Building Effective Trading Systems

I would like to share with you some of my experiences in this business of "building effective trading systems." There is quite a lot implied in that title: <u>Building</u> a <u>Systematic</u> method for <u>Trading</u> that is <u>Effective</u>.

First, let me tell you a little about my background and how I became interested in systems and trading. I'm going to tell you a little more than you probably want to hear because one thread that seems to run through this business is a successful (effective) trader uses a system that "fits" his or her personality. You will need to know a bit about me in order to properly frame what I will tell you about the systems I have developed and traded.

I was a very good high school student and high school athlete. I made nearly straight A's and I played several sports on conference championship teams and I was an important player on my teams, but not ever the "star." My family had a low income relative to the average at my high school. I won a National Merit Scholarship and attended M.I.T. I graduated as an aeronautical engineer and went to work in the Aerospace industry in the mid-sixties. I worked on dynamic models of the Saturn V launch vehicle used to send Apollo astronauts to the moon.

So: Here's what I would have you get from that: I am good at math. I am competitive and winning is a habit of mine. I haven't been pampered and I haven't been a star – I am not unfamiliar with humility. I studied, in a formal way, "systems," that is the dynamic behavior of complex systems, like spacecraft, and I learned to develop mathematical models of these systems that were, imperfect to be sure, but helped us understand why the systems behaved the way they did, and predict how they might behave if we changed them in certain ways.

I left the aerospace industry in 1969 and began working for a small consulting company that did what was known then as "war gaming." We developed models that hoped to provide insights into the composition of military forces: What should be the relative numbers of tanks, infantrymen, artillery, close-support aircraft, air-superiority aircraft, long-rang bombers, etc. "War" can be modeled as a multi-move "game:" The enemy moves, you move, he moves, etc. So our work led us into more than modeling, for instance, the effectiveness of air delivered cluster bomblets against a tank battalion; it led us into the study of multi-move allocation strategies, multi-move game theory. We also studied and used Markov Models: These are models of dynamic systems where the "state" of the dynamic system is described by some fixed number of variables and the changes in those state variables over the next small time period are assumed to depend only on the current state and a probabilistic description of the inherent system dynamics.

So: I've got some background in allocation of resources. I also have some knowledge of the theory of zero-sum games: What I win, someone else loses; whatever I lose, someone else wins. The optimal strategies for two-person zero-sum games often involve saddle-points, or "mini-max points": If both players play optimally, each player achieves the payoff he can guarantee not to do worse than. Of course, one player's payoff is negative and the other's is positive. Such a game is only a "winning" game for one side.

How did I become interested in developing trading systems? Well, I spent the first nine years after college working for the government: The Space Program and then, the Department of Defense. By then Viet Nam had wound down, Nixon had resigned; Israel had won the Six-Day War. The Cold War between NATO and the Warsaw Pact continued to make a Conventional War in Europe worth studying and the US and Russian strategies of Mutual Assured Destruction gave rise to endless analyses of nuclear exchanges, satellite based laser weapons, etc.

Probably the event that triggered my interest in the markets was a commodities options scam that was perpetrated in California in the mid-seventies by a firm named, Goldstein-Samuelson. It just so happened that this Ponzi scheme snagged one or two of the very bright people in our little consulting company. The scam company was selling options (puts and calls) on commodity futures and had an apparently very convincing story that it was a "no lose" system. I am not sure there was even a public market in futures options at that time. As usual in these things, one would make an investment, win several times, each time putting the "winnings" back in and even adding additional personal funds. The investor would unwittingly become a "tout" to his friends. The company might even pay some people off who would quit early, always paying out of "new sales" because the money wasn't even actually being put in the markets. Eventually the California Attorney General and many people lost money put the company out of business. It is possible that this scheme, and others about the same time, led to the creation of the CFTC and government regulatory action. While this was going on over a period of many months, there were many lively discussions at our company about whether there could be a "sure thing" in the futures markets. We read much of the academic literature about the "random walk theory" and discussed whether the markets were, indeed, well modeled by such a presumption. One interesting book was a collection of papers edited by Paul Cootner: "The Random Character of Stock Prices." Benoit Mandelbrot, who would become famous, later, for describing Fractal Geometry, wrote one or two of the papers in this collection.

Several years later, a colleague who evidently had become convinced the markets could be traded profitably and had left our small consulting company to become a commodity futures trading advisor, called me and offered me a job in his CTA firm. I took it. That is when my formal training in understanding and later developing trading systems began.

Let me tell you about the system my friend had developed. It will give you some insights into the way I learned about systems trading and perhaps some insights into a person who is still trading managed accounts some twenty-five years later. This system is a "trend-following" system based on chart formations. It is "technical" in the sense that all of the information deemed pertinent is assumed to be included in the High, Low, and Close on the chart.

1. To be "trend-following" we need a way to identify the trend. In this system, a price some number of weeks prior to the anticipated entry day denoted the "trend." An order generated by the system to buy, which was at a price higher than the "trend-price", would be a valid ("money") order in an Up Trend. A buy order generated by the system that was at a price below the trend-price became a "paper" order, that is, the long position would be tracked, but only on paper. Similarly, orders to sell short at a price below the trend-price were money orders; sell orders above the trend-price were paper orders.

2. For any given commodity the system was either out, long or short. A new position could not be entered unless the system was out. An exit order and an entry order in the opposite direction could happen simultaneously (a turn.)

3. To make this system easy to operate, all normal orders were entered on a Stop-Close-Only basis. I say "normal" because a "trading system" must specify what happens in many situations, like errors and rollovers, etc. We used Market orders for some situations and mid-day Stop orders for others. Some comments on SCO orders: Systems trading is an intense psychological activity. It is important to remain resolute about your system in the face of some really challenging market situations. The beauty of SCO orders is that, in principle, you go to sleep at night with your most recent executions very close to the "current price." This lessens the overnight stress that may occur, for instance, if you bought at the top on a day when the market reversed and closed limit-down. Your "system" must be designed to take into account your psychology – it should help you trade in a way that you can be comfortable with.

4.	To enter a new position, an "entry signal" had to occur. In this system an entry signal was a one-day change in price of a specified percentage, s. That is, if the price today is 1000 and the signal parameter is 1.5%, then a buy signal occurs tomorrow at a price of $(1000/(1-.015)) =$ 1015.22 or more. The order would be Buy at 1016 SCO. A sell signal occurs at a price of $(1000/(1+.015))=985.22$ or lower. The order would be Sell at 985 SCO. One or both of these orders would be a money order; at most one might be a paper order. If a paper position was entered, it would have to be exited before a new paper or money position could be entered.

5.	Once a position was entered, a Stop-Loss order is calculated immediately. In this system, the Stop-Loss order was (in a long position) a price below the previous day's price by an amount equal to half the difference between the closing price and the previous day's price. I'll draw a picture. The Stop-Loss order was used to exit the position if the price moved against you before a profitable Trailing Exit-Order was generated. To continue the previous example, suppose the Trend-Price was 900. The money order would be the Buy at 1016. Suppose the market closed the next day at 1020, a two-percent move. We would have a money position at, or near, 1020. Our Stop-Loss price would be $(1000-(1/2)*20)= 990$. We would have a Stop-Loss order to Sell at 990 SCO.

6.	So we know how to get in. We know what direction to get in. We know how to get out at a loss. It is very important to know how to get out at a profit. This mechanism is the one that really defines the uniqueness of this particular trading system. This system would exit a trade when the closing price broke a "Valid Trend Line" by an amount equal to half the daily price change on the entry day.

7.	What is a "Valid Trend Line"? For me, it is easiest to break this question down into two questions, "What is a Trend Line?" and "What makes a Trend Line Valid for use as an trade exiting mechanism?"

8.   Here I will use an example chart. Any chart can be uniquely "contained" by a family of what I call "envelope lines." The lower envelope lines proceed from the historic low point on the chart, sloping up and to the right. If a horizontal line is moved up until it just touches the historic low, then is rotated counter-clockwise until it touches one other low, it will lie below the remainder of the chart. If the line is broken at the second low and the part to the right is rotated again until another low is touched, the second line will lie below the remainder of the chart. If this process is repeated again and again, the family of lines are what I call envelope lines. The same process works for constructing upper envelope lines.

9.   Now, for an example, lets say we have entered a long position and time has progressed and the price has made some headway in our direction. The Trend is Up. Any one of the lower envelope lines may be considered a Trend Line. Then we move on to the second question, "Which one of the Trend Lines, if any, should we consider a Valid Trend Line, a break of which would constitute an exit order?"

10.   The system we are discussing defined a Valid Trend Line as one for which an "n-day pull back and advance" pattern occurred subsequent to the first of the two points that geometrically define the Trend Line. I will draw an example of a Valid Trend Line formation. Note that all envelope lines prior to the Valid Trend Line are also Valid Trend Lines. We are only interested in the most recent Valid Trend Line because it is higher than all the prior lines and gives us the closest exit signal.

11.   This system incorporates an understanding that a substantial amount of time could play out without the required pattern. Therefore, in the absence of an n-day pull back and advance, the envelope line constructed from (originating at) a low at least four weeks prior to the entry day would be considered a Valid Trend Line.

12.   One final Rule about getting out on the break of a Valid Trend Line: You could not use the trend line break to get out at a loss, unless it was also in the direction of the Long Term Trend. A chart example is helpful here.

Now we have defined a Trading System. In my view this process of developing a System for Trading has two general aspects: One is the tools used to construct the system, for example in this system we use percentage moves, trend lines, pull-back formations, and daily price changes, not to mention using SCO orders. The other aspect is the set of parameter values we choose to give the Trading System an exact definition for a particular market.

I find it useful to think of the construction of the System as developing a "model" of the way you believe markets behave. I say "markets" because the model you construct (in order for it, and you, to hold up under pressure) must incorporate your own broad understanding of market price movements. I interpret the present system example as follows: We think markets can be characterized as trending when the current price is above or below the price some number of weeks prior. (This could be strengthened, perhaps, by saying the price must be some percentage above a price some number of weeks ago.) Our model says we believe a price trend is characterized by larger one-day price changes (percentage signals) in the direction of the trend than against the trend. Therefore a one-day "signal" of some magnitude is more likely a trend-confirming indicator than not and a reason to enter the market if you are out. We think, once a price is trending, there is some likelihood of short-term reversals that are not trend changes and we would like a Stop Loss that is low enough to keep us from getting whipped out but also limits our risk when we are wrong on the strength of the trend. We think it is an effective strategy to drag an exit order along with us if the market goes in our direction. I will point out, below, that trend lines, and Valid Trend Lines, are dynamic and change due to market movements, becoming steeper and also becoming less steep.

Let's examine some of the trading behaviors of this system in an abstract way. Keep in mind there are several parameters to be specified for each market traded: The Long Term Trend parameter, T weeks; the Entry Signal size, s percent; the number of pull-back days required for a Valid Trend Line formation; and, the number of weeks after which a Trend Line would be considered Valid, whether or not there was a pull-back formation.

If a market just begins to run steadily upward (or downward), will we get in? Yes, after no more than T weeks the Trend will be up. We also need a day when the daily price change is at least s% in the trend direction.

If a market sloshes broadly sideways for a period of time, will we get in? Perhaps. After T weeks the Trend will kind of slosh from Up to Down, and if s% signals occur just as often in each direction, the chances of entering a paper position are as great as entering a money position. So we have some mitigation in a sloppy market from getting in and whipped out.

How does the system behave when we are in a money position, the price is trending in our direction and there is a consolidation, then continuation of the trend? A chart example would be helpful here to see how the Valid Trend Line concept works when the Trend Line gets "pushed" and then a new Valid Trend Line is identified as the market resumes its trend movement.

We are probably running out of time here so I would like to just mention briefly a few other topics:

Orders: Sometimes the market will behave in a way that an order your system generated should be executed but is not executed. Your Trading System must specify what you do in each situation that can be foreseen. Think it through, write it down and do it when it happens. Minimize your opportunity to create ad hoc rules in the heat of battle.

Orders: Sometimes an order will be executed but the market High Low Close will be such that your system does not expect you to be in (or out) of the position. The same recommendation as above applies.

Errors: They happen. Decide what you will do when: You get out but should have stayed in. You get in but should have stayed out. You didn't get in but should have. You didn't get out but should have. You bought or sold the wrong number of contracts.

Tuning (curve fitting) System Parameters: This is an activity that requires a tremendous amount of work as well as insight into the mathematics of statistical analysis. Much has been written on this subject and you would be well advised to read many opinions. I might point out that when doing research and selecting the values of parameters your system uses, you need to have a pretty good idea about what you are looking for. This leads us to:

System Evaluation: How do you measure a System's performance? What is the significance of the win percentage, the average win amount, the average loss. What is the Sharpe Ratio? What is the Kelly Criterion? How should you evaluate draw down periods? How about average time between new highs? These are topics that need to be addressed for each market traded. When you begin to consider your portfolio, you enter the realm of:

Money Management: What markets should you trade? What contracts? How often do you switch months? How many contracts should you trade in each market for a given portfolio equity?

And much, much more.