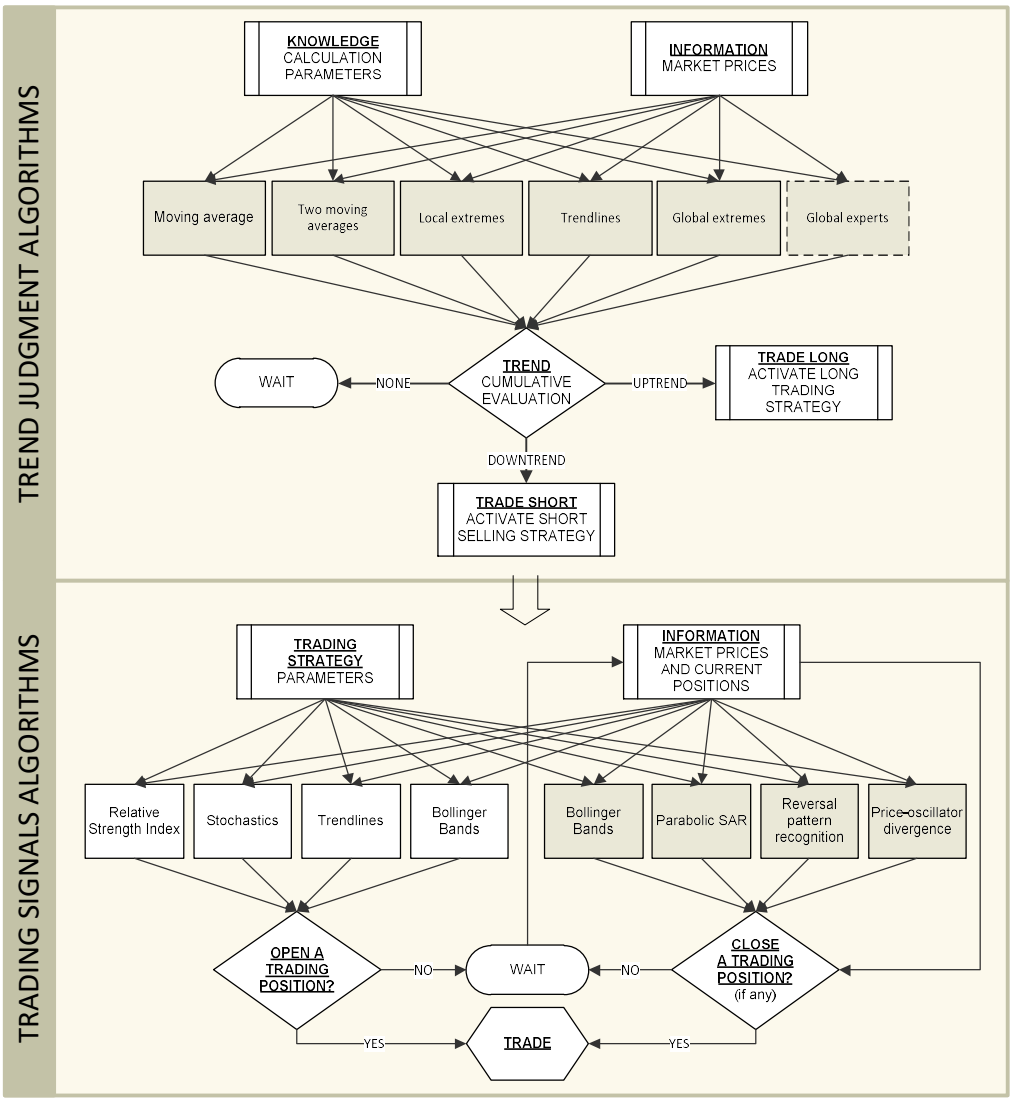
Description of a typical I-System strategy

What's needed is a sound intellectual framework for making decisions and the ability to keep emotions from corroding that framework

Warren Buffett

I-System is a dual neural network consisting of a set of parameter-driven algorithms that define the knowledge framework within which we can formulate, test and implement a large variety of intelligent trading strategies in any security market.



This document seeks to explain the model's functioning by detailing the way a typical I-System strategy generates trend judgment and trading decisions.

I-System strategy: SI 17.01

Strategy name	SI 17.01 where SI denotes the market; 17 denotes its trend definition; and 01 denotes the combination of studies defining the price events that trigger entry/exit signals
Market	Silver (COMEX), 5,000 oz per contract, priced in cents per ounce
Price curve	Delivery months are HKNUZ (H=March, K=May, N=July, U=September, Z=December). Roll-over occurs well before expiry (to avoid trading in thin markets with insufficient volume): on or before the 24th calendar day of the preceding month (i.e. March contract is rolled into May contract on or before the 24th February)
Risk profile	Backtest simulations and performance statistics under this strategy reflect trading one COMEX silver contract with a risk budget of $25,000 and paying a commission of $6.12 per transaction ($12.24 per round turn)
Backtest period	SI 17.01 was formulated on the price history from Jan 1992 through Feb 2007.
Performance summary	Using a $25,000 initial risk budget, the strategy generates an average 12-month rolling ROR of 45.5% with the largest draw-down of 72.5% and longest peak-to-peak period (time under water) of 1406 days

1. Trend definition

The first part of a trading strategy defines how the model decides when the price of a commodity is in an up-trend and when it's in a downtrend. I-System was designed to replicate the way a human chart analyst would arrive at a judgment about price trend. Over time, human judgment fluctuates between *certainty* (100% confidence) that we are experiencing a trend in some market and utter *ambivalence* (0 confidence). Some value between those two extremes warrants taking a risk in the direction of the trend. The advantage of artificially generated *judgment* produced by I-System strategies is that it is quantified and consistent over time and entirely unaffected by distraction or emotional elements that easily contaminate human judgment. It further allows us to determine the threshold level of confidence at which risk taking is optimally productive. SI 17.01 strategy uses the following modules[1] and parameter values to generate its trend confidence:

Module[1]	Parameters (weights)	Description
OMA	27 (0.9)	OMA module (one moving average) analyzes the position of the current price and the 27-day moving average. If the price is below the 27 day MAV the module 'thinks' it's looking at a down-trend. If it is above the MAV, it 'thinks' the trend is up.
TMA	35, 44 (0.5)	TMA (two moving averages) performs a similar analysis as OMA but uses a pair of moving averages. SI 17.01 strategy uses the 35 and 44 day moving averages. Depending on where the price is with respect to the two MAVs and what the relationship of these two are determines the trend confidence. For example, if the faster (35-day) MAV is above the slower MAV (44-day), and the price is above both, we have very high confidence that we're looking at an up-trend. If the price dips below the fast MAV, confidence drops. If the price drops below both MAVs, confidence drops further. If fast MAV drops below the slow MAV, and price is below both, confidence drops further still. It will reach high confidence in down-trend where price < fast MAV < slow MAV.
LSQT	8,4 (0.5)	LSQT (least squares trend-line) projects trend-lines through 4 most recent local extremes (peaks and troughs) identified within 8-day intervals (see LEA, below) on the price curve.
LEA	12 (0.2)	LEA (local extremes analysis) analyzes the price curve to detect trending markets through a succession of *higher peaks and higher troughs* (in the case of up-trend) or *lower peaks and lower troughs* (in the case of down-trends). SI 17.01 analyzes the relative position of local extremes over 12 day intervals (the high and low price turning points within any 12-day interval).
GEM	124 (1.0)	GEM (global extremes method) compares the current price to the single highest or lowest price in the past X trading days. SI 17.01 identifies these extremes in the last 124 days of price history. If the current price is the highest price in the last 124 days, we are sure to be looking at an up-trend.
Cumulative confidence		Each of the above modules generates a certain trend confidence value. Cumulative confidence is generated as a weighted average of the above five modules' verdicts.

[1] A module refers to an algorithm or a set of algorithms carrying out some defined function.

Parameter values and weights are established by back testing and determining which parameter combinations yield best results. Typically, a range of such values will work well, some generating shorter-term trend signals, others longer term. For example, by backtesting the OMA module we might find that 27-day, 60-day and 134-day MAVs work well on Silver. We run similar back-tests on all other modules and in that way obtain a range of viable strategies, each with slightly different speculative behaviour. Each day, the neural network consisting of the above modules generates trend confidence that fluctuates between -1 (100% confidence that we're in a down-trend) and 1 (100% confidence that we're in an up-trend). The chart below shows the trend confidence function of this strategy overlaying the price of silver:

Exhibit 1: Price curve of COMEX Silver overlaid with the **trend confidence** function.

Waiting to be 100% certain that we're in a trending market isn't necessarily the best time to make a bet. Instead, we establish the optimal levels that justify risk-taking, again by back-testing for a range of values. In the case of SI 17.01 strategy, the threshold levels are 0.35 and -0.35%. This means that we'll make *long* bets when trend confidence breaches 35% and will continue to trade long until confidence drops below -0.35%. At that same time we'll start trading *short*. These threshold levels make the trend definition of the strategy <u>always</u> in the market, either on the short side or on the long side:

Exhibit 2: **trend definition**, **long positions** and **short positions**

Any trend definition must capture events that can be traded profitably over time. From January 1992 through September 2010, the above trend definition achieved the following performance using the above-described risk profile:

- Average 12-month rolling return: 15.55% (in terms of the $25,000 initial risk budget)
- Highest 12-month return: 148.36%
- Lowest 12-month return: -75.74%
- Worst draw-down: -124%
- Longest period under water: 2105 days (calendar)

2. Trading signals

The trend definition helps us to avoid taking short positions during an up-trend or long positions in a down-trend. However, within a trend, we aren't obliged to permanently stay long or short until the trend direction reverses. Instead, we can use an overlay of entry and exit signals. Exit signals can be either stop-loss signals or profit-taking signals. In either case, the events that trigger trading signals are always determined in function of price fluctuation dynamics, never in function of risk budget or money under management. Within a prevailing trend, when an exit signal is triggered, the strategy's position reverts to neutral. At that point, the strategy starts scanning the price fluctuations for an opportune entry signal.

SI 17.01 strategy uses the following modules to generate entry and exit signals:

Exit signals		
Module	**Parameters**	**Description**
BB	16, 2.6	BB (Bollinger bands) are generally a profit-taking type of signal. BB plots a 2.6 standard deviations band around the 16-day moving average of the price curve. When the price breaches above the upper BB curve in an up-trend or below the lower BB-curve in a down-trend, this event generates an exit signal (*sell* if we're in an up-trend, or *buy* if we're in a down-trend).
SAR	0.019	Parabolic SAR (stop-and-reverse) signal can be a profit-taking or a stop-loss signal. It defines trailing-stop points above or below the price curve that define the price level at which we'll exit our current position, whether it's in profit or not. The *"and-reverse"* part of this algorithm is ignored – we use the SAR signal only to close the existing position and never take the reverse position until the trend judgment itself changes.
PATT	5	PATT uses local price extremes (see description of LEA module on p. 1) and pattern recognition of their relative positioning to signal major price corrections or provide an early indication of price reversals. PATT module detects technical patterns such as double-tops, double-bottoms and head-and-shoulders patterns. The parameter in question determines whether the pattern is detected as a smaller-scale event or a larger-scale event.
Entry signals		
STO	8, 72	Stochastic rescales price fluctuations on a horizontal range between 0 and 100 where values above 72 an *overbought market* and those below 28 denote an *oversold* market. Thus, when Silver is *oversold* during an up-trend, this is a signal to buy. If it is *overbought* in a down-trend, this is a signal to sell.
LSQT	10,3	SI 17.01 projects trend lines through the most recent 3 LEA extremes identified within 10-day price intervals. LSQT (least squares trend line) signals are triggered when, in an uptrend the price falls below the trend-line, then breaks back above it again, or in a down-trend when the price rises above the trend-line, then breaks back down below it.
BB	20, 1.7	BB(Bollinger bands) signals are similarly triggered by price falling below the lower band then breaking above it again (in up-trends) or the price rising above the upper band and falling below it (in down-trends)
SAR	0.005	Parabolic SAR generates entry signals on significant price break-outs in the direction of the trend.

3. Performance

The objective of every I-System strategy is to generate sufficiently large gains from price trends over time to offset the inevitable periods of draw-downs during trend reversals and periods of range-bound price fluctuations. Strategy SI 17.01 achieved the following performance over the entire back-test period:

- Average 12-month rolling return: 39.54% (in terms of the initial risk budget of $25,000)
- Highest 12-month return: 259.65%
- Lowest 12-month return: -26.64%
- Worst draw-down: -72.50%
- Longest period under water: 1408 days (calendar)

Trend-following strategies can generate very substantial returns when the underlying markets are trending, but they also undergo significant draw-downs and long periods between performance peaks. Besides having a high-confidence trading model that functions correctly, the key ingredient for success in trend following is discipline. This is intuitive and simple enough to accept. However, the emotional experience of suffering long losing streaks, deep draw-downs and extended periods of flat or negative returns will test any trader's discipline. Staying the course with a strategy that has not produced any positive returns for 1406 days is the key to successful trend following. The charts below illustrate the strategy's trading performance over time:

July 1993 – December 1996:

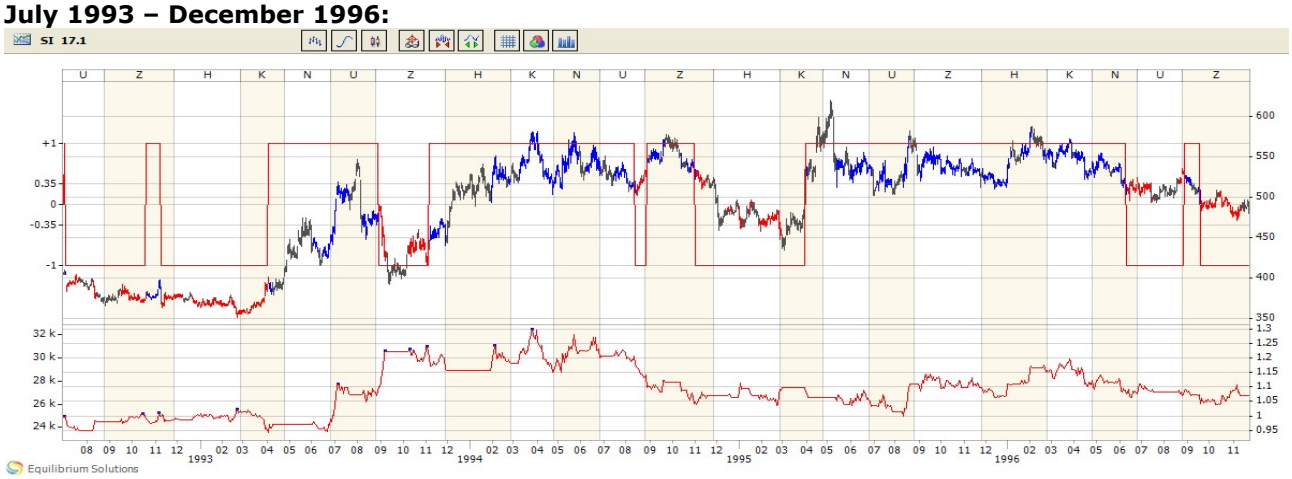
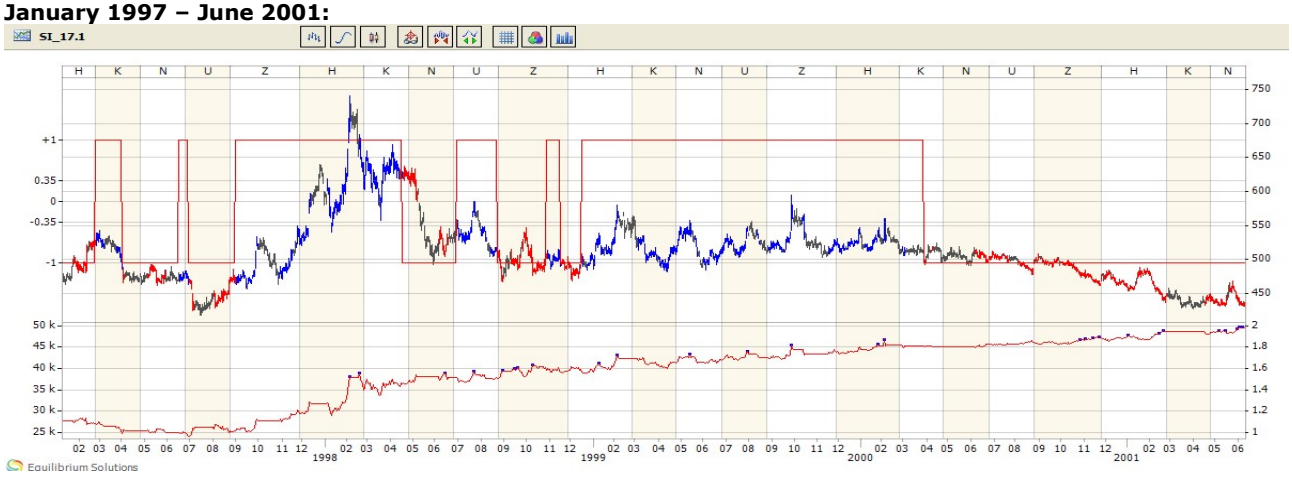


Exhibit 3: SI 17.1 trading - **long positions**, **short positions** and **neutral positions**. **Equity/fitness** curve in the sub-chart shows strategy's assets (left-hand scale) and the value of $1 invested on 1st July 1992 (right-hand scale).

January 1997 – June 2001:



July 2001 – January 2006:

May 2006 – October 2010:

Using the I-System, we have formulated many thousands of strategies like SI 17.01 covering more than 200 different financial and commodities markets. Every trading day these strategies reliably generate the directional exposure and trade timing signals with utmost consistency and no dilution of focus.

> ***Q: But how do you know that the model you have created is right?***
>
> ***A: There is no proof that Einstein's theory is right. There is no proof that Ohm's law in electricity or Boyle's law in gasses are right. There is only an experimental demonstration that such laws are useful for specific, limited purposes. There is no way of proving that a model or law or theory representing the real world is right.***
>
> ***Jay W. Forrester***

The "specific, limited purpose" of I-System strategies is to capture value from large-scale price events. For nearly 20 years, they have proven dependable and very effective in fulfilling that purpose.

I-System Trend Following
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