TECHNICAL STRATEGIES

Michael Tan, Ph.D., CFA

330 E 38th St 14L
New York, NY 10016
Tel: 212-682-0507
mltan@yahoo.com

Traditional Language of Technical Analysis

- *Technical analysis* is really just a fancy term for the study of prices.
- It is considered the original form of investment analysis, dating back to the 1800s, predating the era of fully disclosed and publicly available financial information and thus predating fundamental analysis.
- Charles Dow, editor of the WSJ and creator of the Dow Jones Industrial Index, at the turn of the 20th century created a method of analyzing markets based on security price movements.
- He promulgated such principles as the trending nature of prices, prices discounting known information, volume confirming the trend, etc.
- Ideas of trading ranges, support and resistance levels can be found in works as early as Wyckoff (1910).

Traditional Language of Technical Analysis

- Despite its long history, technical analysis has brought forth much ridicule, especially from academics, due to its colorful and unfathomable semantics.

- When laid against an intellectually neater theory such as informational efficiency of markets, technical analysis suffers criticisms such as:

> "Obviously, I am biased against the chartist… Technical analysis is anathema to the academic world. We love to pick on it. Our bullying tactics are prompted by two considerations: (1) the method is patently false; and (2) it's easy to pick on…"
>
> Burton Malkiel, *A Random Walk Down Wall Street* (1985)

- A more valid criticism is that of *data snooping,* i.e. that analysts are cognitively prone to focus disproportionately on the unusual and thereby discover "interesting" patterns that are really spurious.

- The semantics of technical analysis – perhaps symptomatic of an abstract (but rigorous) discipline like physics or mathematics – belied its rigor and quantifiable edge.

- We shall demonstrate some of this edge in this monograph.

Traditional Language of Technical Analysis

- Two aphorisms of technical analysis and their meaning are explained:
  - *"Price is a trader's only concern"*

    Prices already incorporated all available information and therefore the study of information other than price is redundant. However this statement is problematic and imprecise (e.g. if the price reflected all information, then our expectation of the future price change must be zero and hence all trading strategies will have zero expected profit). Thus we merely state the practical behavior necessitated by this rule, viz. the trader must proactively ignore all information other than price and act according to what the price is telling him.

  - *"The future can be found in the past" or "history repeats itself"*

    People will continue to make the same mistakes that they have made in the past. From a data analysis point of view, this is the principle that a connection found in the past, say between two price patterns one presaging the other, will hold again in the future.

- The idea that price trends are determined by the changing psychology of investors toward economic, monetary and political factors, *which is already subsumed in the price*, can hardly be overemphasized.

- For the devout technical analyst, this means the trader must ignore all else except price.

Modern Language of Technical Analysis

- The Efficient Market Hypothesis (EMH) asserts that

$$E(R_t | I_t) = (1 + r_t)$$

i.e. the expected return R_t from t to $t+1$, conditional on the information set I_t available at time t, is equal to the riskless rate r_t.

- A well-known implication of EMH is that traders in a rational expectations world who use technical analysis can only expect to receive a return of the opportunity cost $(1+r_t)$.

- Another implication is that returns should be serially uncorrelated or that discounted prices follow a martingale.

- However it has been shown that prices can be rationally determined even if they do not follow a martingale (Campbell, Lo & MacKinlay (1997)).

- For example, if a stock's expected return is positive, it may be the reward necessary to induce investors to buy the stock and bear its risk; thus the presence of trading implies that prices do not follow a martingale.

- More importantly, lack of serial correlation does not imply lack of predictability – *returns can be serially uncorrelated and still be dependent.*

Proof that Uncorrelated Does Not Imply Independent

- Consider two random variables x_i and x_j where

  $x_i = \sigma_i \varepsilon_i$
  $x_j = \sigma_j \varepsilon_j$ where ε_i and ε_j are iid innovations such that $\langle \varepsilon_i \varepsilon_j \rangle = 0$ and $\langle \varepsilon_i^2 \rangle = 1$.

- σ_i and σ_j are themselves random variables with non-zero correlation.

- Suppose ε_i and σ_i are independent so that the probability density $P(x_i;\sigma_i)$ is equal to $P(x_i)P(\sigma_i)$ (note that σ_i is randomly chosen but once it is chosen, the value of x_i depends only on ε_i).

- For example, if ε_i is gaussian, then $P(x_i;\sigma_i) = P(\sigma_i) \cdot \frac{1}{\sqrt{2\pi\sigma_i^2}} \exp\left(-\frac{x_i^2}{2\sigma_i^2}\right)$.

- Denoting averaging over x's by $\langle \cdots \rangle$ and averaging over σ's by $\overline{\cdots}$, we have

  $\overline{\langle x_i x_j \rangle} = \overline{\sigma_i \sigma_j} \langle \varepsilon_i \varepsilon_j \rangle = \delta_{ij} \overline{\sigma_i \sigma_j}$ where δ_{ij} is the Kronecker delta

  and thus there is no correlation between x_i and x_j.

- However the correlation of x_i^2 and x_j^2 is

$$\overline{\left\langle \left(x_i^2 - \langle x_i^2 \rangle\right)\left(x_j^2 - \langle x_j^2 \rangle\right) \right\rangle} = \overline{\langle x_i^2 x_j^2 \rangle} - \overline{\langle x_i^2 \rangle \langle x_j^2 \rangle} = \overline{\sigma_i^2 \sigma_j^2} \langle \varepsilon_i^2 \varepsilon_j^2 \rangle - \overline{\sigma_i^2} \langle \varepsilon_i^2 \rangle \overline{\sigma_j^2} \langle \varepsilon_j^2 \rangle = \overline{\sigma_i^2 \sigma_j^2} - \overline{\sigma_i^2}\,\overline{\sigma_j^2}$$
$$= \text{correlation of } \sigma_i^2 \text{ and } \sigma_j^2$$

  which is in general not zero, i.e. x_i and x_j are not independent in that their higher moments are related.

Nonlinear Forecasting is Key

- Many tests of the EMH were essentially tests of serial correlation in returns and have been largely supportive of the hypothesis (Ross 1989).
- The lack of correlation of price changes at all lags implies that *linear* forecasting rules will be ineffective.
- Linear forecasting models such as ARMA models (autoregressive moving averages, vector autoregressions, etc), and cycle analysis (Fourier transforms) contain the same information as the autocorrelation coefficients.
- Insofar as no information about the future is contained in the autocorrelation coefficients, none is contained in any other linear model.

Nonlinear Forecasting is Key

- Linear models can only handle price patterns that are fully characterized by the first- and second-order moments, i.e. those that have smooth curvatures (second derivatives of price with respect to time).

- But market tops and bottoms, crashes, gaps, etc, are price patterns that do not have smooth curvatures.

- Technical analysis involves the study of patterns containing sequences of local minima and maxima (e.g. support and resistance, head and shoulders) and discontinuous jumps (e.g. breakouts and gaps) which are far from smooth.

- **Therefore technical analysis is a practical way of using nonlinear information in prices.**

The Channel Rule

- The channel rule is a disarmingly simple rule that
  - replaces a long position with a short position when the price is less than or equal to the minimum price during the preceding L days; and
  - replaces a short position with a long position when the price is greater than or equal to the maximum price during the preceding L days.
- The rule is always either long or short the market and L is the only parameter.

A 20-day channel rule applied to the daily prices of KLAC.

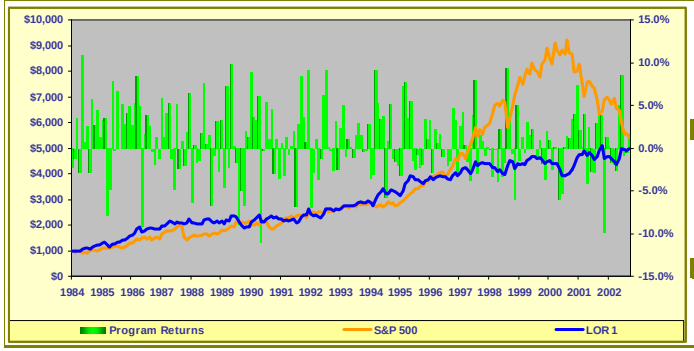
The Channel Rule

Basic Channel Rule
Michael Tan, PhD, CFA
330 East 38th Street 14L
New York, NY 10016
Phone (212)682-0507 E-mail mltan@yahoo.com
Contact Michael Tan Website

Recent Returns	
MTD 09/23	1.6%
YTD 2002	7.3%
Q1-2002	11.0%
2001	0.4%

9/25/02 9:20 AM

Growth of $1000

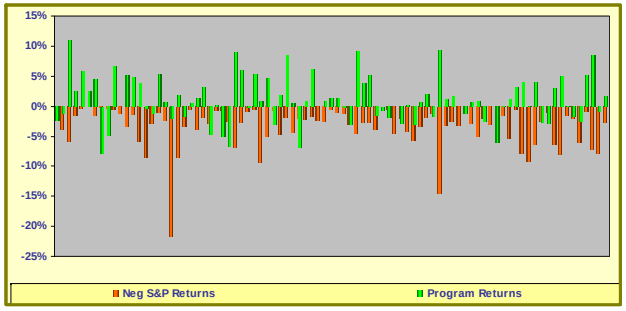


Return	Program	S&P 500
Compound ROR	8%	9%
Avg Month ROR	0.8%	0.9%
Total Return	361%	439%
Portfolio Lifetime	19 Years	19 Years
Best Month	10.9%	13.2%
Worst Month	-11.2%	-21.8%
Success Rate	58%	61%
Risk		
Standard Deviation	4.0%	4.5%
Sharpe Ratio	0.7	0.3
Maximum Drawdown	21%	41%
Drawdown Period	4	25
Recovery Period	6	
Avg Grs Mkt Value	812%	100%
Avg Net Mkt Value	106%	100%
Benchmark Comparison		
Beta	0.00	
Alpha	-0.079	
Correlation	-0.08	
Excess Return	-1%	

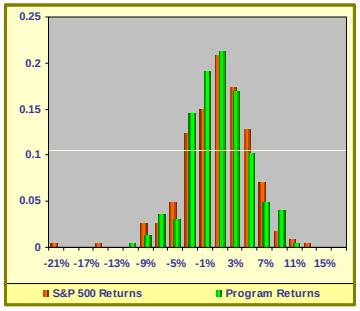
Monthly Performance (simulated, net of fees)

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	YTD
2002	0.1%	-1.8%	-2.0%	-2.6%	5.1%	8.5%	-0.9%	-0.5%	1.6%				7.3%
2001	2.1%	0.1%	3.9%	-4.2%	2.4%	-2.8%	-2.9%	2.9%	4.9%	3.8%	-9.9%	1.2%	0.4%
2000	0.9%	-2.5%	0.0%	-0.0%	-6.1%	-5.4%	0.0%	1.3%	1.1%	3.3%	3.9%	7.4%	3.3%
1999	-1.4%	1.2%	-0.5%	3.0%	1.5%	2.1%	-0.0%	-1.3%	0.8%	-1.8%	-3.7%	1.9%	1.8%
1998	-0.2%	-3.3%	-0.1%	-4.0%	2.2%	-3.4%	-1.7%	9.4%	4.0%	-0.7%	-6.1%	5.0%	0.1%
1997	2.6%	4.2%	0.3%	-1.6%	-3.9%	3.8%	7.9%	-3.1%	1.5%	0.8%	-0.9%	0.0%	11.7%
1996	3.2%	-2.9%	2.2%	0.5%	1.6%	-0.9%	-0.1%	-2.0%	-1.5%	4.6%	3.2%	-2.9%	4.8%
1995	-3.2%	7.2%	7.8%	3.5%	5.5%	-1.5%	-2.6%	-0.7%	-2.3%	-1.9%	3.4%	1.0%	16.4%
1994	-3.6%	-3.1%	9.1%	5.2%	3.4%	3.7%	-5.8%	0.8%	5.2%	-1.2%	-1.6%	-2.1%	9.3%
1993	2.3%	5.0%	-1.0%	1.0%	0.0%	-1.1%	1.5%	2.8%	1.4%	-0.5%	-0.3%	2.8%	14.8%
1992	-7.0%	-2.9%	1.0%	-3.8%	-1.2%	6.1%	9.1%	0.0%	-0.3%	-2.7%	3.2%	-2.5%	-1.9%
1991	0.5%	-3.3%	1.2%	-0.8%	0.2%	1.9%	-6.9%	2.8%	8.4%	3.6%	0.6%	9.2%	17.7%
1990	8.9%	3.6%	3.3%	6.0%	-11.2%	-0.2%	5.4%	1.0%	4.6%	-3.0%	1.0%	-3.6%	15.1%
1989	3.2%	-4.7%	7.3%	-2.3%	9.8%	0.2%	-1.7%	-9.0%	-5.0%	-6.8%	1.9%	1.3%	-7.2%
1988	-6.4%	0.3%	-1.7%	-1.5%	1.7%	7.6%	0.4%	1.4%	-6.8%	-0.9%	3.1%	-2.8%	-6.1%
1987	5.8%	1.3%	4.0%	5.2%	-1.2%	-4.9%	5.1%	-2.4%	0.7%	-2.0%	1.8%	6.4%	20.9%
1986	2.6%	5.3%	8.4%	4.8%	-9.2%	1.6%	3.8%	2.5%	-0.4%	-2.0%	1.2%	-1.2%	17.6%
1985	3.3%	3.4%	-7.9%	-4.9%	7.9%	-0.3%	6.6%	-0.0%	5.1%	2.8%	4.0%	4.9%	26.5%
1984	-2.3%	-1.2%	3.5%	-2.9%	10.9%	0.6%	2.5%	-2.9%	5.7%	2.6%	4.4%	1.3%	23.5%

Returns During Negative Months in Benchmark



Distribution of Returns



- The channel rule or its variants are widely used among futures traders, being the strategy of choice of the “Turtle Traders” school.

- It encapsulates the motto of the Turtle Traders:

“The goal is to capture the majority of price changes or trends. Trend followers don’t pick tops or bottoms. If the market is going down, you sell. If the market goes up, you buy. You can never buy a market too high or sell a market too low."

- A simulation of a 50-day channel rule applied to 30 global bond, currency and commodity markets with realistic transaction costs and 2/20 fee structure is shown to left.

The Channel Rule

- Taylor, S.J., *The Journal of Futures Markets* 14(2), 215-235 (1994) showed that when prices are generated using a Monte Carlo simulation according to a ARIMA(1,1,1) model, the channel rule correctly identifies the sign of conditional expected returns with probability well above 0.5.

TABLE I
Channel Trading Results as the Channel Length L Varies

L days	$\overline{G}$ %	$\overline{N}$	$\overline{R}$ %	P %
2	2.44	35.68	−4.69	57.96
3	2.85	24.87	−2.12	59.35
4	3.13	19.08	−0.69	60.28
5	3.32	15.50	0.23	60.95
6	3.47	13.08	0.85	61.44
7	3.58	11.35	1.31	61.82
8	3.66	10.04	1.66	62.09
9	3.73	9.02	1.92	62.29
10	3.76	8.21	2.12	62.43
11	3.79	7.55	2.28	62.52
12	3.81	7.01	2.41	62.58
13	3.80	6.55	2.49	62.60
14	3.81	6.15	2.58	62.60
15	3.81	5.81	2.65	62.57
16	3.79	5.51	2.69	62.53
17	3.77	5.25	2.72	62.47
18	3.76	5.02	2.75	62.40
19	3.73	4.81	2.77	62.33
20	3.71	4.63	2.78	62.23
21	3.68	4.46	2.79	62.14
22	3.66	4.31	2.79	62.04
23	3.63	4.17	2.80	61.94
24	3.60	4.04	2.79	61.84
25	3.56	3.93	2.78	61.73
26	3.53	3.82	2.77	61.61
27	3.50	3.72	2.76	61.50
28	3.47	3.63	2.74	61.38
29	3.43	3.54	2.73	61.27
30	3.40	3.46	2.71	61.15
31	3.37	3.39	2.69	61.04
32	3.33	3.32	2.67	60.92
33	3.30	3.25	2.65	60.80
34	3.27	3.19	2.63	60.68
35	3.24	3.13	2.61	60.57
36	3.20	3.07	2.59	60.45
37	3.16	3.02	2.56	60.35
38	3.13	2.97	2.54	60.23
39	3.10	2.92	2.51	60.11
40	3.06	2.88	2.49	60.00

That is, if $r_t = \mu_t + \varepsilon_t$ where μ_t is the unobserved component of the autoregressive process $\mu_t = p\mu_{t-1} + \nu_t$, where $0 < p < 1$, and ε_t and ν_t are iid innovations, then the rule correctly predicts the sign of μ_t over a wide range of values of the channel length L.

In the table to left (taken from Taylor 1994), G, N, R and P are the total gross return, number of trades, total net return after transaction costs, and probability of correctly identifying μ_t respectively for the channel rule.

Nonlinearity of the Channel Rule

- A measure of how much return from a trading rule comes from its ability to capture nonlinearities in the data can be obtained by comparing the return to returns from the same rule applied to *Fourier transform surrogate data* (Tan, M., unpublished, 1997).

- A *surrogate* of the original price data having the same Fourier (power) spectrum is obtained by:
  - Computing the Fourier transform of the original data giving a complex amplitude at each frequency f.
  - Randomizing the phases by multiplying each amplitude by $e^{i\phi}$ where ϕ is randomly and independently chosen from the interval $[0, 2\pi]$ and where $\phi(f) = -\phi(-f)$ (i.e. the phases must be anti-symmetrical in order for the inverse transform to be real).
  - Computing the inverse Fourier transform of the phase-randomized amplitudes.

- Since the Fourier transform of the autocorrelation is the power spectrum (Wiener-Khinechine theorem), the surrogate data preserves the autocorrelation structure of the original data but scrambles the nonlinear structure.

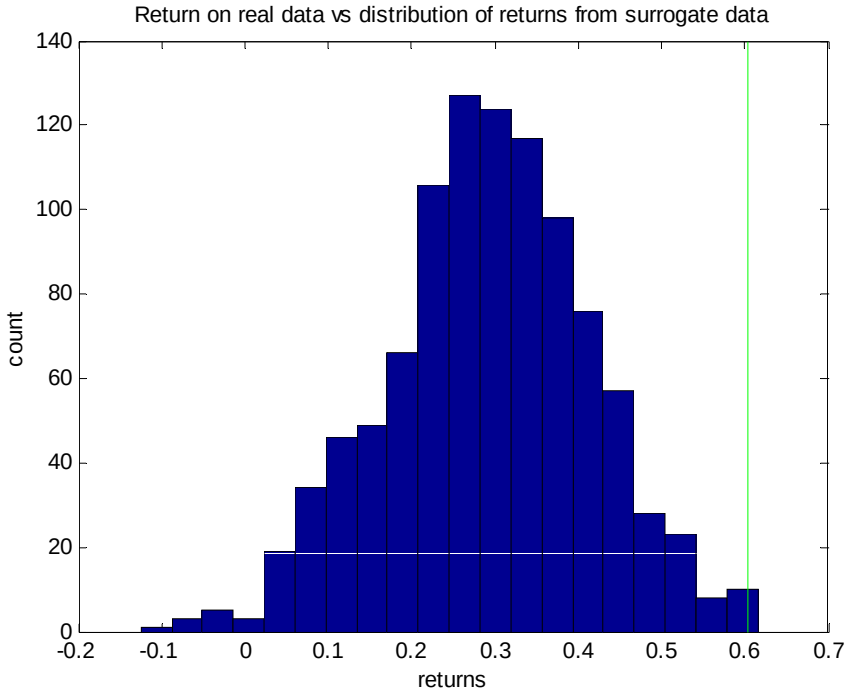
  For finite length time series, the surrogate data preserves the circular autocorrelation

$$\gamma(\tau) = \frac{1}{N}\left[\sum_{t=1}^{N-\tau} x_t x_{t+\tau} + \sum_{t=N-\tau+1}^{N} x_t x_{t+\tau-N}\right]$$

  where N is the length of the time series.

Nonlinearity of the Channel Rule

- If the price process is linear, then the trading rule should perform just as well on the surrogate data as on the original data.
- If the trading rule does not depend on nonlinearities in the data, then it should perform just as well on the surrogate data as on the original data.
- By creating many surrogate time series, a *discriminating statistic*, defined as the percentage of returns on surrogate data exceeding the return on original data, can be computed for the trading rule (this statistic corresponds to the p-value in a statistical test).



Real return (green line) versus distribution of surrogate returns for channel rule applied to U.S. 5-year Treasury Note futures contract from 3/1/1989 to 9/27/02. The mean surrogate return is 0.29; the standard deviation of the surrogate returns is 0.12; the maximum surrogate return is 0.62. The return on real data is 0.60. The number of surrogate data sets is 1000. The discriminating statistic in this case is 0.1%.

Characteristics of a Good Technical Strategy

- Before delving into other technical strategies and indicators, we list the criteria a workable technical strategy must satisfy:
  - The intuition behind the strategy must be conceptually sound.
  - It must provide a small edge, and only a small edge, since the apparent presence of a big edge may be due to the bearing of commensurably big risks or just a figment of the data.
  - It must be simple and expressible with very few parameters to avoid the pitfalls of datamining; a “one size fits all” strategy is best.
  - It must inherently involve nonlinear forecasting, i.e. it must not be a forecasting model based only on linear combinations of past prices or returns.
  - It must manage the “bad tail”.

Two Cardinal Principles of Trend Following Strategies

- The objective of technical analysis has traditionally been to identify trends early enough to make a trade out of them.

- Thus there is abundant “folklore” concerning the makings of a good trend following strategy.

- The two most important principles are:

  Home Runs

  Whatever the strategy, it must catch the “home run”, i.e. the once-a-lifetime runaway trend; it must continually bet in the event that one of the bets become the “home run”.

  Capital Preservation

  Since you can’t bet if you lose all your money, and you can’t make money if you don’t bet**, you must survive with enough “chips” until the next “home run”. Thus risk and money management are paramount.

- Many trend following strategies have only a very small edge (where the percentage of profitable trades is less than 30%).

** This line is attributed to Larry Hite.

Moving Average Cross-over Rule

- Another popular trading rule is the moving average cross-over rule, in use since at least the 1930s (Gartley 1930).
- The rule computes the difference of two moving averages of past prices S_t with different look-back lengths M and N where $M < N$:

$$D_t = \frac{1}{M}\sum_{\tau=1}^{M} S_{t-\tau+1} - \frac{1}{N}\sum_{\eta=1}^{N} S_{t-\eta+1}$$

- An up trend is considered to have started if $D_t > 0$ and $D_{t-1} \le 0$, i.e. when the difference flips its sign from minus to plus, or, from a visual point of view, the shorter moving average crosses over the longer moving average.
- Likewise, a down trend is considered to have started if $D_t < 0$ and $D_{t-1} \ge 0$.
- A variation of the rule is to require for the up trend that $D_t > b \cdot \frac{1}{N}\sum_{\eta=1}^{N} S_{t-\eta+1}$ and $D_{t-1} \le 0$, and for the down trend that $D_t < -b \cdot \frac{1}{N}\sum_{\eta=1}^{N} S_{t-\eta+1}$ where b is a “bandwidth” parameter.
- The “band” reduces the number of trading signals by eliminating “whiplash” signals produced when the moving averages are very close (e.g. when prices are in a tight trading range).
- The rule is long (short) the market in an up (down) trend as defined above.

Moving Average Cross-over Rule

- A study of the moving average cross-over rule can be found in Brock, Lakonishok & LeBaron, *The Journal of Finance*, XLVII (5), 1992, 1731-1761.
- They found that the returns from applying the rule to the Dow Jones Industrial Average from its first trading day in 1897 to 12/31/1986 exceeded the buy-and-hold return with a *t*-statistic of 4 or greater.

Table II

Standard Test Results for the Variable-Length Moving (VMA) Rules

Results for daily data from 1897–1986. Rules are identified as (short, long, band) where short and long are the short and long moving averages respectively, and band is the percentage difference that is needed to generate a signal. "*N*(Buy)" and "*N*(Sell)" are the number of buy and sell signals reported during the sample. Numbers in parentheses are standard *t*-ratios testing the difference of the mean buy and mean sell from the unconditional 1-day mean, and buy-sell from zero. "Buy > 0" and "Sell > 0" are the fraction of buy and sell returns greater than zero. The last row reports averages across all 10 rules. Results for subperiods are given in Panel B.

Panel A: Full Sample

Period	Test	*N*(Buy)	*N*(Sell)	Buy	Sell	Buy > 0	Sell > 0	Buy-Sell
1897–1986	(1, 50, 0)	14240	10531	0.00047	−0.00027	0.5387	0.4972	0.00075
				(2.68473)	(−3.54645)			(5.39746)
	(1, 50, 0.01)	11671	8114	0.00062	−0.00032	0.5428	0.4942	0.00094
				(3.73161)	(−3.56230)			(6.04189)
	(1, 150, 0)	14866	9806	0.00040	−0.00022	0.5373	0.4962	0.00062
				(2.04927)	(−3.01836)			(4.39500)
	(1, 150, 0.01)	13556	8534	0.00042	−0.00027	0.5402	0.4943	0.00070
				(2.20929)	(−3.28154)			(4.68162)
	(5, 150, 0)	14858	9814	0.00037	−0.00017	0.5368	0.4970	0.00053
				(1.74706)	(−2.61793)			(3.78784)
	(5, 150, 0.01)	13491	8523	0.00040	−0.00021	0.5382	0.4942	0.00061
				(1.97876)	(−2.78835)			(4.05457)
	(1, 200, 0)	15182	9440	0.00039	−0.00024	0.5358	0.4962	0.00062
				(1.93865)	(−3.12526)			(4.40125)
	(1, 200, 0.01)	14105	8450	0.00040	−0.00030	0.5384	0.4924	0.00070
				(2.01907)	(−3.48278)			(4.73045)
	(2, 200, 0)	15194	9428	0.00038	−0.00023	0.5351	0.4971	0.00060
				(1.87057)	(−3.03587)			(4.26535)
	(2, 200, 0.01)	14090	8442	0.00038	−0.00024	0.5368	0.4949	0.00062
				(1.81771)	(−3.03843)			(4.16935)
	Average			0.00042	−0.00025			0.00067

Panel B: Subperiods

1897–1914	(1, 150, 0)	2925	2170	0.00039	−0.00025	0.5323	0.4959	0.00065
				(1.19348)	(−1.48213)			(2.30664)
1915–1938	(1, 150, 0)	4092	2884	0.00048	−0.00045	0.5503	0.4941	0.00092
				(1.16041)	(−1.82639)			(2.59189)
1939–1962	(1, 150, 0)	4170	2122	0.00036	−0.00004	0.5422	0.5151	0.00040
				(1.06310)	(−1.26932)			(1.98384)
1962–1986	(1, 150, 0)	3581	2424	0.00037	−0.00012	0.5205	0.4777	0.00049
				(0.94029)	(−1.49333)			(2.11283)

Performance of the Moving Average Cross-over rule applied to the DJIA (Brock, Lakonishok & LeBaron, 1992). The average daily return of the DJIA over the same period is 0.00017 with a standard deviation of 0.0108.

Simple Technical Indicators and How to Use Them

- Support and resistance levels and high volume days
  - Support and resistance levels are price minima and maxima over a given look-back window.
  - A price trough (peak) represents the level at which many investors were willing to buy (sell).
  - Investors who bought at the trough are *strong* shareholders since they have the greatest staying power (they form the “support” for the price).
  - A price break through a previous trough will turn them into *weak* shareholders.
  - The effect is magnified if the trough or peak occurred on a high trading volume day.
  - Support and resistance levels tend to be contrarian indicators for stocks but trending indicators for other macro-markets.

Simple Technical Indicators and How to Use Them

- When examining more complicated trading rules, it is useful to know the rationale behind common rule components such as:

  Higher highs and lower lows

  The price pattern for a bull market is characterized by “higher highs”, i.e. where each day’s high is higher than the previous day’s high. The price pattern for a bear market is characterized by “lower lows”, i.e. where each day’s low is lower than the previous day’s low.

  Inside and outside days (bars)

  An inside day is one whose high is lower than the previous day’s high and whose low is higher than the previous day’s low. It signals that a reversal of the recent trend is about to occur.

  An outside day is one whose high is higher than the previous day’s high and whose low is lower than the previous day’s low. It is a strong signal if it occurs in the direction of the recent trend, i.e. if it closes near its high for a bull trend and if it closes near its low for a bear trend.

  Reversals

  A strong trend does not start unless it starts out as a strong reversal. For example, an up trend preceded by a price decline that is fast and drastic may rally far above the initial decline.

Simple Technical Indicators and How to Use Them

- Relative Strength Index (created by Welles Wilder)

$$R_t = \frac{\sum_{\tau=1}^{N} \theta(S_{t-\tau+1} - S_{t-\tau}) \left| S_{t-\tau+1} - S_{t-\tau} \right|}{\sum_{\tau=1}^{N} \left| S_{t-\tau+1} - S_{t-\tau} \right|} \cdot 100$$

where $\theta(\ldots)$ is the Heaviside function and S_t is the stock price at time t. The Relative Strength Index R_t is the ratio of total positive price changes to total absolute price changes over a look-back window. A market with R_t above 70 is considered overbought and one with R_t below 30 is considered oversold.

- Stochastic (created by George Lane)

$$F_t = \frac{S_t - \min\limits_{t-\nu<\tau<t} (S_\tau)}{\max\limits_{t-\nu<\tau<t} (S_\tau) - \min\limits_{t-\nu<\tau<t} (S_\tau)}$$

$$K_t = \frac{1}{N} \sum_{\tau=1}^{N} F_{t-\tau+1}$$

where ν is a given look-back window. F_t measures the relative position of the current price within the past high-low range, and K_t smooths out F_t by taking its moving average. A market with K_t above 0.8 is considered overbought and one with K_t below 0.2 is considered oversold.

Examples of More Complicated Trading Rules

- Here are examples of more complicated trading rules (Connors 1998, Kaufman 1995):

8-Day High/Low Reversal Rule

For buys:

1. Day 1 must be an 8-day low.
2. Day 2 must trade above the day-1 high.
3. One of days 3 to 6 must trade under the day-2 low.
4. When condition 3 is satisfied, buy one cent above the day-2 high if the break-out occurs with 4 tradings days of the occurrence of condition 3.
5. Place a stop-loss one cent below the day 2 low.

For sells:

- Day 1 must be an 8-day high.
- Day 2 must trade below the day-1 low.
- One of days 3 to 6 must trade above the day-2 high.
- When condition 3 is satisfied, sell (short) one cent below the day-2 low if the break-in occurs with 4 tradings days of the occurrence of condition 3.
- Place a stop-loss one cent above the day 2 high.

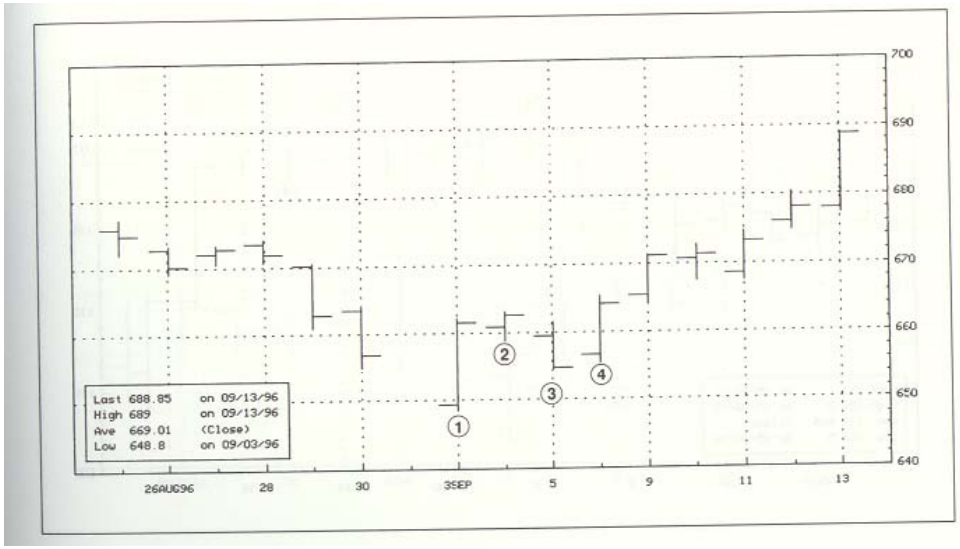


Illustration of the 8-Day High/Low Reversal Strategy (taken from Connors, *Advanced Trading Strategies*, 1998).

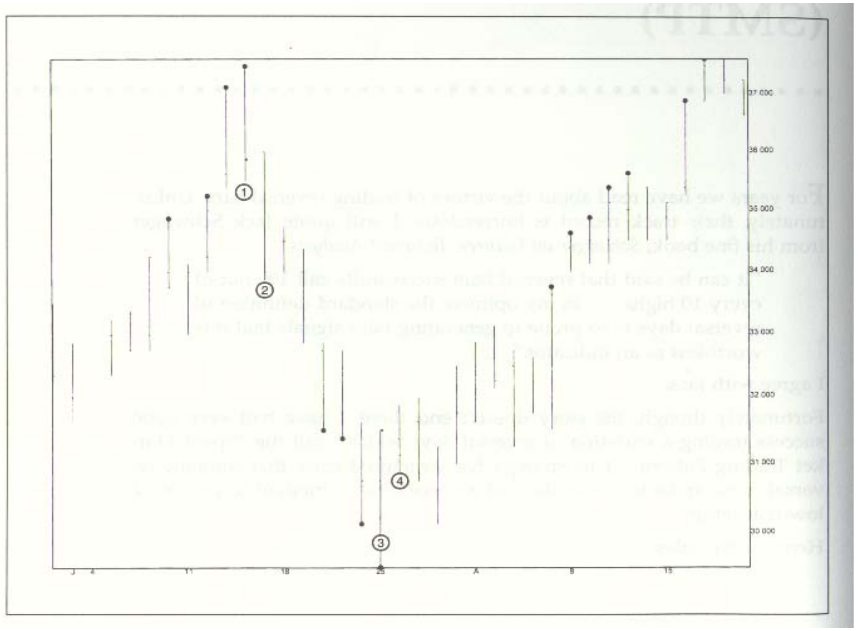
Examples of More Complicated Trading Rules

Spent Market Pattern or the “Capitulation” Trade

For buys (reverse instructions for sells):

1. Today’s low is a 10-day low.
2. Today’s range is the largest of the past 10 days’ ranges.
3. Today’s close is in the top 25% of today’s range.
4. Buy tomorrow or day after tomorrow 1 cent above today’s high.
5. If filled, place a sell stop at today’s low and trail it properly to lock in profits.

To right: Illustration of the Spent Market Pattern for Compaq Computer (taken from Connors 1998).



- Timing the stock market “capitulation”, i.e. the point at which investors are disgusted by losses, have had enough and are throwing in the towel, is a industry by itself.
- Technical analysts usually do this by applying many rules and indicators synergistically.

Examples of More Complicated Trading Rules

- Some indicators for timing market tops and bottoms are:
  - Short-term Trade Index (TRIN or ARMS Index)

$$\text{TRIN} = \frac{\frac{N_A}{N_D}}{\frac{V_A}{V_D}} = \frac{\frac{V_D}{N_D}}{\frac{V_A}{N_A}}$$

where N_A is the number of advancing issues, N_D is the number of declining issues, V_A is the total volume traded in the advancing issues and V_D is the total volume traded in the declining issues. This is a contrarian indicator of overbought and oversold levels in the market. It is the ratio of per issue volume flowing into declining issues to per issue volume flowing into advancing issues. A TRIN value of 0.8 signals an overbought market and a value of 1.2 signals an oversold market.

  - Put-Call Ratio

This is the ratio of the total trading volume of put options to that of call options, and is used as a contrarian indicator. Two ratios can be constructed, one from equity options and the other from equity index options. A high reading for this ratio indicates a reversal is likely from an excessively bearish market; a low reading indicates a reversal is likely from an excessively bullish market.

  - NYSE Issues Up/Down Ratio (TICK)
  - CBOE Market Volatility Index (VIX & VXN)
  - Price of Gold

Examples of More Complicated Trading Rules

VIX Reversal

For buys:

1. Today the VIX must make a 15-day high.
2. Today the VIX must close below the open.
3. If condition 1 and 2 are met, buy the market proxy (e.g. S&P 500) on the close of today.
4. Hold the position at least 1 to 3 days.

For sells:

1. Today the VIX must make a 15-day low.
2. Today the VIX must close above the open.
3. If condition 1 and 2 are met, sell the market proxy (e.g. S&P 500) on the close of today.
4. Hold the position at least 1 to 3 days.

Suggestions for Further Work

- **The premise that most trading opportunities are nonlinear effects and that technical analysis is a practical tool to exploit them is a compelling one.**
- The opportunities vary in the “specificity” of the associated price pattern, its frequency of occurrence and the scalability of the profits.
- One can combine many technical strategies exploiting myriad effects into a portfolio.
- Such strategies abound and make for futile research:
  - “Fade the Morning Call”
  - “Exhaustion Gap Reversals”
  - “Runaway Moves”
  - “Late Announcement Crash”

Michael Tan, Ph.D., CFA
330 E 38th St 14L
New York, NY 10016
Tel: 212-682-0507
mltan@yahoo.com