From No System to a Proven System in Three Well-Defined Steps

The author of "Trading 101 - How to Trade Like a Pro" boils trading system design and analysis down to its basic components.

By Sunny J. Harris

Eschew Obfuscation

Traders who are consistently successful, whether they know it or not, are using some sort of system to make trades. A system is simply a recipe, a map, a guide that you follow to its conclusion. Your system might be as simple as trading on the long side on sunny days and on the short side on rainy days. That's a system! And if you follow that plan day after day, keeping track of the results, are a systemized trader.

The word "system" has become synonymous with the fear of math and for many of the same reasons. Usually people who didn't like math in school simply didn't have a good teacher. Likewise, if you hesitate at the word "system," it's probably for lack of a good teacher. In this article we'll look at the elements necessary to create a successful trading system and how you can apply them to your own trading.

Potential Hourly Wage Analysis

For my own analysis I've come up with a rule of thumb which I use in determining which markets are tradable. I take a look at all markets on the same scale, over a one year period, and mark the ideal entries and exits. If 40% of the ideal would give me an annual wage I'd be happy with, then I consider the market to be tradable. I initially called that "Potential Hourly Wage" Analysis (PHW Analysis), and though the concept grew well beyond hourly computations, the name stuck.

The first thing we do is mark all the ideal entries and exits, trading from both the long and the short sides. Although you and I will see different ideals, the concept is the same. Here's the chart as I would mark it:

Figure 1

Why didn't I mark every jig and jag on the entire chart? Because we have to leave room for error. You can't catch every up and down move in any market. Keep in mind that we're estimating we'll only catch 40% of the ideal move. Thus, if a move is small and we miss 60% of it, then it'll probably be a losing trade.

Next we must analyze the ideal trades we've marked to see how much our annual wage would be from this effort. Will it be worth our time to trade this instrument?

Looking at each trade (beginning with the first "sell") and closing out at the end of the chart, our hypothetical transaction log would look like this:

Date	Action	Entry
8/17/95	SELL	114
1/12/96	BUY	86
2/23/96	SELL	128
7/22/96	BUY	90
12/3/96	CLOSE	164

Figure 2

Translating this into a performance table we get:

Entry Date	Action	Entry	Exit Date	Exit	Profit/Loss
8/17/95	SELL	114	1/12/96	88	$26
1/12/96	BUY	86	2/23/96	128	$40
2/23/96	SELL	128	7/22/96	90	$38
7/22/96	BUY	90	12/3/96	164	$74
TOTAL					$178

Figure 3

So what? We make $178 in a year. Big deal. Well, yes, it can be a big deal. You'll not be buying and selling one share of this stock, you'll be trading as many shares as you can, considering your budget, your available capital, and other risk factors. Let's say we were trading a round-lot —100 shares. Then we would have made 100 * $178 = $17,800 that year on an initial investment of $11,400. That's 156% profit in the ideal case. What if you had $25,000 to trade with instead of $11,400?

Now that we've considered the ideal, we've got to get back to reality and take a look at what's more likely to happen. In PHW analysis I make the assumption that it's possible to capture 40% of the ideal profit. So, 40% * $178 = $71.20, which means we could have made $7,120 that year, which is a return on investment of 62% on the 100 shares. Still great!

Lots of people think they can get into trading and hit the jackpot — getting rich over night. Wrong. Trading is a business, like any other. It takes lots of hard work and time to become an overnight success. If today you started a retail business, any business, how long would it take to breakeven? A fair estimate is three years. And how much profit would you expect this business to make every year after that? Probably about 10%. Those two numbers are industry-standard. So, when it takes three years to breakeven trading and you make anything over 10% per year, you're doing well! That's why I say that 62% in the above example is great.

As a further refinement of this step in our research, we could, and in fact should, investigate other timeframes. Maybe a 60 minute chart of IBM would show us shorter term trades that happen intraday and potentially generate a greater income. If that turns out to be the case, then investigate 30 minute charts as well. But, as they always say in math classes: "That exercise is left to the reader."

Before we go on, let's take a quick look at the "buy and hold" strategy. What if we wanted to be investors rather than traders? Looking back at Figure 1, let's buy at the beginning of the chart, in April 1995, at a price of 85. If we hold to the end, and sell at 164, we would have made 79 points. Forty percent of that ideal leaves us with almost 32 points profit for the year. Assuming again that we were trading 100 shares, we would have made a 28% return on investment. That's why I prefer trading.

Then next step in our PHW analysis is to create or borrow an indicator which will approximate our ideal entries and exits.

Looks Like a Duck, Walks Like a Duck

There should be no pride of ownership syndrome evident in your market analysis. You don't have to be Welles Wilder and invent new and proprietary indicators. Your goal, don't forget, is to make money. Do you really care whether you do it with some brilliant new technique you can name after yourself, or whether you do it with something simple like moving averages? You shouldn't.

The more elegant solution to any problem is always the simplest solution. Simple solutions tend to work over time. Complicated solutions tend to fail as new data creates new and unforeseen situations.

Figure 4

If, in Figure 4, our original premise was that this vehicle traded in a channel, because of the data we observed from April 1995 to April 1996, we would have gotten long too soon in July 1996, and short too soon in December 1996. We fit the answer too closely to the data under observation.

It's well known that the less complicated the model, the more it seems to work overtime. In pursuit of simplicity, let's follow the market, rather than try to lead it. The market is always right, and will do whatever it wants to, independent of your predictions. Dancing backward with your eyes closed is the best way to respond to the markets. To that end, moving averages are great - they follow the trend (your friend) and slowly change as market conditions change. In my own work I use some pretty fancy moving averages which change themselves dynamically and which are based on exponential moving averages. I like this area because the exponential averages react quicker to changes in the market.

For now, and for the simplicity of this exercise, we'll take a look at simple moving averages. Keep in mind that a chart is a chart … everything we're doing applies equally well to charts of futures, stocks, mutual funds, etc. … but for clarity we're going to stick to the chart of IBM.

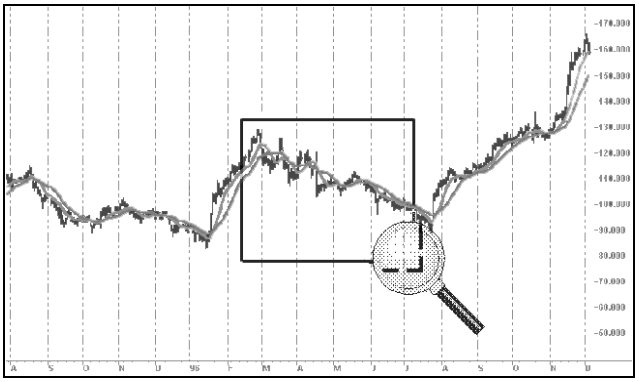

Figure 5

In Figure 5 we've overlayed a standard 9,18 moving average on our chart of IBM. That means we are drawing two curves, one where we average the last nine closing values and the other one averages the last eighteen closing values. With a two moving average system, we look for the places one moving average crosses over the

other. When the shorter moving average crosses the longer one we take the trade in the direction of the movement.

In general (if you blur your eyes) this set of moving averages is not too bad. However, upon closer inspection of the boxed area, we see that the moving averages cross back and forth over each other, more than likely giving us false signals and whipsaw results.

Here's where the fun begins. As we search for indicators or patterns that will call out our ideal trades, we get to play with mixing and matching indicators. Since we now know that we would like to eliminate the whipsaw area, we can try several options and see what works. Off the top of my head, I'd say we could try:

- increasing the length of the longer moving average,
- using an exponential moving average,
- or filtering the signals through another indicator.

Again, this exercise is left up to the reader, but I'll give you a hint. Welles Wilder's ADX (average directional movement index) will tell you whether the market is trending. You can filter out the whipsaws by only taking the signal when ADX indicates a trend. Of course, it's up to you to run many, many tests while you hold one set of numbers constant and vary the others, in order to isolate a range of values that more closely approximates the ideal entries we set up.

Your log of experiments will look something like:

MAV-1	MAV-2	ADX	Profit/Loss
9	18	9	$
9	18	10	$
9	18	11	$
9	20	9	$
9	20	10	$
9	20	11	$

Figure 6

where you fill in the profit/loss figures as you run each separate test. Eventually you will need lots of 3-ring binders or file folders to categorize the experiments you've run and their results. Research and testing is not an overnight project. In fact, you should plan this phase of your work as if you were developing a software product to sell at Egghead. It may take many months as you grind through the tedium of running and logging each experiment. In the end it will be well worth it; you will have done your homework and you will have the evidence that gives you the confidence to follow the system.

When you reach the point where your experimental results are consistently close to the theoretical results you postulated at the onset, you've probably got a duck.

How Much Is Enough?

How much data do you need to use for testing before you can be sure of the replicability of the results? And furthermore, is there a way to keep from curve-fitting the data?

There is plenty of discussion in the trading community about statistics: how many trades constitute a statistically valid test? The answer I have heard most often is "thirty". I couldn't disagree more.

To test a system over a set of data which produces only thirty trades would generate a very nice model which would work well in the past, but as the markets fluctuate and the mood changes from bull, to bear, to sideways and back again, the model with thirty trades would probably prove to be only accurate over that subset of data that you initially developed it for.

The trick to successful system generation is to start your research using only part of the available data. After completing the entire research process for that limited set of data, we would engage in “back-testing” and “forward-testing.” I divide my data into thirds, testing the middle third first as I generate theories and systems.

Using the data from 1987 through 1995 for testing, the data from 1987 through the end of 1989 is historical data to your new system. Thus, any testing you do on data which happened before the period you’ve proven is “back-testing.” Likewise, the data which comes after 1992 (which you didn’t even peek at) is future data to the system. In effect, you are running a blind trial which could not have been curve-fit, because you didn’t have the data as part of the initial design.

1987	1988	1989	1990	1991	1992	1993	1994	1995
	II		Data Set I				III	

Figure 7

If your system performs reasonably well (within your expectations) over the backward test and the forward test, you just might have a tradable system. But, don’t trade it yet, there’s more we have to do to find that out.

The Proof Is In the Pudding

As a mathematician, the word “proven” means something very precise to me. Let’s first get the definition of that single word out of the way, so we’ll have an agreement about it’s meaning. Webster’s defines it as “tested by experiment” or “established as true.” While this is part of what I mean by the word “proven”, I also mean that we must have a measure or measures of success which quantify “true.” And further, we need a specific set of procedures which constitute the “experiment.”

Computer trading is very similar to flying by instruments in an airplane. First you test your instruments, and then you test them again, THEN you must rely on those instruments and follow your flight plan without regard to the fog around you. If you override your instruments, you just might fly into a mountain. The same is true with

computerized trading. Establish your system, test it, test it again, and then trust your instruments. Trading then becomes as easy as 1,2,3.

Okay, the system looks pretty good after all the procedures we followed above. But, is it robust? Can it withstand the test of time and changing conditions? We got a pretty good handle on that by dividing our data into thirds and back- and forward-testing. We showed that it still performs on different sets of data. Now, can we quantify that in some way?

Here's what I look at:

- Mathematical Expectation (ME)
- Percent Profitability (P)
- Ratio of the Average Profitable Trade to the Average Losing Trade (P/L Ratio)
- Profit Factor (PF)
- Return on Account (ROA)

I call these my Cardinal Profitability Constructs. If a system I have designed passes muster through this rigorous set of CPC conditions, after already passing through the first set of tests, I'm ready to trade it.

The qualifying conditions I look for in the CPC numbers are these:

1. Mathematical Expectation > 0.0
2. Percent Profitability $\geq$ 35%
3. (P/L Ratio) x (Profit Factor) $\geq$ 3.0
4. Return on Account $\geq$ 30%

All well and good, you say, but where do we get those numbers? Okay, hang on just a little bit here, we're going to do some mathematics. Not real strenuous, though.

Mathematical Expectation

Mathematical Expectation tells us whether we should expect to win or lose in the long-run. Note that a Mathematical Expectation of one (1) is breakeven. We calculate Mathematical Expectation using this formula:

ME = [(1 + A) * P] -1, where
P = Probability of winning and
A = (Amount you can win) / (Amount you can lose).

For example, if P, the probability of winning, is 40% and the Average Profitable Trade is $5.00, while the Average Losing Trade is $2.00, then your mathematical expectation is:

ME = [(1 + 5) * .40] -1 , or
ME = [(6) * .40] -1, or
ME = 2.40 -1, or
ME = 1.40

Ralph Vince, in *Portfolio Management Formulas* demonstrates that you'll never end up a winner with a trading system which has a mathematical expectation less than zero. He goes on to say that any system with a ME greater than zero can be

improved through money management techniques, while no money management scheme will make a system with ME < 0 a winner.

That's why we calculate this value first. There's no use calculating any more if we find that our new system fails this first test.

Percent Profitability

This one's simple. If we have 100 trades total in our database, and of those 40 are winners, then we figure the percent profitability thus:

P = [number of profitable trades] / [total number of trades]

So, P = 40 / 100 = 40%. It's how many times we expect to be profitable out of the total number of trades.

Ratio of the Average Profitable Trade to the Average Losing Trade (P/L Ratio)

Sometimes referred to as the Profit to Loss Ratio, for this calculation we simply divide the Average Winner by the Average Loser. Thus, where

AW = the dollar value of the average winning trade (the average of all your wins),
AL = the dollar value of the average losing trade (the average of all your losses),

then P/L Ratio = AW / AL.

Profit Factor

The Profit Factor tells us how robust the system is by comparing the Gross Profit to the Gross Loss. It tells us how many dollars the trading system made for every dollar it lost. Thus,

PF = Gross Profits / Gross Loss

A profit factor of one (1.0) means we're making and losing the same amount of money, i.e. breakeven. If the profit factor is less than one we're making less money than we're losing, i.e. this is not a winning system.

Return on Account

This number will vary, depending on how much capital it took to handle the drawdowns of this system. The more money you put into the account, with the same dollars net profit, the lower this percentage will be. For purposes of testing, I let the computer determine the account size required and calculate the ROA on that. Clearly we want the ROA to be a positive number, and hopefully a large positive number.

Conclusion

Clearly, anyone can develop a trading system; but, not all trading systems are created equal. Before you consider trading real dollars on anything, make sure that

you've at least met the above criteria. Next time we'll talk about ways to dramatically improve your system through dynamically adjusting indicators and money management techniques.

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Futures trading includes the risk of loss and must be conducted with risk capital only. Hypothetical or simulated performance results have certain inherent limitations. Unlike actual performance records, simulated results do not represent actual trading. Also, since the trades have not actually been executed, the results may have under- or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity. Simulated trading programs in general are also subject to the fact that they are designed with the benefit of hindsight. No representation is being made that any account will or is likely to achieve profits or losses similar to those shown. Further, past performance is no guarantee of future results.