Probability, Risk, and Position Size
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Most people think the terms "probability" and "risk" are synonymous. Many articles on the internet use the words interchangeably. The terms are related but significantly different.

PROBABILITY is the chance of something happening. Probability is calculated as a number between 0 and 1. If you flip a balanced coin, the probably of it landing heads up is about 0.5 (50%). If you roll a fair die, the probability of it landing with a 3 on top is about 0.1667 (16.67%).

RISK has two parts: one is the <u>probability</u> of something happening; the other is what it will <u>cost</u> if it does (or doesn't) happen.

When you get into your car and drive to the store, the ***probability*** of getting into a serious accident is quite small, less than 1 in 1,000. However, if you do get into a serious accident, the ***risk*** is that you could lose a limb, your vision, or even your life. Even though the probability of having a major accident is very small, the risks are so high that states throughout the US have passed laws that require measures — liability insurance, seat belts, and air bags — in order to mitigate the risks associated with serious automotive collisions.

Chances of Predicting Directional Movement

When you buy shares of some security, your hopes are that it will go to the moon, although there is also the chance that it will go to zero. Unless you are clairvoyant, you cannot know what will happen.

The overall probability any given security going up this week is 0.5. There's an equal chance it will go up or go down. By doing some research about the company and what the stock has done lately, you may be able to shift the probability for a specific security a few points in your favor. But don't ever assume you're going to move that probability much more than a few percent in your favor.

Getting the probability of predicting direction up to 0.55 (55%) is not hard, but it's still not much better than a coin flip. If somebody tries to sell you a system that is right 70% or 80% of the time, they are either lying or the cost of losing is disproportionately high. Think about it. If they had a system that was right even 60% of the time, they'd be making money trading it rather than trying to sell it to you.

There is only so much you can do about probabilities in the market. And don't ever forget that even if there is a 60% chance a stock will go up, there is still a 40% chance it will go down. This is why risk management is essential to investing success.

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POSITION SIZE means how much of your money you should put into any given investment. But before we talk about position size we need to talk about initial capital. In other words, how much money do you need to have in your brokerage account before you should even start to actively manage your own money.

Common sense tells that when pursuing something new, it is best to start small and work your way up. That works for a lot of things but it's the wrong advice when it comes to how much capital you should start with. Actively managing your investments is one of a number of areas where starting bigger is important. Consider the following two examples:

Scenario 1

You decide you would like to have an aquarium with some goldfish in it. At the pet store you notice a "starter set" with a 5 gallon aquarium, an aerator, a couple of goldfish, and so on. It looks nice and the price is affordable so you buy it. When you get home you set it up, fill it, condition the water, and put in your fish. Two weeks later, they are both dead and you have no idea why.

Contrary to popular belief, beginners should start with a 40 or 50 gallon aquarium. A small error in a 50 gallon tank is seldom a fatal one. The same small error in a 5 gallon aquarium has 10 times more effect on the fish, so starting small is not the best approach when it comes to aquariums.

Scenario 2

During a coffee break, you are matching pennies with a friend. You both flip a penny and if the pennies match, you get to keep both of them. If the pennies do not match, your friend keeps them.

1. If you start out with 10 pennies and your friend starts out with 10 pennies, then the odds of you winning all the pennies is about even: 10 / (10+10) or 50%.

2. If you start out with 10 pennies and your friend starts with 100 pennies, then your odds of winning all the pennies is about 10 / (10+100) = 1 / 11 = 9.09%. Just by starting with fewer pennies, your chance of winning all the pennies drops to about 1 chance in 11.

> [I use the word "about" here because the element of randomness means the real
> results will never be quite so tidy and these calculations are, in fact, just averages.]

What causes this shift in the odds? The obvious explanation is that your friend can lose a lot more times in a row than you do before he goes broke. But there is something more subtle going on here. If you start the game with 10 pennies, then each time you play, you are risking one tenth (10%) of your total capital. The person starting with 100 pennies is only risking one hundredth (1%) of their capital on each play. How much of your capital you risk on each investment has a huge influence on your chances of losing everything (also referred to as "Risk of Ruin").

Professional money managers rarely risk more than 2% of their total capital on any one position. This is a good size for a number of reasons. One reason is that with a 2% limit you can have 15 trades in a row go against you and you will still have a little over 75% of your original capital left. Another reason is that it makes each position small enough that it does not represent a large psychological issue. Small positions are easier to manage objectively, which is very important.

If you put in $50,000 to start your brokerage account, then with a 2% limit, you can afford to risk $1000 on each position. Some people look at that number - $50K – and think, "I can't afford to risk that much on the stock market!" But remember, just because you put that much into your account does not mean you are going to be putting that whole amount at risk.

Let's say all you can afford to put into a brokerage account is $10,000. That makes your 2% risk $200 per position. That is still enough to be able to take positions and make money. We will talk about how next.

If you cannot afford to put together $10,000 to start a brokerage account, then you really should save up money until you can. Trying to start out with just a thousand dollars means you will very likely end up taking too much risk on individual positions and you will be stacking the odds against yourself. You will be putting yourself in the position of the guy who gets into a game of matching pennies with 10 cents in his pocket against a guy who brought a 25-pound bag of pennies with him.

Position Size and Position Risk

You may be thinking, "If I have $10,000 to invest, what can I buy for $200? One share of Target?" But the amount risked is not the same as the position size. Let's say Target (TGT) really is at $150 and you want to buy it. Let's also say you are planning on using a 10% stop order to limit your risk. That means that if TGT drops by $15, then the stop order will automatically get you out. Finally, you are going to adjust that stop order upward every time the price of TGT goes up.

So if you buy one share of TGT for $150 with a 10% stop, you will have a position size of $150 and a position risk of $15. With $10,000 in your account then a 2% account risk means you can buy 13 shares of TGT. 13 shares will make your position size $1950 but the 10% stop will limit your position risk $195, which fits your 2% account risk. The basic rule to follow is: Actual position risk on any single security must be less than or equal to "maximum position risk".

Here are the steps to calculate appropriate position size:

1. acceptable_risk = 2% or 0.02
2. total_capital = $10,000
3. maximum_position_risk = total_capital * acceptable_risk $200 = $10000 * 0.02
4. exit_stop = 10% or 0.10
5. risk_per_share = share_price * exit_stop $15 = $150 * 0.10%
6. maximum_shares = maximum_position_risk / risk_per_share 13.3333 = $200 / $15

So the appropriate position size for Target (TGT) at $150 per share with a 10% stop in a $10,000 account is 13 shares [13.3333 rounded down].

At first these calculations may seem a little complicated, but once you've gone through it a few times, it becomes really straight forward.

Note: In this explanation I purposely glossed over some details about how stop orders work, but the position size calculations are real and will provide you with a reasonable estimate of a safe, manageable position size. Later on we will talk about whether or not stop orders are the best approach to position management.

Appendix A

This gets a little deep. If it gives you a headache, trying reading it again six months from now.

Article by Charles Rotblut, AAII Journal, 14 May 2015

Wall Street defines risk as volatility. The more a fund or portfolio fluctuates in value, the riskier it is deemed. The vast majority of individual investors define risk differently. Individual investors, in aggregate, define risk as the chance of losing money.

Both definitions are correct. If time horizons are very long or infinite, then the degree to which a fund or a portfolio fluctuates does not matter as long as the expected gain is large enough. This viewpoint works very well for developing mathematical equations. Whenever expected returns and volatility can be specified, a quantitative model can be constructed to determine whether it is logical to expect an investor to be compensated for the amount of risk taken. The Sharpe ratio is an example of this type of model.

Human emotions are far different than the logic underlying mathematical models. We view losses and gains differently, as Nobel laureate Daniel Kahneman and Amos Tversky documented. Specifically, they found that people will not act in their economic best interest in order to avoid a sure loss. This is because we humans feel greater pain from losses than pleasure from gains.

If mathematical models treat gains and losses equally, but humans derive more pain from losses than pleasure from gains, then a disconnect clearly exists. Some academics and practitioners have tried to resolve the difference by creating of various measures to assess risk.

One of them is the "Pain to Gain" ratio. Recently on the Financial Planning website, Craig Israelsen explained this formula. It divides the standard deviation of return by the actual return. The standard deviation, in this case, is the amount an asset's return deviates from its typical range of returns. You can calculate it by downloading return data from a website such as Yahoo Finance and using the "STDEV" function in Microsoft Excel.

In describing the indicator, Israelsen wrote, "We want to experience less volatility (pain) for a given level of return (gain)—so the lower an investment's score, the better." (Israelsen used rolling 10-year period returns in his article, but told me in an email that 36-month periods can also be used. The more common practice for calculating risk measures is to use monthly returns for the past 36 months.)

At AAII, we use a similar but slightly different measure: the risk index. This is the standard deviation of a fund's or portfolio's return divided by the standard deviation of return for a benchmark. The benchmark can be a broad market index (e.g., the Dow Jones U.S. index) or a fund's category average. A score of 1.0 indicates greater risk than the index and values below 1.0 indicate lower risk. This measures tell you whether or not a portfolio (or a fund) has incurred greater price volatility than its benchmark.

Knowing how relatively volatile a portfolio (and/or a fund) is can help you adjust your investment strategy to allow you to sleep better at night. But volatility works in both directions. What matters to most investors is how much downside volatility there is. One measure of downside volatility is the Ulcer Index, a more complex mathematical equation that considers the retracement in value (or price).

A simpler rule of thumb is to compare monthly drawdowns between a portfolio or a fund and an appropriate benchmark. Another rule of thumb would be to calculate the risk index for up and down

months; this would reveal whether the excess volatility is incurring on the upside (a good thing) or on the downside (which could fray your nerves).

The big thing to remember is that you have to be willing to accept downside volatility if you want to build long-term wealth. A savings account will ensure your wealth never drops in absolute terms (as long as you don't make withdrawals), but you will lose out to long-term inflation (prices will rise at a faster pace than your savings will grow at).

A portfolio composed entirely of stocks will give you the largest amount of growth over the long term, but your net worth may rise and fall significantly over the shorter term. In between are a wide range of allocation options, each with varying degrees of risk and reward. Finding a mix that keeps the pain of downward market moves at a tolerable (not comfortable, but tolerable) level can help you achieve your long-term goals.