

PORTFOLIO-LEVEL COMMODITY TRADING

*Maximizing Risk-Adjusted gains with Trade Management*

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**We take a \$50,000 Futures Account to Over \$500 Million  
Using Sensible but Little-Known Money Management Techniques**

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What in thunder has the editor been doing for the past three months? At first tentatively, then with growing anticipation, and finally with eager excitement, I wound up exploring a whole new realm of trading—one that I think you'll find equally absorbing. Broadly defined, money management is the practice of rating a trade's prospects for success and graduating the scale of the investment to the likely risk and reward. This is a topic often touched on in trading books and financial workshops but one rarely examined in depth. Like many of us, I long viewed money management as secondary to the ceaseless quest for more accurate timing methods.

Just about every day I am privileged to talk with professional commodity traders, some of them quite well know. Our discussions range from new technical tools and trading systems to regulatory compliance and industry gossip. In the five years I've published this letter, I don't think the subject of portfolio management has come up once in these chats.

To be sure, some veterans of the seminar circuit have practically built careers around the topic of money management. I long regarded this faction as a kind of professional cult, sincere but out of touch with the real imperatives of trading. The most partisan among these enthusiasts claim that money management is more vital to trading success than timely entry and exit

signals. I once dismissed this claim as the messianic message of an eccentric sect. No longer. This report will document the Conversion.

I had been an active trader for nine years before I found a helpful treatment of money management in the commodity literature. It came in Bruce Babcock's indispensable *Dow-Jones Guide to Commodity Trading Systems*. Near the end of the text, which was otherwise largely devoted to mechanical timing methods, Bruce shifts course to explore issues of trade management. We learn that small changes in money management can have a big impact on the bottom line. Frankly, I was a bit disconcerted when the discussion turned to casino-style betting strategies, a domain I considered inferior to the loftier pursuit of unseating the random walk theory. But I had to admit the tactics Bruce described were surprisingly effective.

In time this fleeting interest subsided and I got back to the familiar task of building better indicators. Then, in 1994, *Futures* magazine asked me to review a software product called "The Allocator," written by Ralph Vince. I had met Ralph and knew of his reputation for pioneering work in the field on money management. The Allocator was designed to assist large commodity traders in optimally structuring their portfolios. Unfortunately, the esoteric logic and Ralph's complex mathematical

derivations were way over my head. Once again my interest in money management trailed off. (Today I count Ralph a good friend, but I don't profess to understand most of what he says.)

Fast forward to last summer. FORMULA RESEARCH subscriber George Bagsarian asks me to look over a family of original trading systems he developed. George employs a variety of technical indicators but his systems share some common characteristics. First, each is designed to trade a portfolio of futures rather than a single market. A diversified basket of commodities cuts risk because outsized losses are offset by outsized gains. Diversification can also increase profits. If your system has an edge, you can apply it to more opportunities.

Just as important, the number of contracts traded varies with the circumstances. If you are flush with profits you trade in larger size. If you are thinly capitalized you have to cut back. Likewise with risk control. If your stop is very tight, you can put on more contracts at the same level of dollar risk than if your stop is very wide. As we will see, it is possible to methodically adjust these elements to achieve either higher returns, lower risk, or both. What's refreshing in George's trading systems is that money management takes center stage.

George's systems had another feature in common. Each was created with a software product called "Trading Recipes." I had never heard of Trading Recipes when the developer of the program, Bob Spear, sent a copy for possible review in this publication. Bob's gesture was appreciated since Trading Recipes retails for \$2,500. I assured him that I would feature his program at the very next opportunity. That was three years ago—a lapse only someone with my aversion to punctuality could inflict on a person as talented and good-natured as Bob.

How to describe Trading Recipes? It's a bit like TradeStation in that it offers a flexible, high-level command language. You can test virtually any system with straightforward code. Unlike TradeStation, Recipes is DOS-based and lacks Windows fetching graphics. Trading Recipes bears a resemblance to SystemWriter, the DOS predecessor to TradeStation.

What makes Recipes unique is that you can test a system across a portfolio of commodities. You specify the composition of the portfolio, whether two markets or 50. Also, the program lets you easily test a variety of money management strategies. As an example, suppose your system gives a buy signal and you want to know how many contracts to put on. Recipes lets you set the number of contracts so that the risk is limited to, say, 2% of equity. These limits apply across the entire portfolio.

Consider another scenario. Most position traders will have several trades open at any given time. Suppose you are suddenly stopped out of every single position. Such a setback could put you out of business if you were trading aggressively. Using simple commands, Recipes makes it easy to limit exposure on the entire portfolio to, say, 15% of equity.

Recipes can help insure your portfolio is diversified. You can instruct the program to avoid undue concentration in a single commodity complex. For example, if 20% of your dollars at risk are already in the energy sector, you might want to reject the next crude oil trade. A variant might be to limit the number of open trades in a single complex. For instance, if you already have positions in gold, silver and copper, you might want to skip the next silver trade.

If all this sounds like a glowing endorsement of Trading Recipes, well it is. As this study should make clear, Recipes is an authentic breakthrough. But let me say a

few words of caution. Recipes is geared to the professional rather than the casual trader. You should be an experienced computer user. Documentation is scant. Expect little or no technical support. Graphics are clunky. The DOS interface is antiquated. You cannot use a mouse. There is no optimization feature. Processing time can be agonizingly slow.

The fact remains that Recipes is unique among system-testing software. It is the only program I know of that can track a portfolio of commodities in dynamic interaction. This means you can simultaneously test across multiple markets while constantly adjusting position size to total equity and risk. As you will see, analysis at the portfolio level opens up striking opportunities. In effect, you can use Recipes to choose a rate of return appropriate to your risk tolerance and capitalization.

The program offers other features too numerous to mention. Bob Spear labored more than three years on the project. Just as he was preparing to market his program in earnest, Bob's career took an unexpected turn. He decided to become a practitioner, not a vendor. In 1994 Bob linked up with system designer and longtime FORMULA RESEARCH subscriber Alex Spies to start Annapolis Capital Management, a trading firm. With an initial stake of \$2 million, assets under management have skyrocketed. No doubt a good measure of the success they've enjoyed can be credited to Trading Recipes.

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## Introduction to Portfolio Management

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Let's start with a simple trading system to illustrate how money management can affect, even dominate performance. This case study, adapted with permission

from the trading Recipes manual, is particularly revealing. Our system looks for a pattern of weakness and then goes long on an apparent upside reversal.

The setup for a buy signal is two lower lows followed by a higher low. Assume today the setup was satisfied. You enter long on tomorrow's close if two other conditions are met. First, today's close must be above a 28-day simple moving average. Second, tomorrow's open must be greater than today's close. Once long, trail a stop at the lowest low of the past ten days. Short trades are the mirror image of long trades.

We will test this simple system on the four major foreign currencies—Japanese yen, German mark, Swiss franc, and British pound. Our test period is 1984 through 1988. Trading single contracts, the four-market portfolio gained \$63,087. All performance figures in this study allow \$100 per trade for slippage and commissions.

Suppose you start with a \$50,000 account. With just over \$63,000 in profits, Recipes reports the compound annual return (CAR) is 18.2%. Recipes treats drawdown as the maximum dip in open equity. You can measure drawdown in terms of percent or actual dollars. Recipes reports both along with their respective dates (which rarely coincide.) Here the drawdown figures are 29% and \$22,863. Recipes also tells us the duration of the longest drawdown, in this case 16 months. (This useful statistic reports the longest period in which your account made no new equity high. In effect, this is a third, temporal specification of drawdown.)

Now let's experiment with some trade management tactics. The entry and exit rules remain exactly the same, but we will vary the number of contracts traded. Recall that our exit point for long trade is the lowest low of the past ten days. For short trades the stop is the highest high of the past

ten days. Now we can calculate our risk. (Of course, we are only estimating the risk since a gap opening could blow through our stop.) Having a predefined stop is critical to the money management functions of Trading Recipes.

Suppose our system tells us to buy the Swiss franc at today's close. Toward the end of the session we monitor the close and compute the distance to our stop point—the lowest low of the past ten days. We determine that a fill at current prices would expose us to a theoretical maximum loss of \$1,500 per contract (including slippage and commissions). How many contracts do we trade?

Well, let's start by limiting the risk per trade to 5% of equity. With \$50,000 in account, we have \$2,500 to commit to the market. That is enough to purchase one contract (with \$1,000 left over). If we limited risk to 2% of equity (\$1,000), the trade would be rejected. If we wanted to risk 10% of equity per trade, we could trade three contracts. (See box.)

$50,000 * .10 = 5,000$ $5,000 / 1,500 = 3.33$ <p>Round down to 3 contracts</p>
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So what happens when we limit exposure to 5% of equity? First, several trading signals are rejected because the risk is too high. Of 136 potential trades, 17 signals were ruled out. As for the trades that were taken, position size varied greatly, from single lots to as many as 25 contracts.

The greater presence in the market had a big impact on the bottom line. Profits doubled to \$132,000, CAR of 30%. Unfortunately, drawdown also soared to 48%. The longest equity dip fell only modestly to 16 months. Apparently our

efforts at risk-control were not entirely successful.

Another sign of unwelcome risk in our results is that three margin calls were generated. Recipes will mark your position to the market and track margin much like a brokerage firm. (You can adjust the margins used in Recipes' internal calculations. Mine came from my broker, Lind-Waldock.) One way to eliminate margin calls is to cap the percentage of equity allocated to margin. We will size our "bets" so that total margin never exceeds, say, 20% of equity.

Assume we have a \$50,000 account. Assume also we are already long one Swiss franc with margin of \$1,750. Now we get a buy signal for the British pound, with margin of \$1,650. To cap total margin at 20% of our equity, we could trade up to 5 contracts ( $[(50,000 * .20) - 1,750] / 1,650 = 5$ ). Assume we take the five-lot trade. Our total margin is now \$10,000 ( $[5 * 1,650] + [1 * 1,750]$ ), exactly 20% of equity.

Back to improving our system. We have two money management filters to work with. We cannot risk more than 5% of equity per trade. And we will limit margin on all open positions to 20% of equity. To be conservative, we will choose whichever formula prescribes the least number of contracts.

Results are very different with these new rules. The margin calls disappear. Drawdown falls from 48% to 38%. And the longest drawdown period was cut in half, from 16 months to 8 months. Clearly risk has receded. Meanwhile, the profit-side of the picture is just as bright. Trading gains actually climbed to \$194,000, a 38% annual return.

We can push the envelope further. Now let's risk 10% of equity on each trade. And instead of a 20% cap, up to 50% of our equity is committed to margin. Here the

compound annual return soars to 63%. A \$50,000 stake grows to \$535,000. This is the same system that yielded \$63,000 in profits with single contracts! Of course, such returns come at a cost. In this case drawdown climbs to a punishing 62%. But the example underscored how seemingly small adjustments in trade management can drastically affect performance.

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### George Bagsarian's ATR System

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George Bagsarian is a man with a purpose. Currently he is a successful small businessman. He would like to become a Commodity Trading Advisor (CTA). The interesting trading systems he developed confirm George possesses all the necessary technical expertise. His friendly bearing coupled with reserves of determination show he has the psychological wherewithal as well. Like Bob Spear, who nimbly shifted from software developer to money manager, George Bagsarian welcomes the challenge of transition.

Our point of departure for the rest of this study will be George's ATR system. ATR is short for average true range. First we will describe the system rules. Then we will show how money management techniques can alter the expected risk and reward. Before going further, note that most of ATR's indicator values are Fibonacci numbers. George chose these parameters not for their mystical properties but simply to avoid curve-fitting.

ATR is a breakout system with two creative exits. Here are the buy-side rules. (Short sale trades are the mirror image of long trades.) Place a buy stop tomorrow one tick above the highest high of the past 84 days. If you are filled there are two ways to get out. Choose the tighter of the two stops.

The first exit is a dynamic trailing stop. Each day record the session's true range. The true range is the true high minus the true low. The true high is the higher of today's high or yesterday's close. The true low is the lower of today's low or yesterday's close. The true range helps adjust for price gaps.

Multiply the true range by four. Calculate an 8-day exponential average of this product, which we will call  $P$ . On the first day of the trade your stop is the entry price minus  $P$ . Thereafter, subtract  $P$  from each day's close. If the result is higher than the current exit, raise the stop to the newly computed level.

The second exit is a volatility stop. Each day divide the close by its 144-day simple moving average. The result is a relative strength indicator we can call  $R$ . (In this study we use back-adjusted continuous contracts. Whenever you perform ratio calculations with such data, you will get different results than if you had used actual prices. I am not overly concerned about this perennial problem. The biggest discrepancies will occur in the distant past. Note that analysts like Tushar Chande and Robert Barnes actually encourage use of simulated market data to bolster a system's robustness.) Take a 21-day simple moving average of  $R$ . Plot bands at intervals 3% above and below the 21-day smoothing. If  $R$  drops below the lower band, exit the trade on tomorrow's open.

As noted, use whichever stop is closest to the market. Also as noted, sell signals are the exact opposite of buy signals.

The ATR system can be applied to any commodity (or stock). Obviously, some markets will produce better results than others. A major question is which commodities to select for our trading portfolio. If you are not careful, you could choose an unrepresentative mix that worked

will in the past but may falter in the future. The question of portfolio selection raises some of the same issues of curve-fitting we often encounter when optimizing indicators. You could write an entire book about the implications.

I wound up using a very simple method to choose which markets to trade. I began with an isolated segment of data, the period 1984

through 1994. I tested ATR on 27 futures markets during this eleven-year span. It turned out 19 of the 27 commodities were profitable. The table below shows all 27 markets grouped by complex. The shaded commodities were those that did not show a profit and were therefore dropped from further testing. Notable among them was the S&P 500, which the trend-following ATR system simply cannot handle.

<b>Currencies</b>
British Pound
Deutchmark
Japanese Yen
Swiss Franc
<b>Energy</b>
Crude Oil
Heating Oil
<b>Grains and Soy</b>
Corn
Soybean Meal
Soybean Oil
Soybeans
Wheat
<b>Interest Rates</b>
Eurodollar
10-Year T-Notes
30-Year T-Bonds

<b>Meats</b>
Live Hogs
Pork Bellies
<b>Metals</b>
Gold
Silver
Platinum
Copper
<b>Softs &amp; Fibers</b>
Coffee
Cotton
Orange Juice
Cocoa
Sugar
<b>Stock Index Futures</b>
S&P 500

The surviving 19 markets became our trading portfolio. The next step is to test the same markets forward and back in time. The first out-of-sample period was September 1981 through December 1983, 28 months. The second out-of-sample period was January 1994 through April 1997, also 28 months. The entire test period covered almost 16 years. The in-sample span represented 70% of the data. Each out-of-sample period covered 15% of the data.

Trading single lots across 19 markets from 1981 to 1997, ATR gained \$561,863.

If you started with a \$50,000 account, the compound annual return is 17.4%. There were 1,032 trades of which 460 were profitable (46%). Maximum drawdown was high at 45%.

Performance was notably better in the first out-of-sample test period than in the second. Between 1981 and 1984 ATR gained 36% a year. From 1995 to date, the return dropped to just 2.8% a year. This is a disappointment, but it should not detract from our main focus. As we will see, money management can actually help offset

the periodic lapses inevitable in most trading systems.

Let's test the ATR system once more but this time with two money management filters. First, we will risk only 3.5% of equity on any given trade. Second, we will limit our trading so that total equity at risk never exceeds 11% of our capital.

Keeping everything else the same but using these risk-control tactics greatly improves results. The compound annual return climbs from 17% to 22%. Profits double from \$561,000 to \$1.1 million. Despite the increased returns, drawdown actually drops from 45% to 25%. Even the poor showing in the second out-of-sample test period improves. The CAR climbs from 2.8% to over 11%, not a phenomenal return but a step in the right direction. You can see the equity curve in the chart below.

ATR EQUITY CURVE  
Equity at Risk Limited to 11%

1981	\$50,000
1986	\$120,000
1991	\$750,000
1996	\$1,120,000

Let's make a simple change. Instead of limiting money at risk to 11% of equity, we cap total risk at 12.5%. All other conditions are unchanged. Believe it or not, with this slight adjustment profits double once again, to \$2.2 million. The compound annual return climbs to 27.6%. Meanwhile drawdown increased modestly to 27%. A seemingly simple change had a huge effect on performance. The equity curve appears below.

ATR EQUITY CURVE  
Equity at Risk Limited to 12.5%

1981	\$50,000
1986	\$240,000
1991	\$1,000,000
1996	\$2,240,000

Now we increase the risk cap to 17.5%. In other words, total dollars at risk on all open positions cannot exceed 17.5% of capital. Profits now soar to \$9.6 million. The compound annual return climbs to 40.0%. As you might expect, our more aggressive posture also increased risk. Drawdown climbs to 36% (still comfortable below the CAR).

Also worth noting are higher gains in the two out-of-sample periods. In the troublesome second span (1995 to date), the CAR climbed to 14.6%, up from an initial 2.8%. The real fireworks came in the first out-of-sample period (1981-83). Here the ATR system gained 51% annually. The equity curve appears below.

ATR EQUITY CURVE  
Equity at Risk Limited to 17.5%

1981	\$50,000
1986	\$720,000
1991	\$7,000,000
1996	\$9,610,000

I spent hundreds of hours testing the ATR system with a variety of money management tactics. The most profitable of the variants returned 65.7% a year. As you would expect, drawdown was correspondingly high at 55%. (For those interested, this high return/high risk variant allowed you to risk 5% of equity on a given trade. You could risk up to 30% of your equity on all open positions. There were no restrictions at all to promote portfolio diversification.) You would not want to trade this model, but I find it amazing that largely through trade management, a \$50,000 account can grow to \$133 million in under 16 years.

By the way, a striking \$45 million of those profits were earned in the second out-of-sample period, that span of just 28 months that proved so disappointing earlier.

This shows that portfolio management can not only boost returns and control risk but help offset the cycles of poor performance that sooner or later plague most trading systems.

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### Spotlight on Risk and Reward

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Over a period of three months I used Trading Recipes to experiment widely with portfolio management tactics. You will naturally wonder which practices work best and what range of values appears most promising. In part the answer depends on how you choose to balance risk and reward. But even aware of my own preferences, I still lack sufficient insight into this murky but powerful realm of trading to offer much concrete guidance. The fact is, every time I test a model with Trading Recipes, I am almost always surprised by the results.

I decided to close this report with an exercise that focuses on just one trade management factor, the percent of equity at risk per trade. By varying this component and holding all other inputs constant, we can isolate the effect of one crucial variable, thereby gaining new understanding.

The ATR system remains unchanged, as does the composition of the portfolio and

the test period. There is one unvarying money management rule. Total dollars at risk cannot exceed 20% of equity. A departure in this final test is that I have increased the initial account size to a level more appropriate to professional money managers, \$1,000,000. The one factor which varies with each test is the percent of equity at risk in each trade. I started with 1% and worked up to 4% in half-percent increments.

With an initial risk of 1%, you get a superior return with minimal drawdown. A stake of \$1,000,000 in 1981 grew to \$11.6 million by 1997, a compound annual gain of 17.0%. Drawdown was held to under 14%. Any money manager could live with these numbers.

By slightly increasing exposure, your risk goes up, but so does the return. Risking 1.5% per trade, the compound annual return climbs to 25.3%. The million dollar account grows to \$34.1 million. Drawdown increased to 19%.

Suppose we risk 2% of equity per trade. Here the return climbs to 34.1% a year. The initial million dollars has now grown almost 100-fold, to \$97.3 million. Drawdown climbed to 25%.

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#### EQUITY CURVE VS. EQUITY AT RISK PER TRADE

	1.0% of Equity at Risk	1.5% of Equity at Risk	2.0% of Equity at Risk
1981	\$1,000,000	\$1,000,000	\$1,000,000
1986	\$1,300,000	\$4,500,000	\$11,000,000
1991	\$8,500,000	\$19,000,000	\$54,000,000
1996	\$11,600,000	\$34,100,000	\$97,300,000

The chart above shows the equity curves for the first three variants tested. The pattern continues as we increase risk per trade. The return is larger but almost always, so is the drawdown. The table below summarizes the other four tests. As you can see, the numbers get very big, very

fast. With as much as 4% of equity committed to each new position, the compound annual return approaches 50%. A million dollar account grows to \$538 million. Needless to say, at this level of exposure drawdown is also high.

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Risk per Trade	CAR	Drawdown	\$1 million grows to
2.5%	40.2%	30.7%	\$220.0M
3.0%	43.5%	38.3%	\$281.4M
3.5%	47.6%	42.9%	\$437.5M
4.0%	49.6%	40.0%	\$538.3M

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### Epilogue

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I am still astonished by these numbers. After months of research I remain all but a novice in this field of critical importance to traders. My central conclusions from the study are not the precise, systematic findings I would share with you if I could (never risk more than X percent of equity on a single trade; never let total risk exceed Y percent, etc.) I can only report the one compelling certainty that this investigation confirms again and again. It is indeed true that portfolio management can be more

instrumental to trading success than signal accuracy.

For this new perspective I am grateful to Bob Spear, the genial genius who created Trading Recipes. Many thanks also to George Bagsarian, whose good will, innovative research and quiet persistence finally got this inquiry going. No one can say where the effort will ultimately lead, but rest assured, we will intensify the search for new strategies of money management.

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NOTE: Hypothetical testing such as that reported here is not as accurate and dependable a measure of profitability as actual trading results. Even if simulated historical testing were completely reliable, which is not the case, past levels of performance cannot be assumed to prevail in the future. It is not our intention to state, suggest or imply that any technique or treatment found in FORMULA RESEARCH can guarantee profitable investment results. Trading should be undertaken only by those well aware of the many risks.

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Comments by Bob Spear, author of Trading Recipes, on the

FORMULA RESEARCH article reproduced above

Hi, Nelson,

Thanks for the fine Formula Research article featuring Trading Recipes. Following are a few points I was trying to make in our phone conversation the other day, plus a few that occurred to me after we hung up.

I believe you'll agree that when you say TR is slow, to be fair you should say what you are comparing its performance to. As a portfolio level development tool, TR necessarily processes many times the amount of data that the single market programs do. One reviewer describes TR as "blazingly fast"!

TR is not specifically geared toward the professional trader, though quite a few well-known traders and professional money managers use it. I would say that it is also a tool for those who want to become professionals and for those who want to learn how to use trading to become more self-sufficient.

Full customer support is provided by fax. Also, new users get phone support until they are comfortable with the program.

I wouldn't call TR's user interface antiquated. Again, compared to what? It is simply a Windows-like DOS interface. In the DOS environment, memory management is the programmer's responsibility and choices have to be made. Which will it be—Mouse or Money Management? Also, the interface is a pretty close adaptation of Microsoft's Quick Basic, which sold over 400,000 copies.

While some criticism of DOS is appropriate, I think the more logical approach is to ask the question "how do I learn to make a lot of money and control my drawdowns?". When the answer to this question is "buy software and learn to use it", you need to then ask "OK, what software?". If that answer to that question puts you into a program written for the Mac's System X, or UNIX, or XENIX, or Solaris, or PDP 11, or whatever, that's what you need to do. Remember, the question is Not "how do I learn to test systems while multitasking 14 other projects and be able to look at really keen graphs". I even have serious doubts that given the current state of Windows and the limitations of available third party database tools, that a program can be written using them that would recalculate a decent sized portfolio within the span of your lifetime! DOS is lightening fast by comparison.

It's a minor point, but TR treats drawdown as maximum dip in equity, not open equity. Also, having a predefined stop in your system is not critical to sizing positions as you can define risk any way you please. It just seemed intuitive to me to define it as what you stand to lose. Many traders, including some of the famous Turtles who use TR, define risk as some measure of volatility. It's your call.

I believe it's a mistake to "cherrypick" markets to test. To me, fixing the system would be a better solution to the problems of less than adequate returns and big drawdowns. Otherwise, I believe you run the risk of curve fitting a large data set.

As to why there aren't any books available on this subject, I can only guess. Maybe it's as simple as "some folks write books; some write software". I do think it's funny that so many trading advice articles you see these days end with something like "and oh, by the way, always use sound money management".

I believe there are not "correct" values for bet size, just as there are not "correct" money management rules. It is up to the individual trader to design a strategy and drawdown profile that he or his clients can live with. I hope you'll never publish suggested values. It's up to the trader to nail these down for himself. Anyway, wouldn't that cut into TR sales? :)

I sincerely appreciate the great job you did writing the piece. It's thoughtful, thorough, and best of all, it so beautifully describes the exhilarating "WOW" experience everyone has. Keep up the good work!

-Bob