MONEY MANAGEMENT

Guy Bower delves into a topic every trader should endeavour to master - money management.

Many of us have read Jack Schwager's *Market Wizards* books at least once. As you may recall it shows that traders each have their own way of trading; their own experiences; their own philosophies and their own outlook. However one common theme seems to be their reliance on what they call 'money management'.

When I read the first book in 1990 I had no idea what money management was. Was it making sure your stops are in place? Was it just being careful with your cash? What was it?

Money management in the context of trading refers to what a gambler might call 'bet sizing'. It is how many contracts to trade on a certain strategy, given a certain bankroll.

In my experience with retail investors, the number of contracts to trade is normally an arbitrary consideration. One contract, five contracts, ten contracts – whatever you can afford. I have known traders who spent countless hours studying Gann, or testing indicators, or drawing little lines all over their little charts. But when it came to placing the bet, there appeared to be no consideration to the position size. Someone even said to me recently, "*It doesn't matter how much you bet as long as it's a good trade.*" We will use a really simple example to explain why such thinking is incorrect.

Suppose you are invited to play a coin toss game. Tossing heads means you win two units and tossing tails means you lose one unit. Suppose you are given $4 as a starting bankroll. You can bet as much or as little as you like and play the game many times over. It is clear the odds are stacked in your favour. $2 for a win versus $1 for a loss. That's a 'good trade'. But how much do you bet? There are a number of ways to approach this one. We will look at three:

- Fixed dollar amount
- Percent at risk method
- Optimal fixed fraction trading

FIXED DOLLAR AMOUNT

This involves an arbitrary decision, placing one bet (or trading one contract) for a fixed amount of account equity. It is probably the simplest, and for that reason, the most common, money management technique.

In the coin toss example, we would place one bet for every $2.00 in the account. So in this case we would win $4.00 or lose $2.00 on the first toss. Based on the outcome, we would then adjust the amount we bet but still keep it at one bet per $2.00 equity.

When trading futures, this is the same as trading one contract per $x in your account.

The downside in trading multiple futures markets using this technique is that it does not address the unique characteristics of each market with respect to your system. For example, trading one contract per $5,000 in Eurodollars is probably rather conservative. In contrast, trading one contract per $5,000 in Nasdaq futures would be ridiculously risky.

Additionally, the fixed dollar amount method does not distinguish between a volatile trading system and a steady one. To reduce risk a volatile system should trade fewer contracts than a steadier system.

PERCENT AT RISK METHOD

The next most common, and quite sensible, approach to money management is to risk only a fixed percentage of your capital on any one bet or trade.

In the coin toss example it would mean picking a percentage loss you are comfortable with and betting that proportion of capital on each bet. You might, for example, be willing to risk 10 per cent of your capital each time. Given six alternating outcomes, your equity would look like figure 1.

The advantage of this method is that your bet size, and potentially your equity, grows at a steady pace.

Looking at futures, let's say you have a trading system in the SPI where you run with $200 stops. Giving a small allowance for slippage and commissions, let's say the worst outcome is a loss of $300 per contract on a trade.

With the percent at risk method you trade a certain number of contracts that would make your maximum loss no more than a fixed percentage. If you are trading with a bankroll of, say, $100,000, and wish to risk not more than five per cent of that value on any one trade, then you take five per cent of $100,000 or $5,000. Divide this by $300 and you get:

$$\frac{(5\% \times \$100{,}000)}{\$300} = 16.7 \text{ contracts}$$

So with this system and method, you would trade 16 contracts (rounded down from 16.7).

In the *Market Wizards* books, many of the traders said they would risk from one per cent to five per cent of capital on any one trade. So there is some

■ FIGURE 1

Toss	Win/Lose	Starting Equity	10% Bet	Win/lose Amount	Ending Equity
Heads	Win	$4.00	$0.40	$0.80	$4.80
Tails	Lose	$4.80	$0.48	($0.48)	$4.32
Heads	Win	$4.32	$0.43	$0.86	$5.18
Tails	Lose	$5.18	$0.52	($0.52)	$4.67
Heads	Win	$4.67	$0.47	$0.93	$5.60
Tails	Lose	$5.60	$0.56	($0.56)	$5.04

suggestion that this is the method they may have used.

The first and obvious disadvantage of this method is the need to round up or down on contract numbers. This has particular impact on smaller equity amounts.

The real negative of the method is that most people would pick a percentage based on their risk preferences, but that is not necessarily the best percentage for the system being traded.

Think about it. If we have a mechanical system where we can define things like maximum loss and probability or frequency of loss, then surely there must be some type of mathematical method of working out the optimal amount to risk.

Well there is! It is called the Optimal f, or Optional fixed fraction trading.

TRADING WITH OPTIMAL F

Believe it or not, the mathematics of this system has its roots in solving the problem of interference in data transmission over telephone lines. The system was adopted for gambling and then again for trading futures.

Optimal f refers to the mathematically optimal fixed fraction of total equity that is allocated to any one trade. The optimal fraction is defined as the one that offers the maximum long-term growth of equity.

Optimal f is really no different from the percent at risk method, except that we have mathematically determined the figure that will produce the best long-term profits.

For trading systems, the mathematics of Optimal f simply takes into account system parameters as defined by your past results (or hypothetical results) and returns a figure that represent the dollars in your account. This figure tells you how many dollars in your account should represent one contract.

The formula itself is just a little too detailed to list here, so, as they say on TV, "here's one I prepared earlier." I have placed an Excel template and instructions for Optimal f on my website at *http://www.guybower.com/articles.htm*

For those wanting to head down this path I strongly recommend Ralph Vince's first book *Portfolio Management Formulas*. It is heavy on the maths, but the proof is very convincing.

PLAYING WITH COINS

The Optimal f formula will return a decimal that is equivalent to the fraction of the total equity. To come to the amount to trade, you divide the largest loss by this fraction.

In our coin example, the optimal f is 0.25. The largest loss, as we know, is $1.00:

$$\frac{\$1.00}{0.25} = 4$$

Therefore we would bet one unit (dollars) every $4.00. This is the figure that, without question, offers the best long-term growth given the payoff levels ($2 profit and $1 loss) and probability (50 per cent for each).

The same goes for more complex futures trading systems where you have a measurable string of profits and losses. You can use the Optimal f calculation to determine the fixed fraction position size that would have resulted in maximum equity growth given those parameters.

THE PROOF IS IN THE TOSSING

So how much advantage does Optimal f give you? Is it really worth learning the maths? Would it be OK to just make a rough guess at the optimal fraction and trade that way?

Well, the numbers are nothing short of astounding. Let's say we give three traders a bankroll of $100,000 each and have them trade a fixed fraction of equity.

For some reason the first three names that have popped into my head are Peter, Paul and Mary – so we will use those. Peter is conservative and bets 10 per cent. Paul has done some homework and knows to bet 25 per cent. Mary arbitrarily chooses 40 per cent - thinking "It's only risking less than half of my money, and that's not too bad".

If we simulate using alternating returns (profit, loss, profit, loss…etc), then after 50 trades we would have the equity indicated in figure 2.

Peter (10%) and Mary (40%) have the same outcome. Starting with $100,000, they both end up with

FIGURE 2

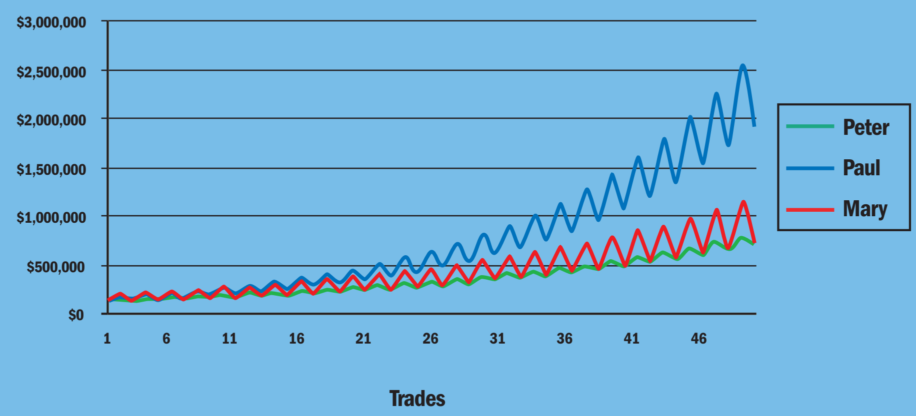

FIGURE 3

SYSTEM A

50	-100	50
-75	50	-50
50	50	75
60	35	-100
40	-50	50
50	80	-10
-50	-100	

SYSTEM B

50	60	50
75	40	75
50	50	60
75	-100	-500
-500	50	50
50	80	50
50	50	

	System A		System B
Total Trades	20	Total Trades	20
% Winners	60%	% Winners	80%
% Losers	40%	% Losers	20%
Profit/Loss	$105	Profit/Loss	-$135
Mathematical Expectation	+$12.50	Mathematical Expectation	-$6.75

just less than $685,000 – a return of 585 per cent! Not too bad.

Paul, on the other hand, has just over $1,900,000 - a return of over 1,800 per cent! It is very interesting to note that for such seemingly small changes in bet size, the optimal fraction showed a return of more than three times the others.

Another interesting point about Peter (10%) and Mary's (40%) results are that drawdowns for the 40 per cent allocation are up to six times that of the 10 per cent allocation. So you make the same amount of money for six times the worry! In other words, it is clearly better to err on the lower side of the Option f figure.

Now ask yourself this question. If you were presented with this game (the 2:1 coin toss), and you wanted to make the most money, what would be your approach?

What if you decided to be very aggressive and bet, say, 55 per cent of your stake on each toss? You would go broke with a probability that approaches 100 per cent the more you play. In the 50-toss example, you would end up with a loss of 75 per cent! That is a loss of 75 per cent from a game that has such advantageous odds.

I hope these figures will convince you that there is something to this 'money management' stuff.

MATHEMATICAL EXPECTATION

You may have got to this stage of the article and be thinking, "Hey, remember that sorry little system I designed that never made any money? Maybe with a clever money management strategy that thing would work!"

Unfortunately, it's not that easy. Any system will still have to make money under the simplest of money management strategies to then make more money under the Optimal f method.

In statistical terminology, the system has to have a positive mathematical expectation. A mathematical expectation is what you would, on average, make per trade. This figure has to be positive. That is, you have to be able to make money on each trade on average.

The figure is quite simple to calculate for simple examples. Back to the coin toss. If you could play the coin toss game where you win \$1 for heads and lose \$1 for tails, then you can easily figure out that on average you would break even, right? In technical terms it is calculated as:

$$= P(W) \times W + P(L) \times L$$

Where
W = profit per winning bet
P(W) = probability of that win
L = loss per losing bet
P(L) = probability of that loss

For the coin toss the mathematical expectation is:

$$50\% \times \$1.00 + 50\% \times -\$1.00 = \$0.00$$

That one is pretty straightforward. What about our \$2.00 win and \$1.00 loss game? The mathematical expectation for that one is:

$$50\% \times \$2.00 + 50\% \times -\$1.00 = +\$0.50$$

On average, each game will win 50 cents. That is why you would play it under virtually any money management method.

If, however, the win payout was \$0.75 for a heads and the loss for a tails was still \$1.00, it would not make sense to play. Your mathematical expectation is:

$$50\% \times \$0.75 + 50\% \times -\$1.00 = -\$0.125$$

On average you would lose 12.5 cents per bet. Nothing but luck would help you make money in the long term on this one. This, interestingly enough, is how a casino makes money. All casino games have a probability of winning and a probability of losing. A casino will set its payouts such that no game ever has a positive mathematical expectation. When you think about it this way, you wonder why anyone would ever go to a casino.

So how can you calculate your mathematical expectation on your futures system? If you cannot work out a probability distribution on your trades, then you can simply use past results.

Let's say we have two systems, System A and System B. (Figure 3 indicates the results after 20 single contract trades.) If we assume that these 20 trades are indicative of the systems overall, then we can simply take the average to work out the mathematical expectation. System A shows a positive expectation despite having a lower proportion of winners. System B wins more often but has a negative expectation given the size of a couple of the losses.

System A would be suitable for an Optimal f calculation. System B would have no Optimal f since it cannot make money in the first place.

Using the spreadsheet provided, the Optimal f for System A works out to be 0.13. Dividing the largest loss by this figure we get:

$$\frac{1.00}{0.13} = \$769$$

This means you would trade one contract per \$769 to achieve maximum long-term growth from this system. A lower dollar figure would mean more risk, resulting in lower long-term growth (on average). A higher dollar figure would mean you would not be using the system to its potential and your returns would suffer.

A figure greater than or less than the Optimal f number will result in lower returns in the long run.

PITFALLS OF USING OPTIMAL F

The first pitfall is making the assumption that future results will match those of the past. This all comes down to your testing methods. The most important figure is the estimate of the largest loss. You have probably not been trading long enough if you have never been surprised by the extent of a loss in unusual circumstances (for example, September 11). There is then a real problem picking what the exact loss should be. Should you assume your system will run into another September 11 scenario? Should you take that month out of your figures? Each side of the argument has its pros and cons.

Another danger area is the volatility of returns. Optimal f will show you the number of contracts to trade to maximise profits. However drawdowns can be significant, particularly if you experience sequential losses. Anyone using Optimal f should be prepared for this.

The way around significant drawdowns caused by sequential losses is to trade multiple un-correlated systems at any one time. In English, that means to diversify. If, on the other hand, you were to design a great system for one market and invest all your money in that, then you would have to be prepared for significant drawdown solely thanks to Optimal f.

VARYING BET SIZE BASED ON PREVIOUS RESULT(S)

In all of the above we have assumed that any one profit or loss from your system has no bearing on the next profit or loss. That is, there is no sequential relationship or correlation. This is something many people do not think about.

Head on down to the roulette table at pretty much any casino and you will see an electronic screen showing some statistics of past spins - things like '% black versus red'; '% odd versus even' and the outcomes of the last few spins. The idea is that the gambler will use this information to work out where to place the next bet. You would expect the number of blacks and number of reds to both be close to 50 per cent, right? So if blacks drop and reds rise, you might think, "Hmmm, chances are black will come up next."

If you are laughing at this suggestion, don't. Some people do actually think this will work. If you are one of them ask, "How?" How could it possibly work? Is there any way that the last spin has anything to do with the next spin? How could it? How then can you make a betting decision based on past spins? It's ridiculous.

Some people do make these decisions and in the markets it's even more common. After a string of losses, a trader might say, "Chances are my luck will turn around and the next trade will be a winner." Based on this type of thinking a trader may increase or decrease position sizes.

In roulette this is a stupid strategy (you may think playing roulette in the first place is stupid) because it has everything to do with dependency. One spin has no bearing on another. In the markets, most mechanical trading systems are similarly independent. One trade will have no bearing on another. I have seen systems that do have some form of correlation, but they are rare. If, then, we were to make one assumption, it would be that a time series of trade results are not correlated. Therefore any betting strategy that increases or decreases the bet size based on one of a string of past profits of losses, does not make sense – just like the roulette example.

SUMMING UP

The Optimal f method of position sizing shows incredible results over and above any other method of sizing. Ultimately, however, the benefits rest entirely on the accuracy of the parameters used in the calculation. This of course comes down to your testing and your homework. Unfortunately, nothing comes free. YTE

Reading guide

Balsara, N. 1992, *Money Management Strategies for Futures Traders*, John Wiley & Sons, New York.

Schwager, J.D. 1993, *Market Wizards: Interviews With Top Traders*, HarperBusiness, New York.

Schwager, J.D. 1994, *The New Market Wizards: Conversations With America's Top Traders*, HarperBusiness, New York.

Vince, R. 1990, *Portfolio Management Formulas*, John Wiley & Sons, New York.

Vince, R. 1992, 1st edn, *The Mathematics of Money Management: Risk Analysis Techniques for Traders*, John Wiley & Sons, New York.

Vince, R. 1995, 1st edn, *The New Money Management: A Framework for Asset Allocation*, John Wiley & Sons, New York.

Guy Bower is a Director of CDM Trading, offering a managed options trading service. He is also the author of two books: Options: A Complete Guide and Hedging: Simple Strategies. Web: www.guybower.com Email: guy@guybower.com