Compounding Profits for Maximum Returns

By Sunny Harris

Introduction

I would expect that most of you reading this article know how to play Blackjack. The game can readily be played betting (trading) one unit at a time. That is, placing the same bet on every play, whether it's $5 or $20 or more. One can play with no compounding, or management scheme, and bet the same amount on every hand. I call this Unit Trading (or Fixed Unit), that is, betting the same amount on every bet.

One can also use simple compounding techniques to increase profits by folding the profits back into the betting pile and increasing the bet size each time the equity allows one to trade another unit. So, if you are at a table that has a $5 minimum bet you can bet one more unit each time your equity exceeds the limit. In the case of equities, let's say the cost of the stock is $100 per share and you start with $100, then you can trade 2 shares (or 2 units) when your account size exceeds $200.

Probably the most common way to maximize profits in the game of Blackjack is to double down on every win. Intuitively it seems that trading more each time you win and backing off with each loss would make more money in the long run. This scheme is called Anti- (or Reverse-) Martingale.

The Martingale strategy is to double the bet size after each loss. This is rather counter-intuitive. Why would I want to bet more after I lose? In fact, this is ultimately a winning scheme if one has infinite wealth since the bet size increases geometrically.

We will also briefly examine the optimal-f strategy proposed by Ralph Vince in *Mathematics of Money Management*. The theory takes some studying and mathematical prowess, but it is exciting in its potential. I once created a little booklet (signed by Ralph) called *Ralph Vince at a Glance*, in which I summarized the work and the formulae. I think it is still on my website, www.moneymentor.com.

Lastly, I will present my own money management scheme, which (with Ralph's permission) I call Ultimate-F because it compensates for Ralph's high risk of ruin.

Data for the Experiment

In this article we will use simulated trading profits to examine several methods of compounding the results to maximize profits and at the same time not realizing financial ruin.
The first few rows of the spreadsheet for this simulated trading profits is in the Figure 1 below. The pattern repeats ad nauseum for as long as you want to simulate. Of course you can trade 100 contracts/shares or 1 or 10 or any amount you wish, as long as you are consistent and treat your size as a unit.

beginning $	$ 10,000.00
$ 100.00	$ 10,100.00
$ (50.00)	$ 10,050.00
$ (50.00)	$ 10,000.00
$ 100.00	$ 10,100.00
$ 100.00	$ 10,200.00
$ (50.00)	$ 10,150.00
$ 100.00	$ 10,250.00
$ (50.00)	$ 10,200.00

FIGURE 1 Simulated Trading Profits

FIGURE 2 Chart of the Simulated Trading Profits

Without adequate testing and data collection one cannot know which of several compounding methods actually results in the least amount of risk and the greatest amount of profit.

The examples given in this article will demonstrate what I find to be the least risky and yet most profitable of compounding schemes.

Trading One Lot at a Time (Unit Trading)

If you have a profitable strategy (for these examples we'll say 50% profitable with 2:1 ratio wins to losses, which by the way is difficult to achieve) and are trading a single unit at a time, your profits might take a linear progression upward. This would look like the chart in Figure 2 above. In Figure 3, below, I've expanded the data to 80 rows, so you can see more "long-term." As you

can see from the chart, the data sequence keeps repeating.

NB: Keep in mind that compounding only works with a winning system. No amount of compounding can make a losing strategy profitable.

For this example, I have simulated the performance so you can see what a chart of the equity stream looks like. For a system such as this the trades might look like the spreadsheet in Figure 1 In this spreadsheet you can see that with each trade we are risking one unit, that is one share, one lot, one hundred shares, as long as each trade risks the same "unit." For the remainder of the article I will use the full 80 rows of data, but only show exhibits of the beginning and ending rows, rather than printing all 80 rows each time.

Also keep in mind when reading the charts that the scale on the left side varies with each compounding scheme. Unit trading only goes up to $3,500 while other schemes get to the 10s of thousands.

FIGURE 3 Unit Trading Our Data Over Long-Term

Traders not only need to determine how much to trade with each order, but in real life they also need a plan for what to do with the profits that accumulate. That's as much a part of money management as calculating probability of ruin[1] and determining trade size.

As a profitable day trader, will you want to add the money to your account and trade it as before? Leverage your profits by trading them more aggressively than your core account? Pull money out and put it into long-term investments? Or a combination of the three?

I bring these questions up, not because I am going to answer them in this article, but because they are part of money management and need to be part of your planning.

Compound Interest and Fixed Dollar Trading

Compound interest is a simple concept: Every time you get a return, that return goes into your

account to trade with. You keep earning a return on your returns, which increases your account size some more. (Of course, you will post losses, too.) You keep earning a return on your return, and soon, the numbers get to be large.

If you are trying to live off your trading profits, you will want to take some of the equity out from time to time. When you do, you will have to build back up with less money to do so.

One way to trade the account would be to leave the trading profits in the account and increase the size of your trade each time you had accumulated sufficient profits to increase by one unit. That would be compounding. Let's assume our fictitious stock costs $200 per share. In this example we will add contracts with every additional $200 of equity, and back off similarly.

The corresponding spreadsheet exhibiting compounding with the profits follows.

COMPOUNDING every		$	200.00
	Trade Profit		Equity
nxt trade	beginning	$	10,000.00
1	100	$	10,100.00
1	-50	$	10,050.00
1	100	$	10,150.00
1	-50	$	10,100.00
1	-50	$	10,050.00
1	100	$	10,150.00
1	-50	$	10,112.50
1	100	$	10,168.75
52	100	$	20,413.15
78	100	$	25,619.72
59	-50	$	21,714.79
88	100	$	27,572.19
66	-50	$	23,179.14
99	100	$	29,768.71
74	-50	$	24,826.53
56	-50	$	21,119.90
83	100	$	26,679.85
63	-50	$	22,509.89
94	100	$	28,764.83

FIGURE 4 Compounding Spreadsheet

Notice that compounding aggressively assumes that you can or will trade 94 contracts by the end, and that you have sufficient funds in your account to do so. Nevertheless, the effect of simple compounding is dramatic. Also, please notice that as the share size increases the drawdown accelerates, losing $5,000 - $9,000 at a time. That amount of drawdown scares even the most battle-hardened trader.

FIGURE 5 Compounding Chart

Fixed Dollar Trading on the other hand, requires that you invest the same dollar amount in every trade, regardless of the price of the stock or commodity. For instance, NIO is trading at $47 per share while GOOG is trading at $1,730 per share. If you were investing $10,000 in your account, you would trade 212 shares of NIO or 5 shares of GOOG. As the price of the stock goes up you would trade fewer shares, investing the same $10,000 with each trade; if the price were to go down, then you would trade more shares with the same $10,000.

I don't have a spreadsheet for this scenario, as it requires knowing the price action of the stock/commodity a priori versus our previous examples which used profit/loss rather than price.

This is a dollar cost-averaging technique that trades fewer shares as the price goes up and more shares as price goes down.

Martingale Betting Strategy

Martingale is a cost-averaging strategy. It increases your exposure on losing trades. This results in lowering of your average entry price.

Let's say I place a trade with a $1 stake. On each win, I keep the stake the same at $1. If I lose, I double my stake amount with each loss. Gamblers call this doubling-down. This is the Martingale strategy.

The idea is that you just go on doubling your trade size until fate eventually gives you one single winning trade. Due to the doubling effect, you can exit with a profit. The immediate disadvantage is that you need a limitless account size to keep adding shares or contracts. As with other strategies, a losing system will not be made better with a compounding scheme. In the examples below you can see that the $10,000 simulated account expands to $17,050 with the varying contract size and this money management scheme.

MARTINGALE			
	Trade Profit		Equity
this trade	beginning $	P/L	$ 10,000.00
1	100	$ 100.00	$ 10,100.00
1	-50	$ (50.00)	$ 10,050.00
2	100	$ 200.00	$ 10,250.00
1	-50	$ (50.00)	$ 10,200.00
2	-50	$ (100.00)	$ 10,100.00
4	100	$ 400.00	$ 10,500.00
1	-50	$ (50.00)	$ 10,450.00
2	100	$ 200.00	$ 10,650.00
1	-50	$ (50.00)	$ 16,300.00
2	100	$ 200.00	$ 16,500.00
1	-50	$ (50.00)	$ 16,450.00
2	100	$ 200.00	$ 16,650.00
1	-50	$ (50.00)	$ 16,600.00
2	-50	$ (100.00)	$ 16,500.00
4	100	$ 400.00	$ 16,900.00
1	-50	$ (50.00)	$ 16,850.00
2	100	$ 200.00	$ 17,050.00

FIGURE 6 Martingale Strategy Compounding

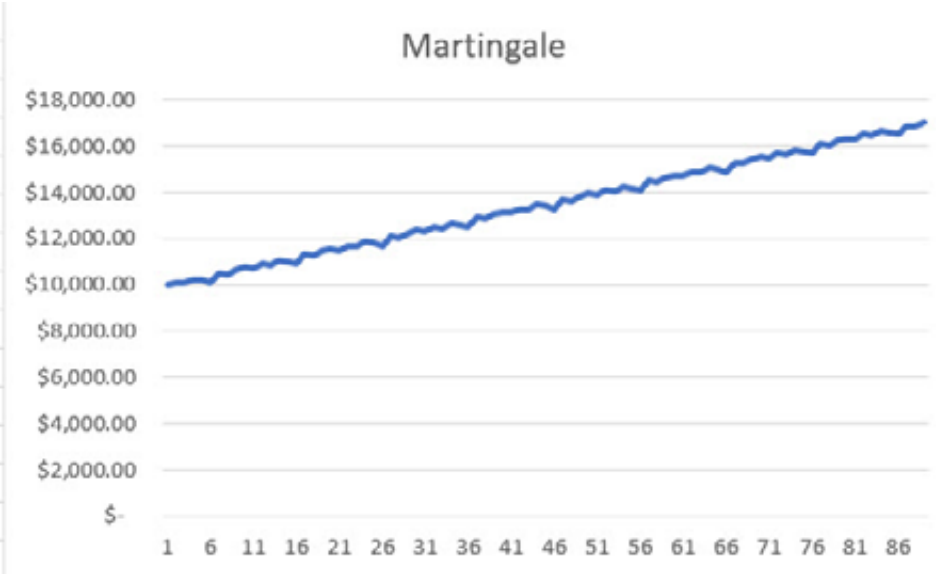

FIGURE 7 Martingale Equity Chart

Anti-Martingale

Another touted scheme is to double down after every win; this is called the Anti-Martingale or Reverse-Martingale scheme. In this system you would double your trade size each time there is a win and half the bet each time there is a loss. This is the opposite of the Martingale strategy.

ANTI-MARTINGALE			
	Trade Profit		Equity
this trade	beginning $	P/L	10,000
1	100	$ 100.00	10,100
2	-50	$ (100.00)	10,000
1	100	$ 100.00	10,100
2	-50	$ (100.00)	10,000
1	-50	$ (50.00)	9,950
1	100	$ 100.00	10,050
2	-50	$ (100.00)	9,950
1	100	$ 100.00	10,050
2	100	$ 200.00	10,250
4	-50	$ (200.00)	10,050
4	-50	$ (200.00)	10,050
2	100	$ 200.00	10,250
4	-50	$ (200.00)	10,050
2	100	$ 200.00	10,250
4	-50	$ (200.00)	10,050
2	-50	$ (100.00)	9,950
1	100	$ 100.00	10,050
2	-50	$ (100.00)	9,950
1	100	$ 100.00	10,050

FIGURE 8 Anti-Martingale Compounding

As you can see from the spreadsheet, this scheme puts on larger trades on losses and fewer contracts on wins. The ultimate result is that this scheme makes even less money than the Unit Trading scheme.

Ralph Vince's optimal-f

Ralph Vince and I go way back. When I first met him, I was a novice trader, more than 35 years ago. His work fascinated me immediately as it was strictly mathematical and gave astonishing results. Ralph clearly outlines his optimal-f theory in his first book, *Mathematics of Money Management*. It is packed with mathematical theory, which makes it a great read for me.

My own Ultimate-F is an outcropping of Vince's work, with the multiplication of trade size being more conservative, and not reaching the ultimate ruin that plagues optimal-f.

Ralph prefers to use the lower case for optimal-f, so I have honored his wishes throughout. Ralph clearly posits that one must have a positive mathematical expectation to (a) have a winning strategy and (b) benefit from any compounding scheme. Here are the calculations:

Mathematical Expectation = (1+A) * P-1

Where: P=Probability of winning

A=Amount you can win/Amount you can lose.

The runs test is essentially a matter of obtaining the Z scores for the win & loss streaks of a system's trades. The Z score is simply the number of standard deviations the data is from the mean of the Normal Probability Distribution.

Here then is how to perform the runs test, how to find a system's Z score:

1. You will need to compile the following data from your run of trades:

   A. The total number of trades, hereaf-ter-called N.

   B. The total number winning trades and the total number of losing trades.

Now compute what we will call X. X = 2 * (Total Number of Wins) * (Total Number of Losses).

C. The total number of runs in a sequence. We'll call this R.

Let's construct an example to follow along with. Assume the following trades:

-3 +2 +7 -4 +1 -1 +1 +6 -1 0 -2 +1

The net profit is +7. The total number of trades is 12; therefore, N = 12. (Note that a trade with a P&L of 0 is regarded as a loss.)

Now we have: - + + - + - + + + - - - +

As can be seen there are 6 profits and 6 losses. There are 8 runs in this sequence.

2. Solve for the equation:

   N * (R-.5) – X

3. Solve for the equation:

   (X * (X-N)) / (N-1)

4. Take the square root of the answer in number 3.

5. Divide the answer in number 2 by the answer in number 4. This is the Z score.

6. Now convert the Z score to a confidence limit from the table in the book.

If the Z score is negative, simply convert it to positive when finding your confidence limit. A negative Z score implies positive dependency, meaning fewer streaks than the Normal Probability Function would imply, and hence that wins beget wins and losses beget losses. A positive Z score implies negative dependence, meaning more streaks than the Normal Probability Function would imply, and hence that wins beget wins and losses beget losses. A positive Z score implies negative dependence, meaning more streaks than the Normal Probability Function would imply, and hence that wins beget losses and losses beget wins.

Profit Factor

PF = (W% * AW) / (L% * AL)

where: W% = Percentage of winning trades L% = Percentage of losing trades (or 1 – W%). AW = Average winning trade amount.

AL = Average losing trade amount.

The PF can also be expressed as: [If you find dependency] you can alter your behavior accordingly to make better trading decisions, as long as the dependency is at an acceptable confidence limit.

Unless dependency is proven to a very high confidence limit, all attempts to change your trading behavior based on changes in the equity curve are futile and may even be harmful.

Using the previous equity from each trade and increasing the number of contracts/shares with each $200 increase in equity, the number of contracts/shares grows exponentially to a large number.

optimal-f # Contracts		Vince optimal-f Equity
1	$	1,100
1	$	1,050
1	$	1,150
1	$	1,100
1	$	1,050
1	$	1,150
1	$	1,100
2	$	1,300
212	$	32,600
159	$	48,500
238	$	36,600
179	$	54,500
268	$	41,100
201	$	31,050
151	$	46,150
226	$	34,850
170	$	51,850

FIGURE 9 optimal-f Compounding

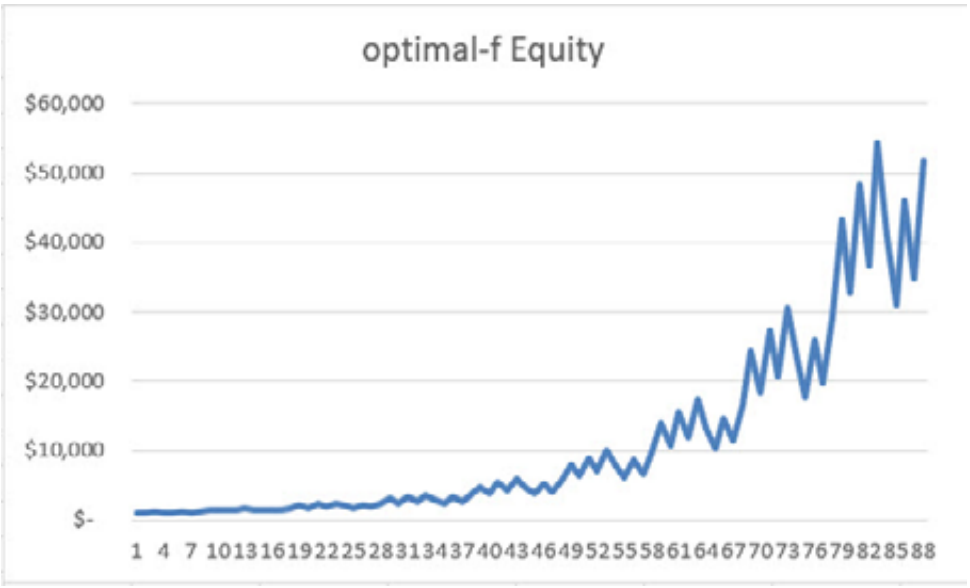

FIGURE 10 optimal-f Equity Chart

Notice in the chart in Figure 10 that the equity increases dramatically and decreases just a dramatically. In several cases the drawdown exceeds $12,000. Most traders cannot weather the drawdown and stop using this scheme at the worst drawdown. Nevertheless, one can readily see that this compounding scheme yields the highest return for our simulated trades, reaching $51,850.

Ultimate-F (by Sunny Harris)

As stated earlier, my own Ultimate-F is an outcropping of Vince's work, with the multiplication of trade size being more conservative, and not reaching the ultimate ruin that plagues optimal-f. Rather than increase my trade size based on the accumulated equity, I simply increase trade size based on the unit equity stream and for my own trading I limit the number of contracts to avoid

the risk of ruin.

QTY	TRADE WIN/LOSS	TRADE P/L	UNIT EQUITY	# contracts for this trade	Ult-F trade P/L	Sunny's Ult-F Equity
1	100	$ 100.00	$ 1,100	1	$ 100.00	$ 1,100
1	-50	$ (50.00)	$ 1,050	1	$ (50.00)	$ 1,050
1	100	$ 100.00	$ 1,150	1	$ 100.00	$ 1,150
1	-50	$ (50.00)	$ 1,100	1	$ (50.00)	$ 1,100
1	-50	$ (50.00)	$ 1,050	1	$ (50.00)	$ 1,050
1	100	$ 100.00	$ 1,150	1	$ 100.00	$ 1,150
1	-50	$ (50.00)	$ 1,100	1	$ (50.00)	$ 1,100
1	100	$ 100.00	$ 1,200	1	$ 100.00	$ 1,200
1	-50	$ (50.00)	$ 3,000	10	$ (500.00)	$ 9,200
1	100	$ 100.00	$ 3,100	10	$ 1,000.00	$ 10,200
1	-50	$ (50.00)	$ 3,050	10	$ (500.00)	$ 9,700
1	100	$ 100.00	$ 3,150	10	$ 1,000.00	$ 10,700
1	-50	$ (50.00)	$ 3,100	10	$ (500.00)	$ 10,200
1	-50	$ (50.00)	$ 3,050	10	$ (500.00)	$ 9,700
1	100	$ 100.00	$ 3,150	10	$ 1,000.00	$ 10,700
1	-50	$ (50.00)	$ 3,100	10	$ (500.00)	$ 10,200
1	100	$ 100.00	$ 3,200	11	$ 1,000.00	$ 11,200

FIGURE 11 Ultimate-F Compounding

With this scheme the equity does not reach the $51,850 demonstrated by Ralph Vince's optimal-f, but is still, at $11,200, respectably higher than the $3,200 of the Unit Equity. I use my scheme for my own trading as I don't relish large drawdowns.

FIGURE 12 Ultimate-F Equity

Conclusion

I am not trying to present the authoritative work on compounding schemes herein. I am simply sharing with you what I have learned over the last 40 years, and what I have found works for me. To learn more about any of these schemes, turn to online sources.

If you have questions or want to discuss these concepts, don't hesitate to email me at sunny@moneymentor.com, or give me a call at 1-760-908-3070 after market hours.