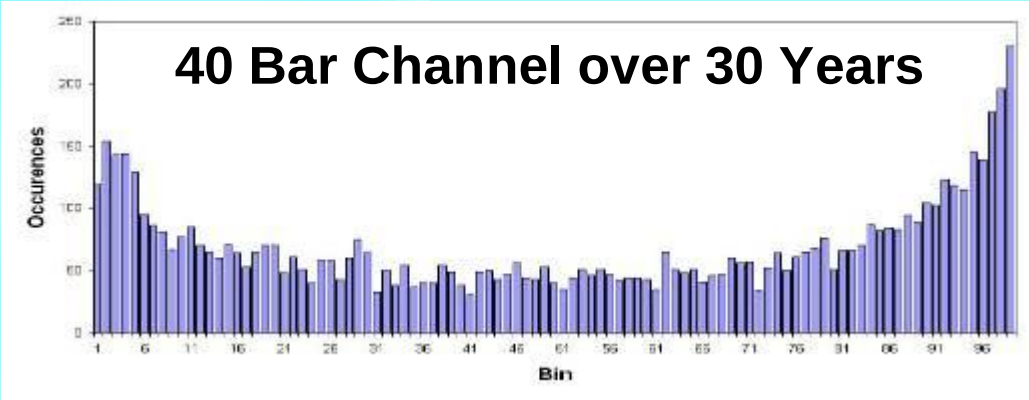
John Ehlers

```
Inputs:
        Length(20);
Vars:
        HH(0),
        LL(0),
        J(0),
        I(0);
Arrays:
        Filt[2000](0),
        Bin[100](0);
HH = Close;
LL = Close;
For I = 0 to Length -1 Begin
        If Close[I] > HH then HH = Close[I];
        If Close[I] < LL then LL = Close[I];
End;
If HH <> LL Then Value1 = (Close - LL) / (HH - LL);
Filt[CurrentBar] = (Value1 + 2*Value1[1] + Value1[2]) / 4;
For I = 0 to 100 Begin
        If Filt[J] >= I/100 and Filt[J] < (I + 1)/100 Then Bin[I] = Bin[I]+1;
End;
For I = 0 to 99 Begin
        Print(File("c:\tsgrowth\pdf.csv"), I, ",", Bin[I]);
End;
Plot1(Filt[CurrentBar]);
```

Channel PDF for Treasury Bonds

John Ehlers

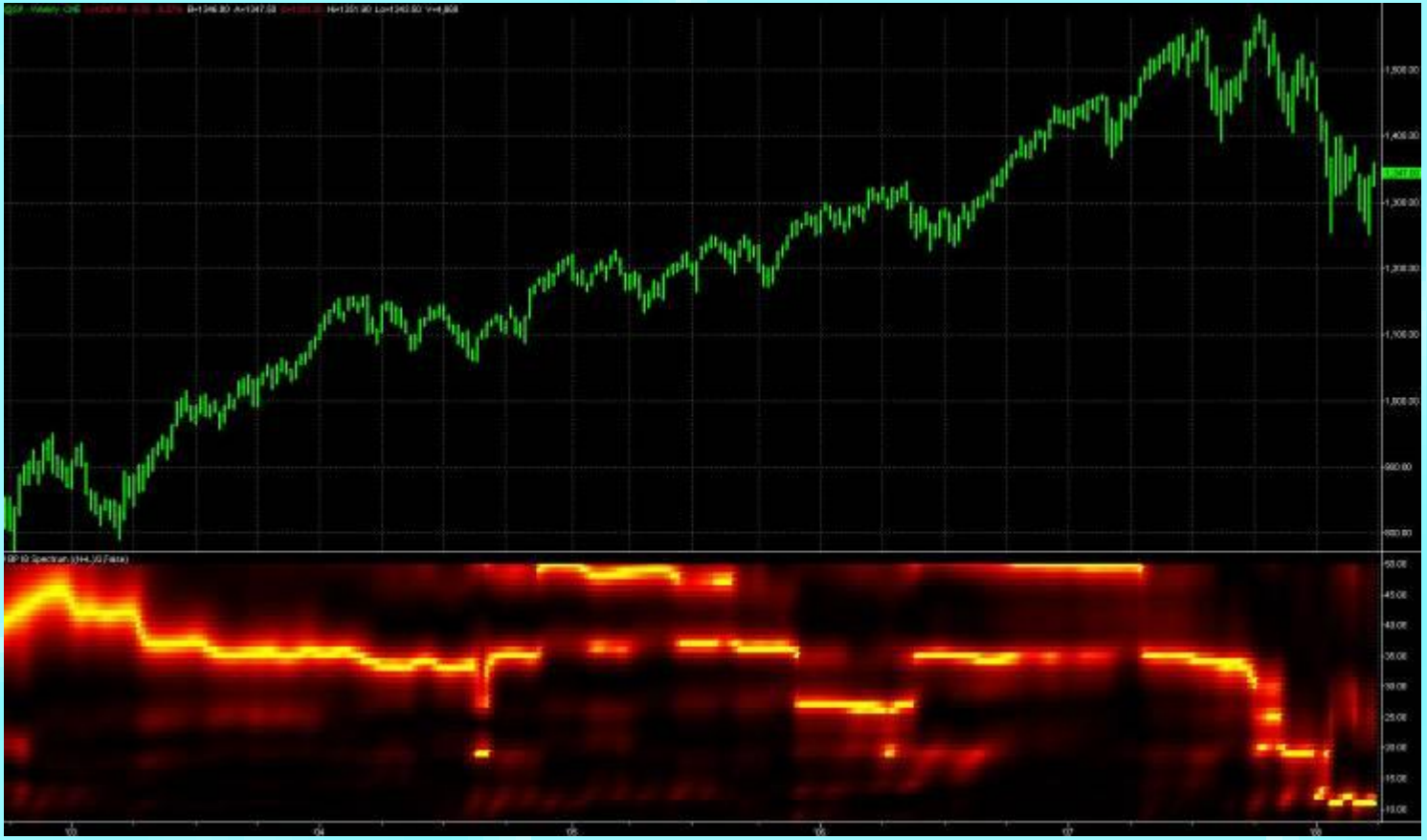




Clearly, Channel Limited Detrending produces Sinewave-Like PDFs

SPY Weekly for Last Five Years

John Ehlers



Consistent 36 Week Cycle is Measured
(code from Jan 2008 Stocks & Commodities)

CONVINCED THERE ARE TRADEABLE CYCLES?

- Market Cycles have been measured
  - With Probability Distribution Functions
  - With Spectral Analysis
- Trading with Cycles is difficult because the turning points MUST be anticipated
  - Conventional Indicators are basically useless because of lag
- I will show you two ways to anticipate the turning points using cycles
  - Correlating prices with a sinewave and advancing the phase
  - BandPass Filtering

Sine Correlation System

Sine Correlation System

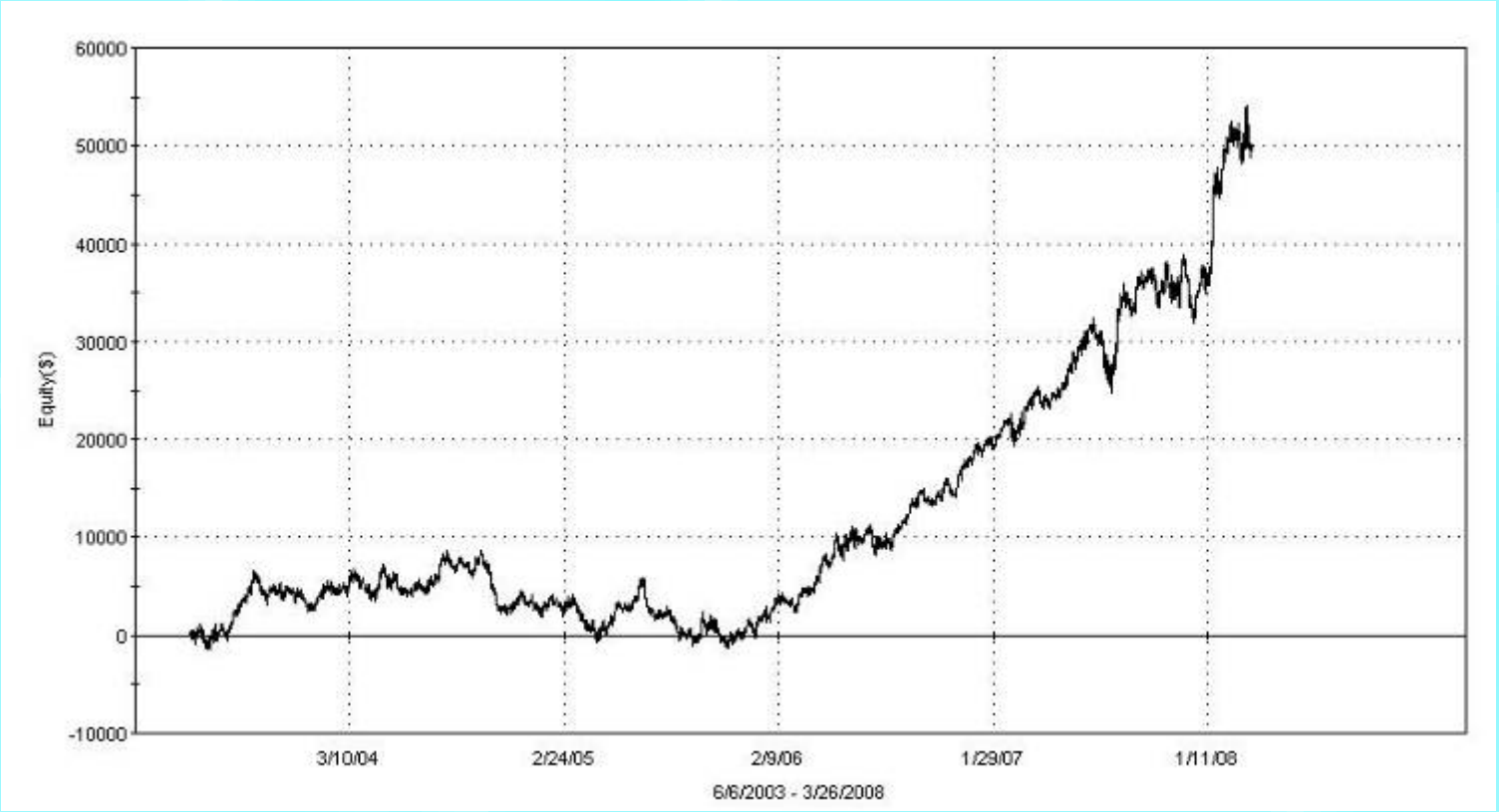
John Ehlers

- Detrend prices by highpass filtering
- Correlate a sinewave to the detrended price by maximizing the sum of the product across:
  - Full range of cycle periods
  - 360 degrees of phase for each period
- Resulting sinewave (period and phase) is the signal
- Advance the signal by two bars to get a leading signal
- Crossover of the two signal lines are the trading signals

Sine Correlation Performance for Five Years on @ES.D

John Ehlers

Net Profit:	$50,637
# Trades:	185 (about one trade every 1.25 weeks)
% Profitable:	63.8%
Profit Factor:	1.87
Trade Drawdown:	($5,375)



BandPass Filtering

BandPass Filter System

- BandPass filtering through a narrow passband filter reduces prices to a sinewave with slowly varying phase and amplitude
- This technique **ONLY** works because the filtered prices are quasi-sinewave
  - The period of the cycle must be known
  - Don't try this on a Stochastic, RSI, or other oscillator
- From the calculus we know that

  $d(\text{Sin}(\omega t))/dt = \omega * \text{Cos}(\omega t)$
- Therefore, a 90 degree leading waveform can be obtained by taking a one bar momentum and dividing it by the angular frequency (multiply by Period/2π)

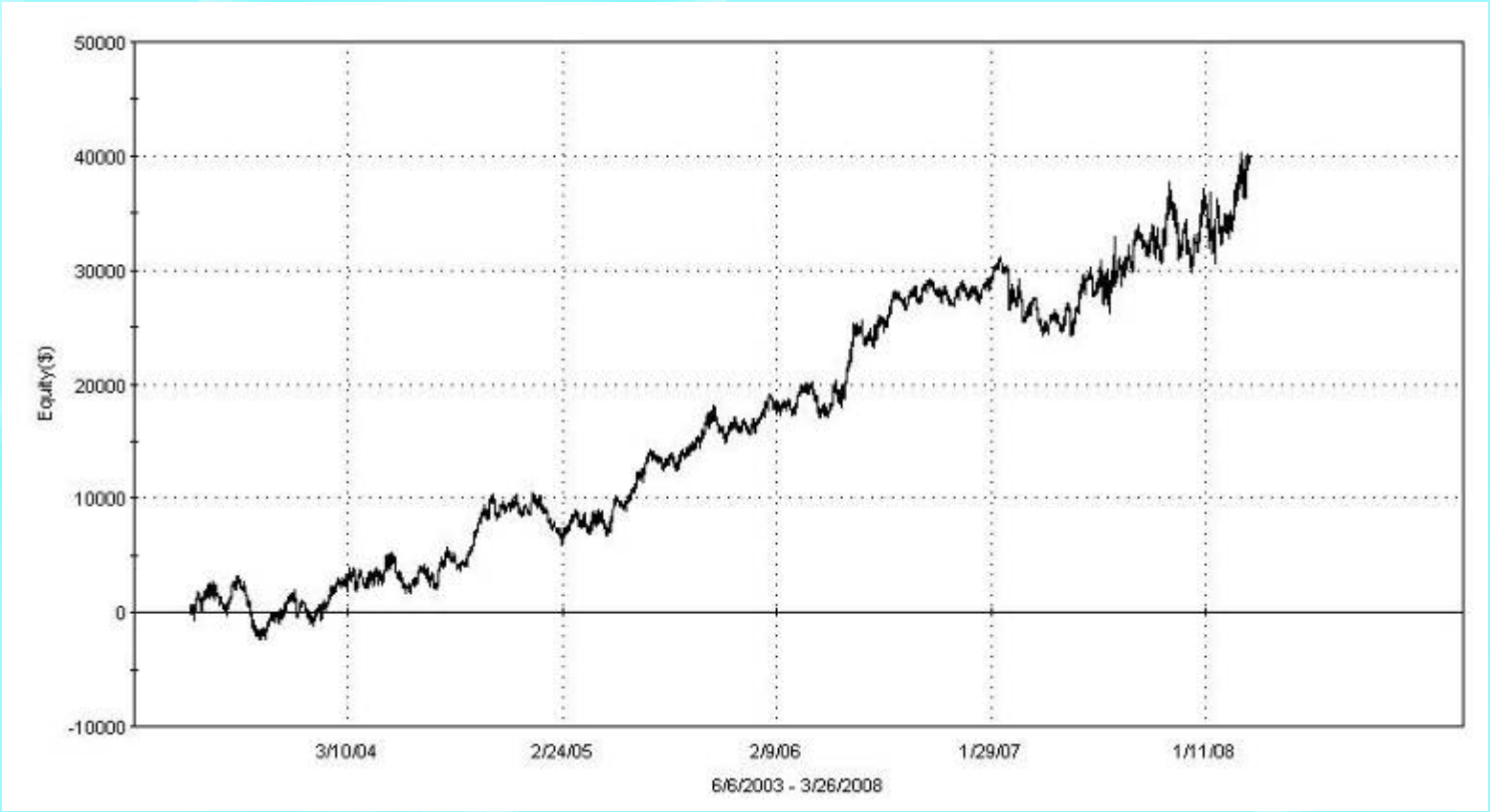
BandPass Filter System

- Bandpass filter the price for a selected cycle period
  - Call this I for In-Phase
- Multiply one bar momentum of the bandpass filtered signal by (Period/2π)
  - Call this Q for Quadrature
- Create a 60 degree leading signal
  - Lead = .5*I + .866*Q
- Crossovers of “I” and “Lead” are the trading signals

BandPass System Performance

John Ehlers

- Net Profit: $40,037
- # Trades: 133 (about one trade every 1.75 weeks)
- % Profitable: 59.4%
- Profit Factor: 1.84
- Trade Drawdown: ($3,550)



Probability Distribution Varies with Detrending

- Channel Limited detrending generally yields PDFs similar to the PDF of a Sine Wave
- Two more detrending approaches will be described where that is not necessarily true
  - HighPass Filtering
  - RSI

Highpass Filter PDF Generator Code

John Ehlers

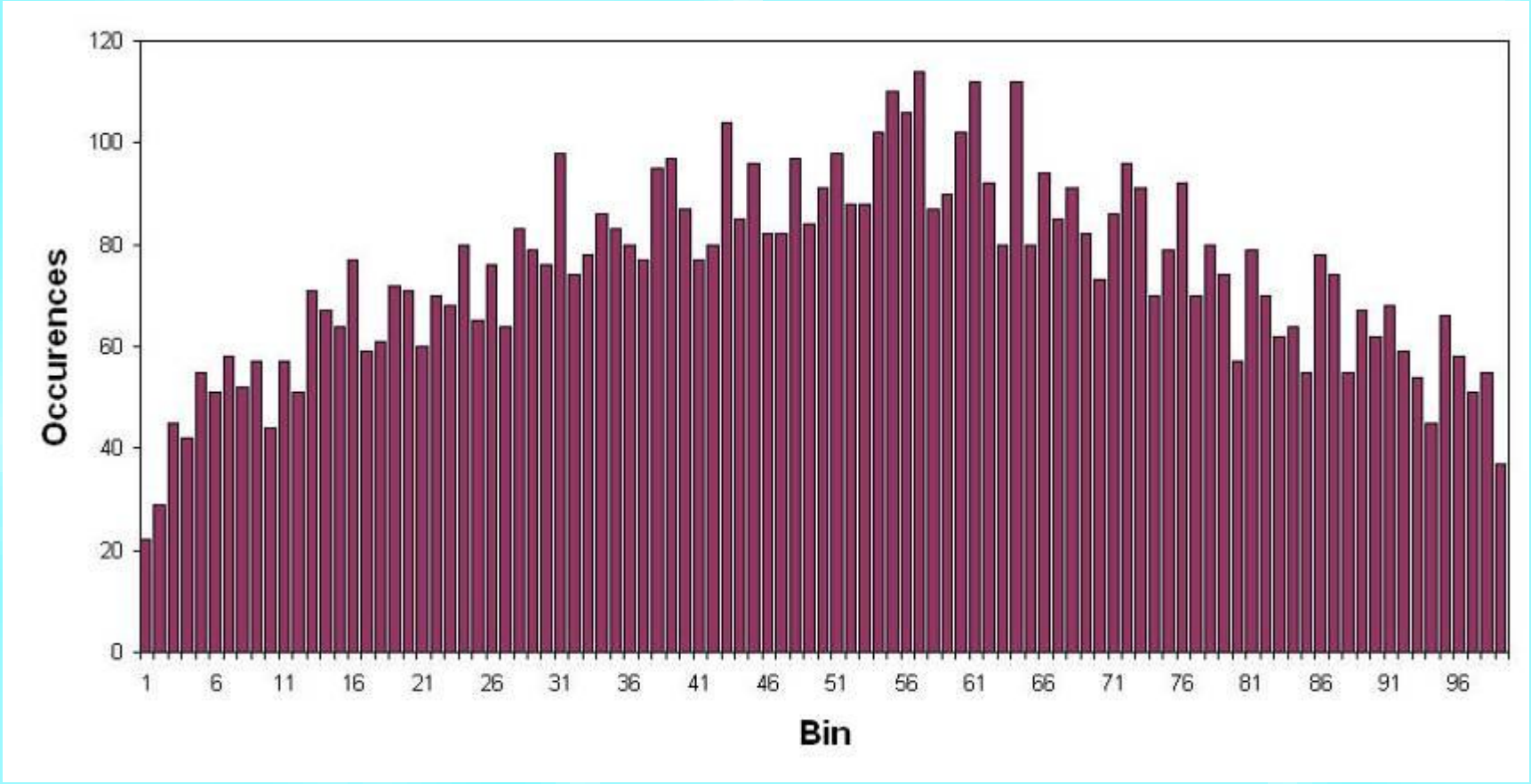
```
Inputs:
        HPPeriod(40);
Vars:
        alpha(0), HP(0), HH(0), LL(0), Count(0), Psn(0), I(0);
Arrays:
        Bin[100](0);
alpha = (1 - Sine (360 /  HPPeriod)) / Cosine(360 / HPPeriod);
HP = .5*(1 + alpha)*(Close - Close[1]) + alpha*HP[1];
IF CurrentBar = 1 THEN HP = 0;
If CurrentBar > HPPeriod Then Begin
        HH = HP;
        LL = HP;
        For Count = 0 to HPPeriod -1 Begin
                If HP[Count] > HH Then HH = HP[Count];
                If HP[Count] < LL Then LL = HP[Count];
        End;
        If HH <> LL Then Value1 = 100*(HP - LL) / (HH - LL);
        Psn = (Value1 + 2*Value1[1] + Value1[2]) / 4;

        For I = 1 to 100 Begin
                If Psn > I - 1 and Psn <= I Then Bin[I] = Bin[I] + 1;
        End;
        Plot1(Psn);
End;
If LastBarOnChart Then Begin
        For I = 1 to 99 Begin
                Print(File("C:\TSGrowth\PDF_HP.CSV"), I, ",", Bin[I]);
        End;
End;
```

HP Filtered PDF for Treasury Bonds

John Ehlers

40 Bar Cutoff over 30 Years



PDFs produced by filtering have nearly uniform probability

MyRSI PDF Generator Code

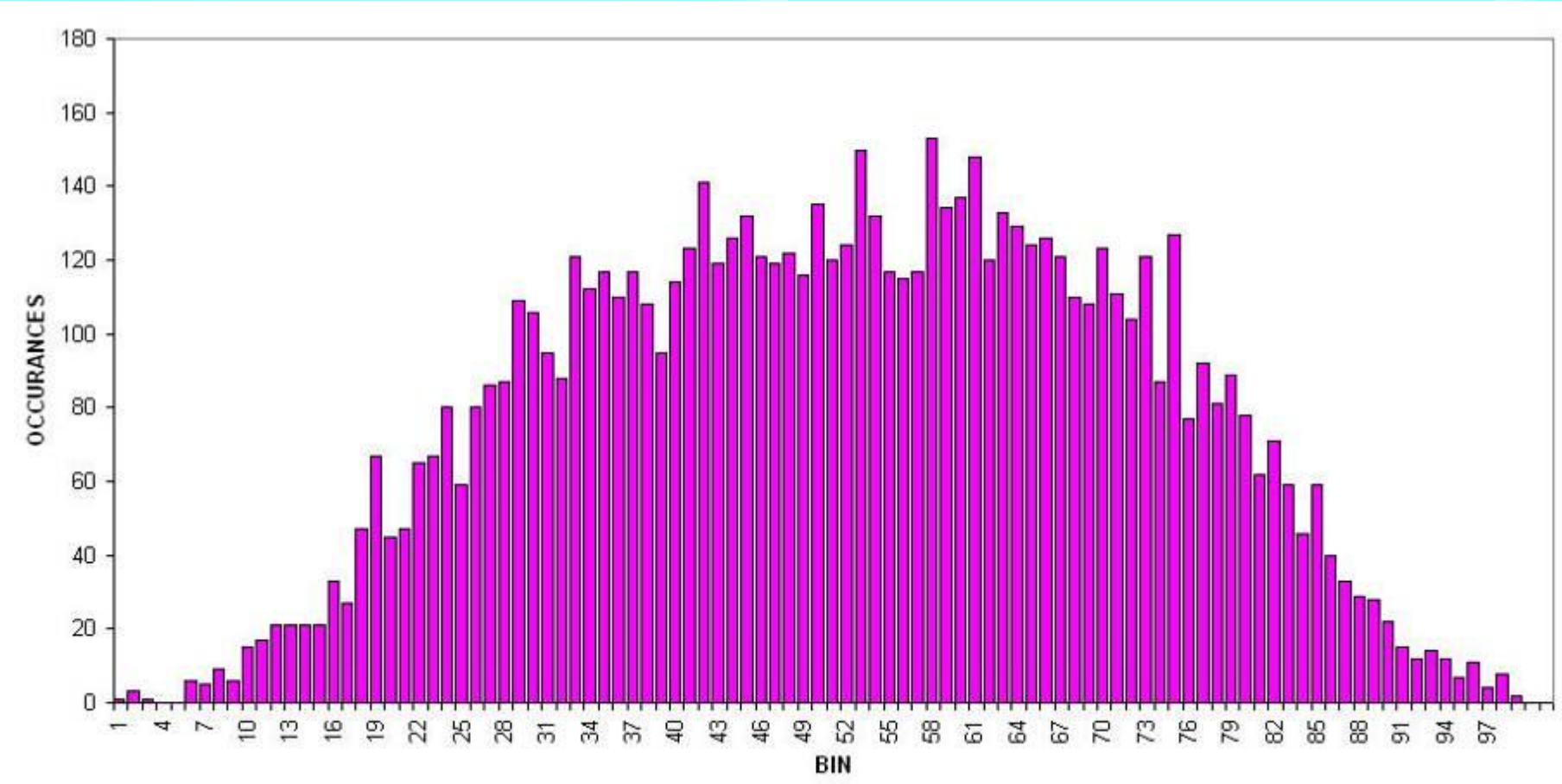
John Ehlers

```
Inputs:
        Length(10);
Vars:
        CU(0), CD(0), I(0), MyRSI(0), Psn(0);
Arrays:
        Bin[100](0),
        PDF[100](0);
If CurrentBar > Length Then Begin
        CU = 0;
        CD = 0;
        For I = 0 to Length -1 Begin
                If Close[I] - Close[I + 1] > 0 Then CU = CU + Close[I] - Close[I + 1];
                If Close[I] - Close[I + 1] < 0 Then CD = CD + Close[I + 1] - Close[I];
        End;
        If CU + CD <> 0 Then MyRSI = 50*((CU - CD) / (CU + CD) + 1);
        Psn = (MyRSI + 2*MyRSI[1] + MyRSI[2]) / 4;
        For I = 1 to 100 Begin
                If Psn > I - 1 and Psn <= I Then Bin[I] = Bin[I] + 1;
        End;
End;
If LastBarOnChart Then Begin
        For I = 1 to 99 Begin
                Print(File("C:\TSGrowth\PDF_RSI.CSV"), I, ",", PDF[I]);
        End;
End;
```

MyRSI PDF for Treasury Bonds

John Ehlers

10 Bar RSI over 30 Years



RSI Detrending yields PDFs that appear Gaussian-Like

RSI PDF Suggests a Trading Strategy

- The RSI PDF appears to be Gaussian-Like
- Probability of events at the amplitude extremes are very low
- Strategy is based on the higher probability of prices reversing
  - Sell Short when prices cross over some upper threshold
  - Buy when prices cross under some lower threshold

RSI Strategy

- Compute RSI
- Buy when RSI crosses below 20%
- Sell when RSI crosses above 80%

Fisher Transform

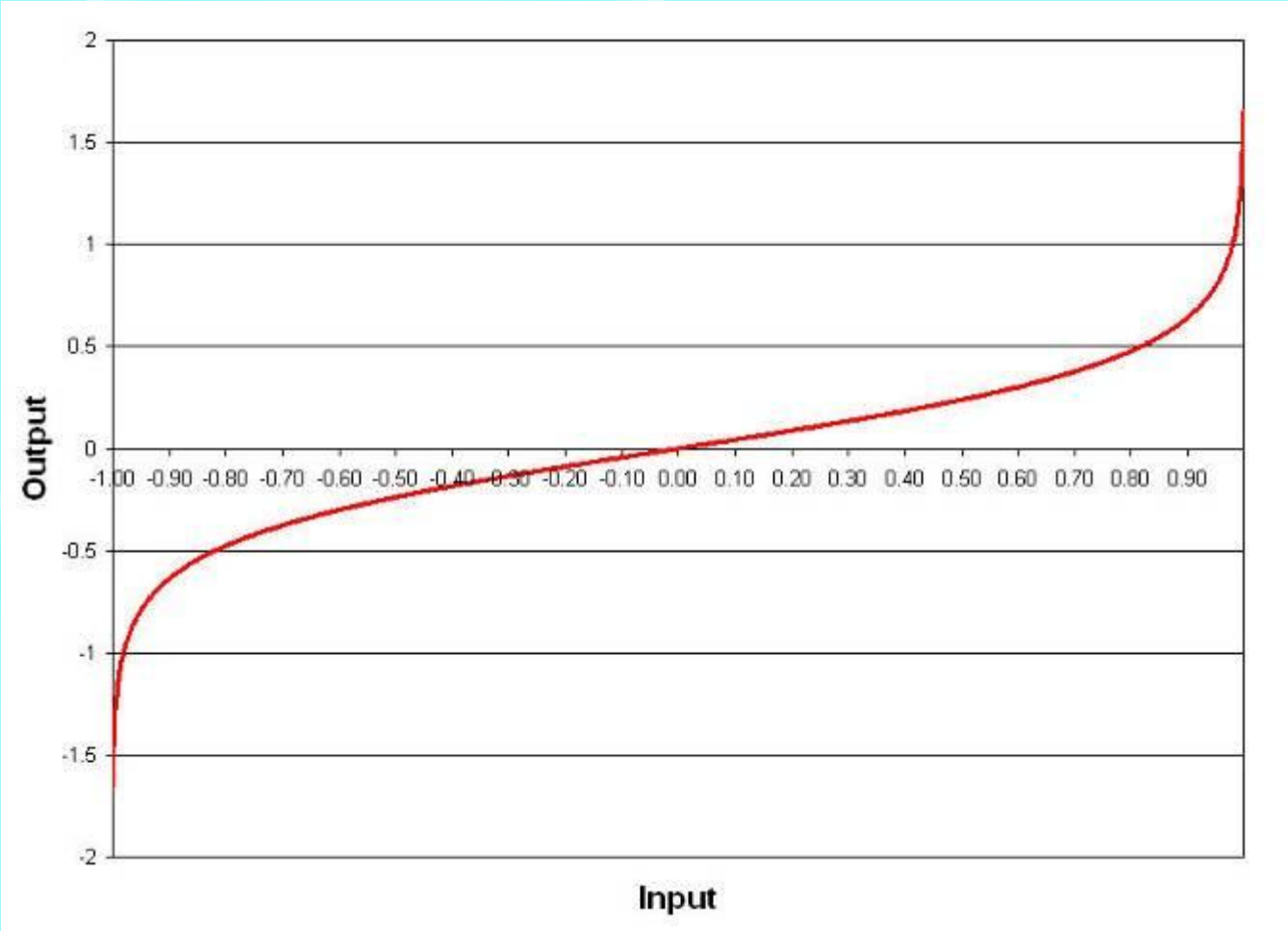
A PDF of virtually any processed data can be converted to a Normal PDF using the Fisher Transform

Fisher Transform

John Ehlers

$$y = 0.5 * \ln\left(\frac{1+x}{1-x}\right)$$

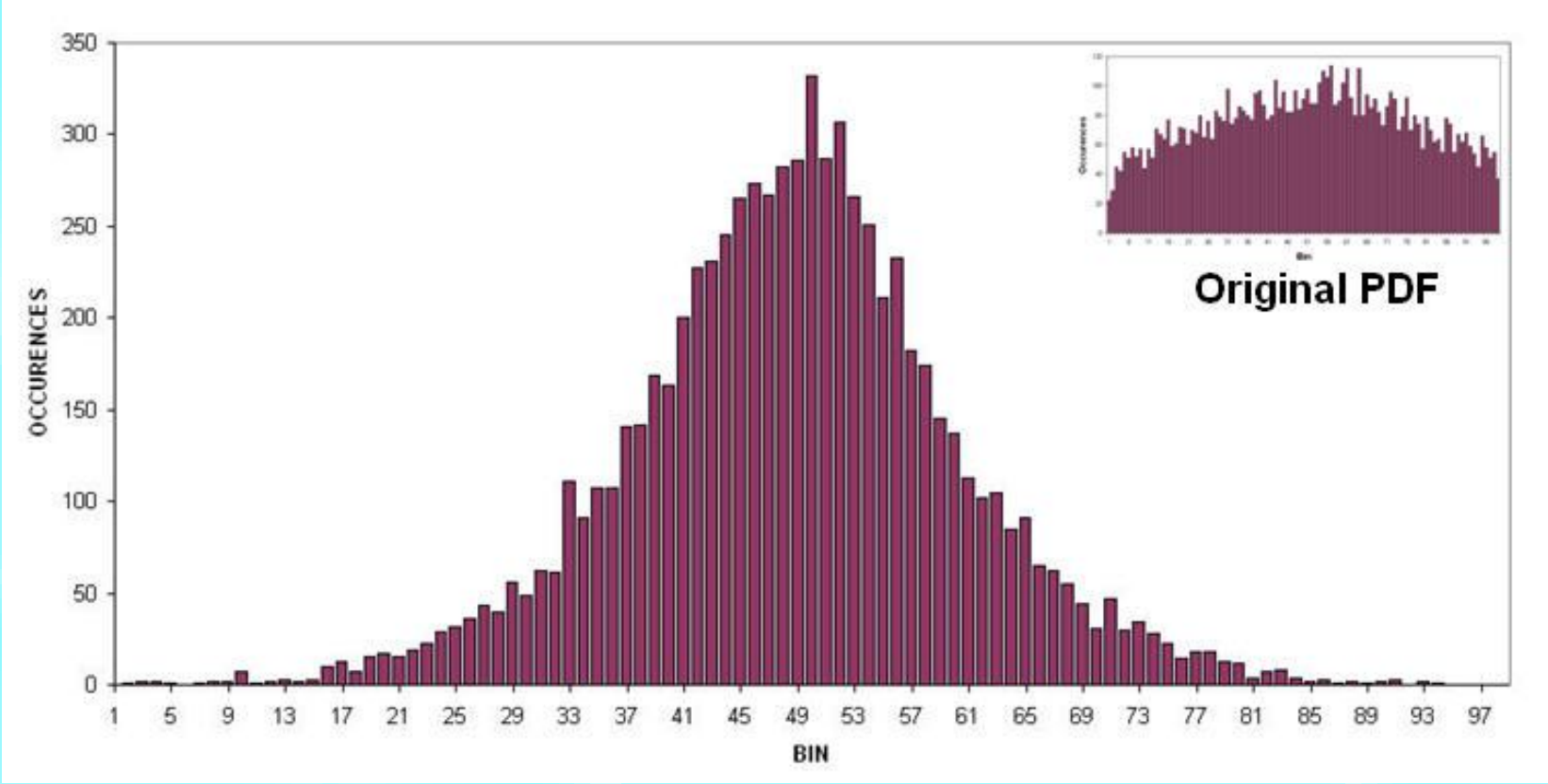
A Fisher Transform has no lag – it expands range near the endpoints



Fisherized PDF for Treasury Bonds

John Ehlers

Fisherized Detrended Signal Over 30 Years



The Fisher Transform enables the use of the same kind of strategy as before
Where we reverse position when extreme amplitude thresholds are exceeded

Fisher Transform System

John Ehlers

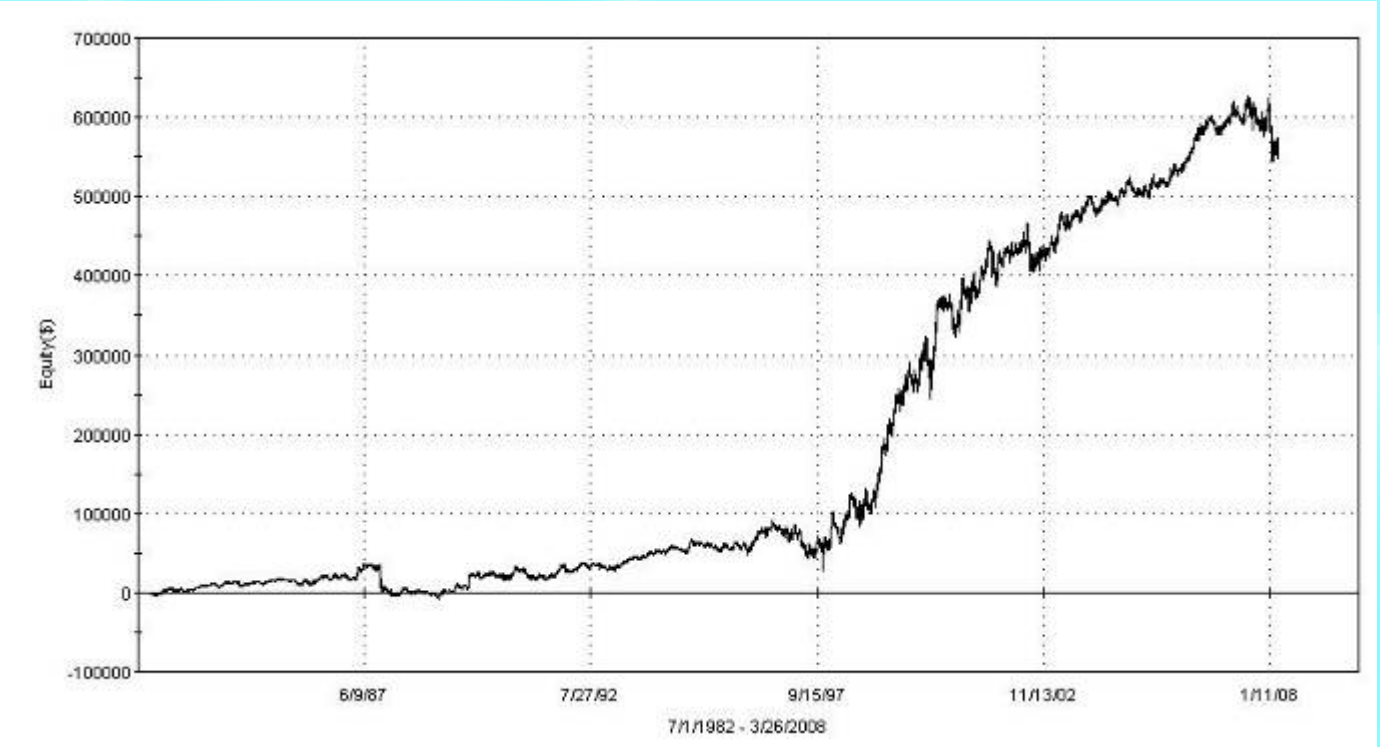
- Highpass Filter prices
- Normalize between -.999 and +.999 using a Stochastic-like approach
- Buy when transformed prices cross below an optimizable lower bound
- Sell when transformed prices cross above an optimizable lower bound

TRADING SYSTEM RESULTS

RSI Trading System Results

John Ehlers

- @SP.P for the life of the contract (from April 1982)
- 576 Trades (about once every two weeks)
- 68.6% Profitable Trades
- Profit Factor = 1.62

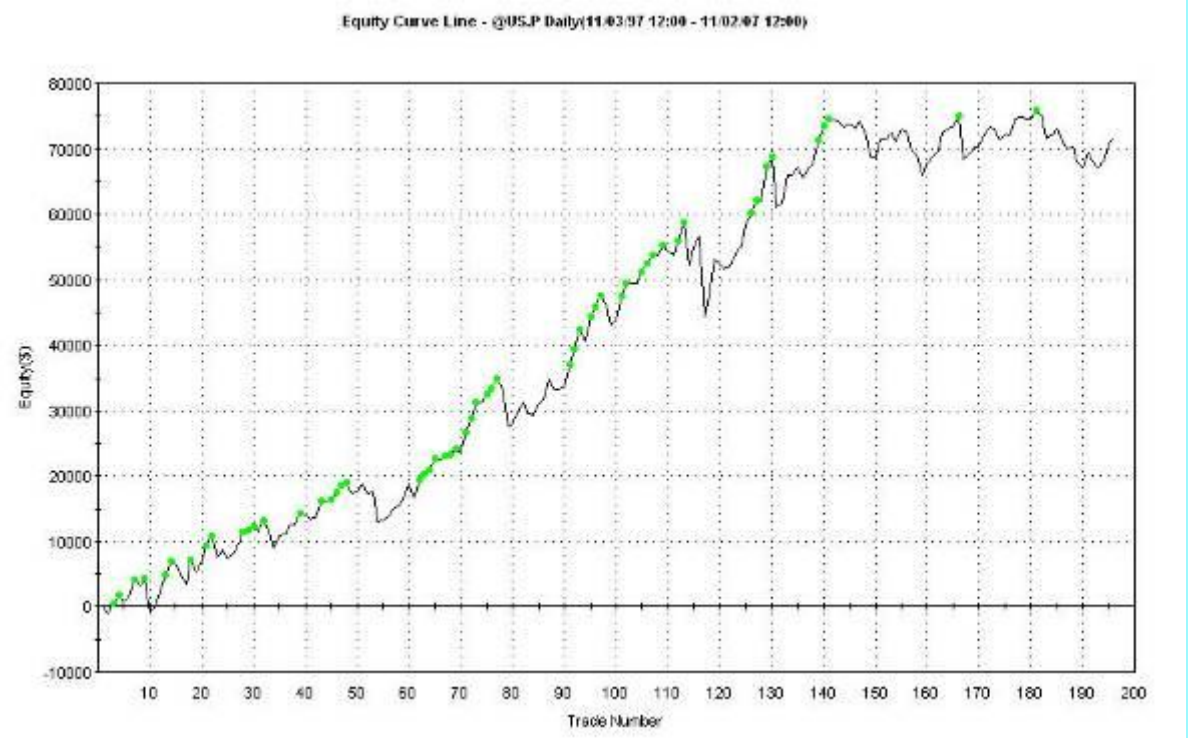


The strategy is robust across the entire life of the contract!

RSI Trading System Results (2)

John Ehlers

- @US.P for last 10 years
- 196 Trades (about once every two and a half weeks)
- 63.8% Profitable Trades
- Profit Factor = 1.60

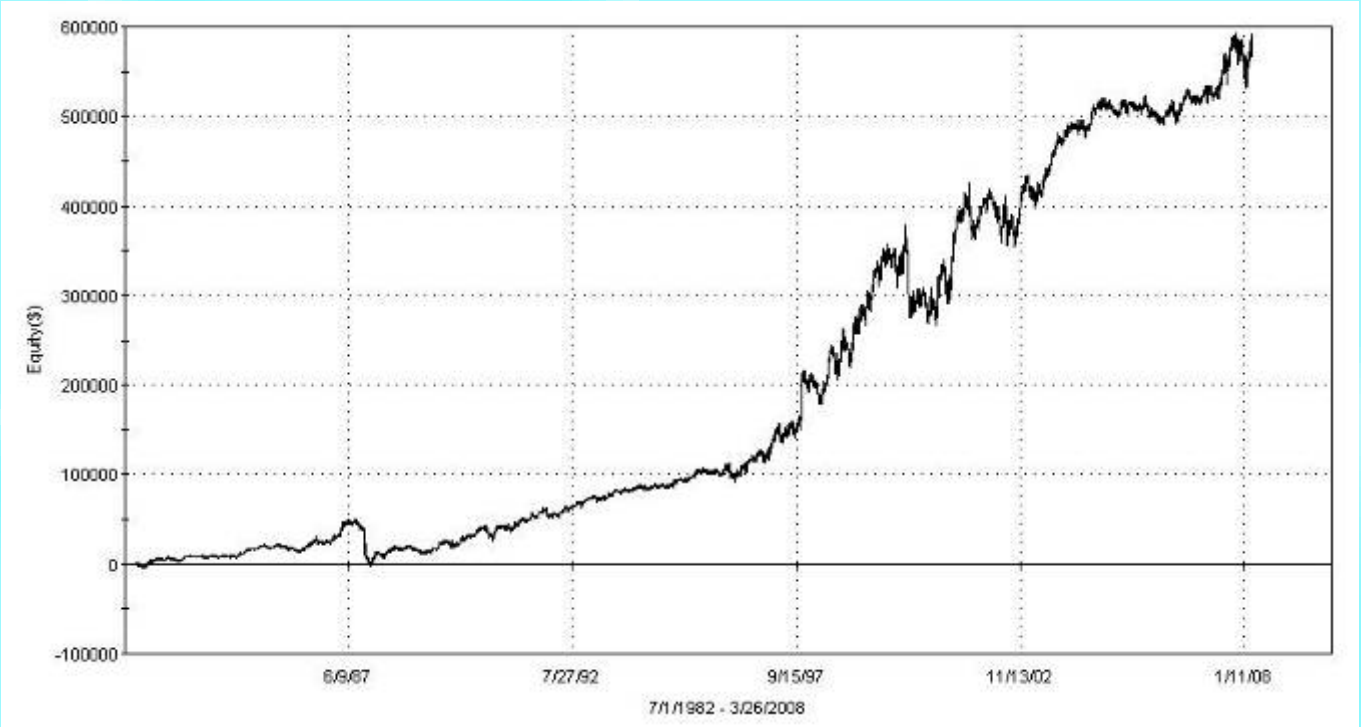


The strategy is robust for the last ten years!

Fisher Transform System Results

John Ehlers

- @SP.P for the life of the contract (from April 1982)
- 802 Trades (a little more than once every two weeks)
- 65.2% Profitable Trades
- Profit Factor = 1.53



The strategy is robust across the entire life of the contract!

TRADING STRATEGY COMMENTS

John Ehlers

- The concepts are provided for educational purposes only
- There was no allowance for slippage and commission
- Results were shown using in-sample optimization
- No stops or disaster reversals were used
- The strategies are not adaptive to current market conditions
- Commercial versions of these strategies are available at www.eminiz.com
  - Adaptive
  - Out of Sample strategy selection (no optimization)
  - With stops

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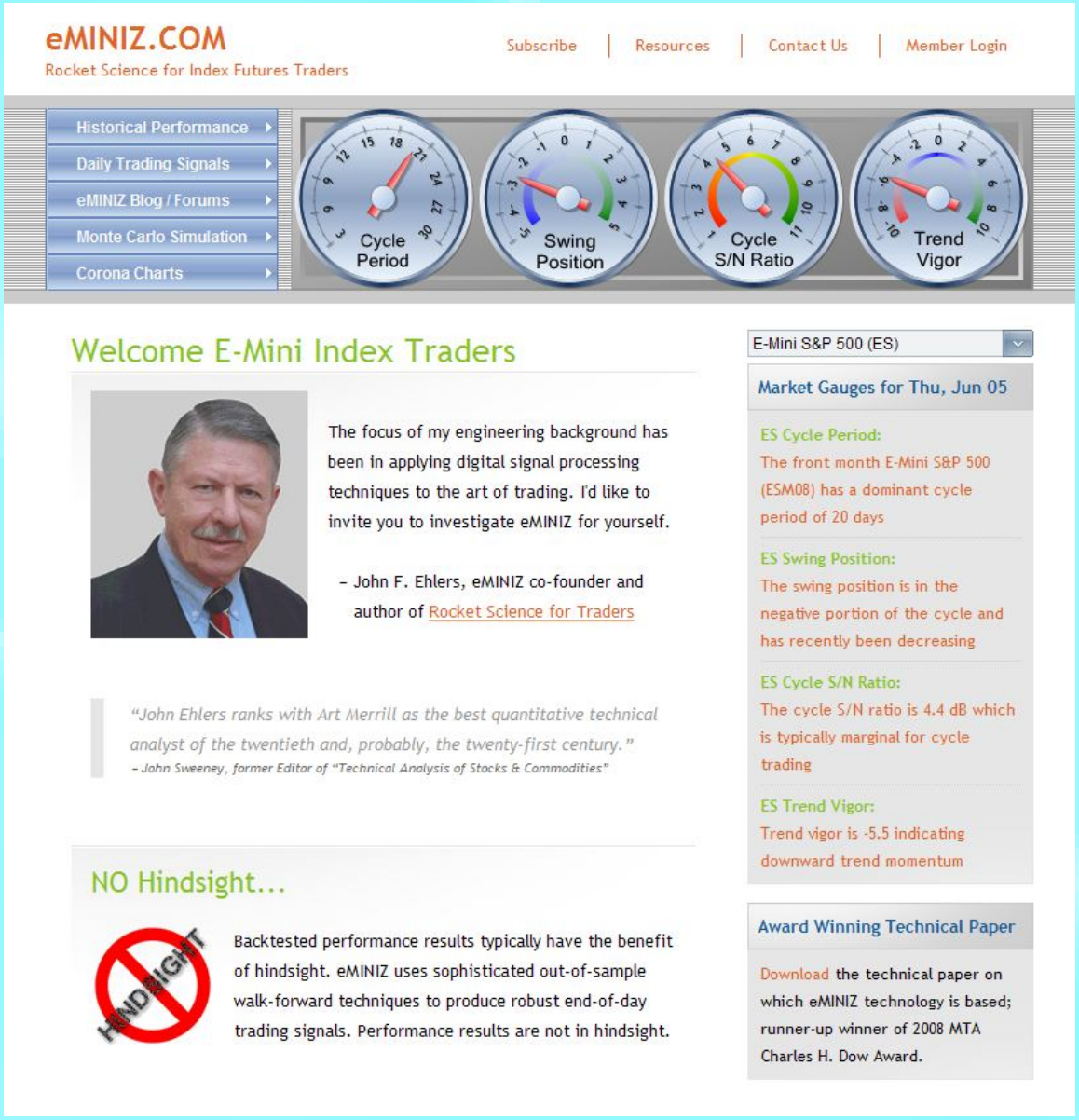

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Trade-by-Trade Charts

E-Mini S&P 500 (ES) | 6 Months

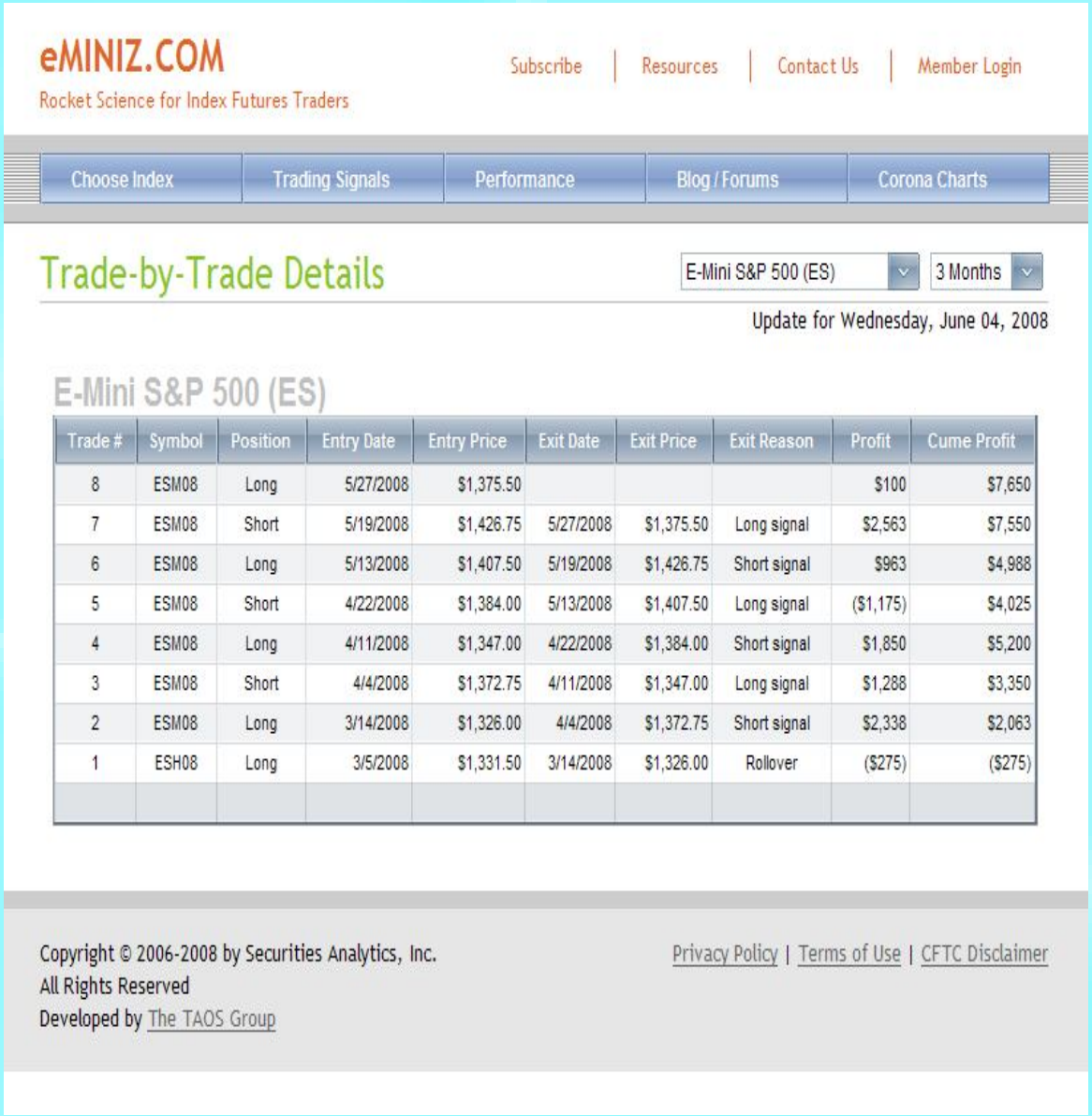
Update for Monday June 16, 2008

Legend:

- Green Arrow: Long Entry
- Red Arrow: Short Entry
- Blue Dashed Line: Winning Trade (slope indicates magnitude of profit)
- Red Dashed Line: Losing Trade (slope indicates magnitude of loss)

www.eminiz.com Trades List

John Ehlers



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Trade-by-Trade Details

E-Mini S&P 500 (ES) | 3 Months

Update for Wednesday, June 04, 2008

E-Mini S&P 500 (ES)

Trade #	Symbol	Position	Entry Date	Entry Price	Exit Date	Exit Price	Exit Reason	Profit	Cume Profit
8	ESM08	Long	5/27/2008	$1,375.50				$100	$7,650
7	ESM08	Short	5/19/2008	$1,426.75	5/27/2008	$1,375.50	Long signal	$2,563	$7,550
6	ESM08	Long	5/13/2008	$1,407.50	5/19/2008	$1,426.75	Short signal	$963	$4,988
5	ESM08	Short	4/22/2008	$1,384.00	5/13/2008	$1,407.50	Long signal	($1,175)	$4,025
4	ESM08	Long	4/11/2008	$1,347.00	4/22/2008	$1,384.00	Short signal	$1,850	$5,200
3	ESM08	Short	4/4/2008	$1,372.75	4/11/2008	$1,347.00	Long signal	$1,288	$3,350
2	ESM08	Long	3/14/2008	$1,326.00	4/4/2008	$1,372.75	Short signal	$2,338	$2,063
1	ESH08	Long	3/5/2008	$1,331.50	3/14/2008	$1,326.00	Rollover	($275)	($275)

www.eminiz.com Trades at a Glance

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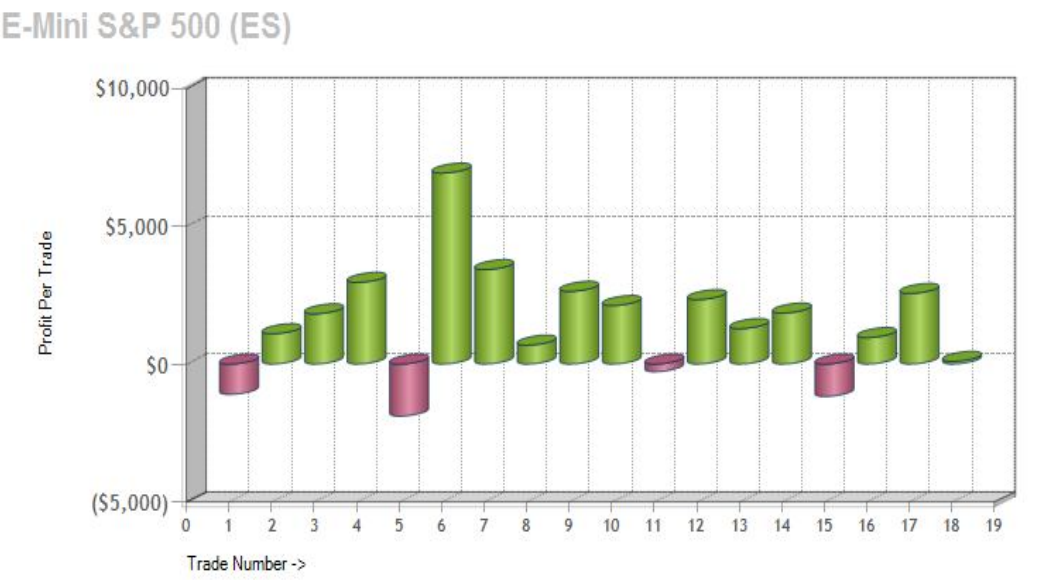
Trades At-A-Glance

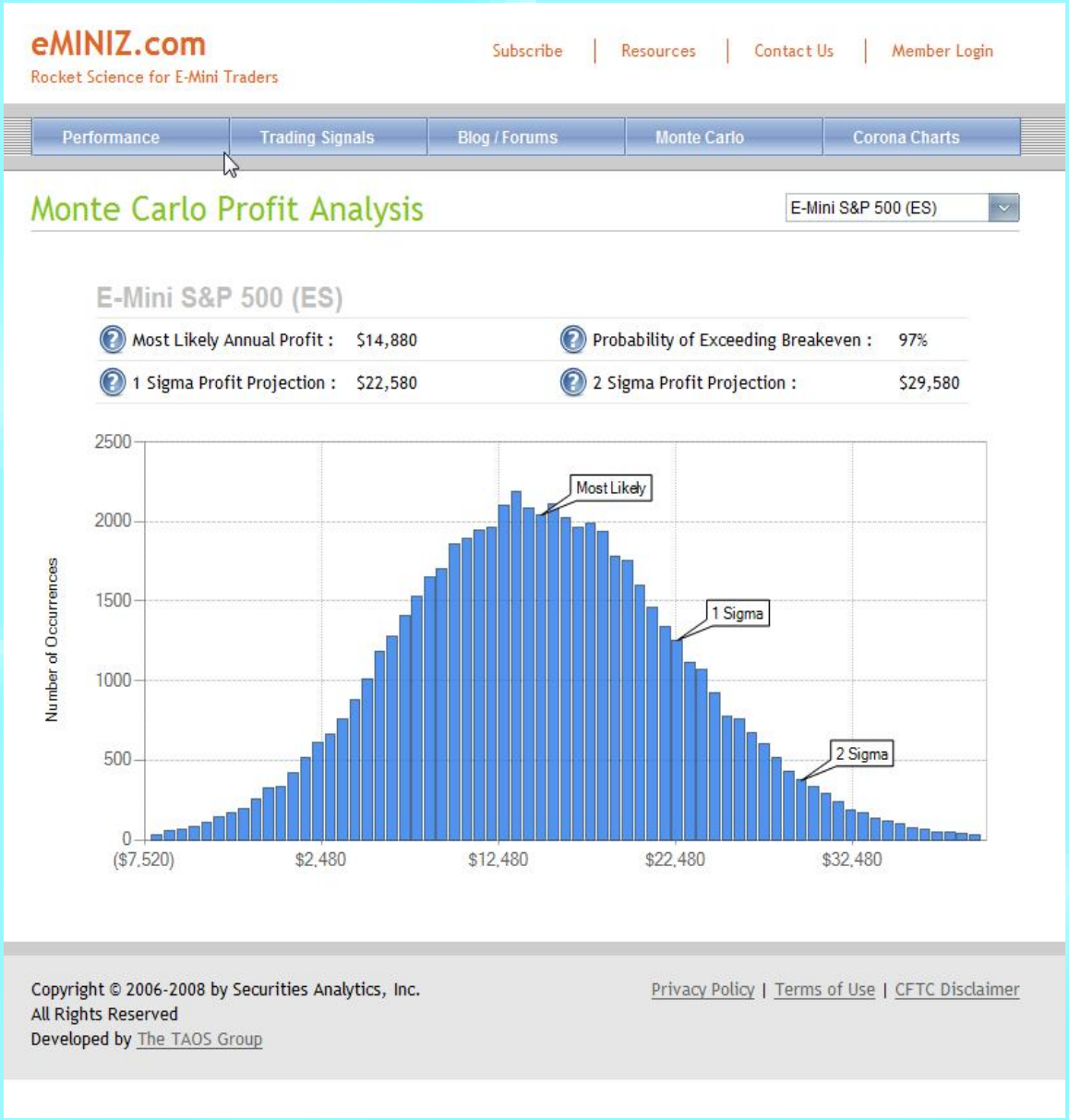
E-Mini S&P 500 (ES) | 3 Months

Update for Wednesday, June 04, 2008



www.eminiz.com Monte Carlo Profit

John Ehlers



www.eminiz.com Monte Carlo Drawdown

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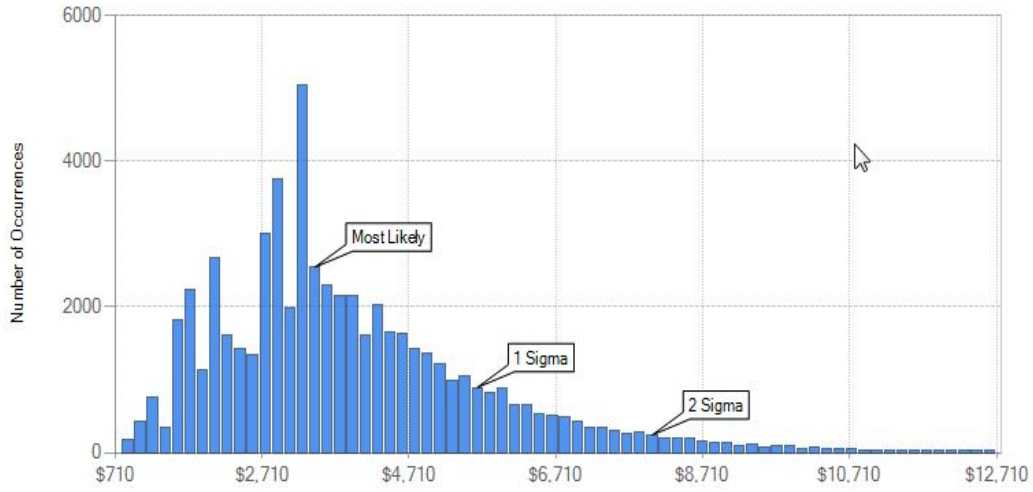
Monte Carlo Drawdown Analysis

E-Mini S&P 500 (ES)

E-Mini S&P 500 (ES)

Most Likely Annual Drawdown :	$3,430	Reward/Risk Ratio :	4.3
1 Sigma Drawdown Projection :	$5,640	2 Sigma Drawdown Projection :	$8,020



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- Unique Cycles-Based Dashboard Indicator Histories can be reviewed as corona chart indicators (FREE)
- Explicit Buy/Sell Signals are given for Five Index Futures
  - Equity Growth Charts and Trading Statistics (delayed)
  - Monte Carlo Analysis (delayed)
  - Price Charts with trade history overlaid (delayed)
  - Trade-by-Trade results (delayed)
  - Email notification for trades to be made on the next open
- Eight Different Robust Strategies were developed using the techniques I have described
  - Developed on the S&P Futures contract back to its beginning
  - Strategies are not optimized
- Strategy selection is based on best Out-of-Sample performance
- Selection is made dynamically on a trade-by-trade basis