How Much Money Do You Need to Survive on Stock Market?

Many of those who come to the financial markets for the first time lose their capital very quickly. After all there is a lot of literature with successful trading techniques, and each trading guru coach sells only “100% guaranteed” strategies. So the reasonable question is “Why?”?

~~To~~ **In** my opinion, the foundational answer lays in the field of the theory of probability. Obvious, isn’t it? But how many of us, who name himself as trader or investor, have heard about Gambler’s Ruin Problem or moreover analyZe its consequences? If you are one of these smart guys and you are still in market — you can skip this article. Otherwise, the current material can give you some insights about how initial terms, with which you enter the stock market, have an influence on your success or ruin in this field.

So, here is the plan:

- Definition and (very) basic Math behind Gambler’s Ruin Problem.
- Simulations with different initial terms of Gambler’s Ruin Problem.
- Application (partial) of Gambler’s Ruin Problem to stock market.

Gambler’s Ruin Problem.

Imagine that you are a coin player, with “S” amount of money ~~on~~ **at** the start. You toss the coin and each head gives you +$1 of profit and each tail -$1 of loss. The game finishes whenever you reach “N” amount of money or ruin to zero. The coin is fair, so the probabilities to get the head or tail equal 50% (1/2).

For example, you start the game with $20 and play until you earn additional $5.

The Theory of Probabilities tells us that the probability you’ll leave the game with $25 in your pocket (initial $20 plus $5 that you have won) equals 83.3% and the probability to lose $20 is 16.7%. Promising, isn’t it? Although, don’t rush to casino: people don`t stop when they succeed in winning easy money. The bigger money you are greedy to win — the bigger probability that you will lose everything.

Say, the initial terms are the same, but now you want $30 in your pocket: the probability of happy ending in this scenario is 66,7% and 33,3% for total loss. Still not bad. Hopefully you’re lucky and the heads are on your side, so you continue the game:

- the probability to finish with $40 is 50% by 50%;
- to finish with $50 — 40%, to lose all — 60%;
- to finish with $100 — 20%, to lose all — 80%.
- etc.

The picture of probabilities in such gambler’s ruin problem (with terms defined above) is the following:

As we may observe, almost surely you can finish the game with 21$, and, ~~in~~ **on the** opposite, almost surely you will lose money if you set too big target of fortune to get.

So, the key inputs that we need to take into account before making a decision to play or not to play (or to become trader or not) are:

- the initial amount of money we are ready to spend (invest, lose)
- the desired fortune at which we will stop playing (initial amount + profit)
- probability to win in each gaming round.

The mentioned probability is a key metric as it is something that **is** hard or impossible to change (unlike the starting capital or desired profit level). If you play a fair coin you cannot change 50%/50% chances.

Before we move to stock market cases, let's define the equation to calculate probabilities for games with equal probabilities to win/lose (for those who loves Math, here is the link how this formula is derived):

Seems very ~~simply~~ simple… So for those who do~~es~~ not believe in simple world or who prefers vizs??????, here is the plot of 10000 simulations which confirms the 1/3 probability to get to $60 and 2/3 probability to lose $20 if you start the game with $20 and bet $1 each toss of fair coin:

One can ask, what about **the** size of bet — does the outcome of the game depend on if the bet is $1, $2, $5 or $10? The answer is also on the plots:

And the answer is "~~Not"~~**"No/It doesn't"**. Primarily, the outcome depends on probability to win in each game round. You can find such formula in the above link:

The graphs can show us this dependency more clearly:

It only needs to shift each round probability by few points and the total probability to win or lose in the game strives to 100% depending on direction of shift.

Next, I want to quote the text from "Introduction to Stochastic Processes with R" by Robert P. Dobrow, which is the gist of this article (this note refers to the case when probabilities of win / lose are equal):

The memoryless character of the process means that the probability of winning $n or losing all his money only depends on how much capital the gambler has, and not on how many previous wagers the gambler made.

The closer your starting capital **is** to desired winning fortune (than to a zero) — the higher **is the** probability to get it. Let's check this statement with simulations:

However, if we change the starting capital and the final sum proportionally — the probabilities stay equal (the multiplicator is 1.5x)

Now we have almost all necessary information to go into the matter of:

Stock Market Ruin Problem.

Can you remember your expectation about future earnings when you thought for the first time about trading stocks? Many of us dreamed of becoming as rich as possible and as quickly as it could be.

Now we know that "as possible" mainly depends on two things:

- Starting capital.
- Each round probability.

Suppose 4 traders begin their trading carrier. Each desire to take $10 000 out of the market ~~in~~ a year, but:

- the first one is ready to lose (start with) $2000, the second — $10 000, the third — $50 000, the fourth — $100 000
- so, each expects to close the year with: $ 12 000, $20 000, $60 000, $110 000
- as they are beginners, their win/loss ratio is 50%/50%.

~~•~~ for now, let's assume (something unreal for stock market): each trader open**s** and close**s** positions every day and their profits and losses are always equal: +$100 if **the** day is profitable and -$100 if not.

~~In light~~ **Regarding the** ~~of~~ the previous information it becomes obvious who is much closer to a winner`s pedestal. Using the first equation we can quickly count:

1. 2000/12000 = 0.167
2. 10000/20000 = 0.5
3. 50000/60000 = 0.833
4. 100000/110000 = 0.909

Here are graphs with 10000 simulations per each case — the probabilities are almost the same.

Taking into account the difference in human perception of small and bigger sums it becomes clear that those who come~~s~~ to the stock market with small starting capital fail more often than those with $100K+ (with other things being equal).

Another consequence of larger initial sums is that it allows to stay on the market much longer than with larger starting capital. Here are plots for simulations with assumption that first and fourth traders earn/lose +/- $100 per 1 trade day(wager) :

As we see the trader with $100 000 “S” has 300 times more days before his account empties to zero (if he came to market with very bad luck and caught the 9.1% of ruin).

Some of you might object saying: “It is not fair to compare $100 of risk per $2000 of starting capital (5%) vs $100 per $100 000 (0.1%)”. That’s why let’s look ~~on~~ **at** the plots where both traders are ready to lose (or gain) everyday 5% of their starting capital ($100 and $5000 accordingly):

The number of days the richest stock trading beginner could hold out on market has changed dramatically:

- about half a year to lose all his money being very risky (and unlucky) guy or,
- 1500 years (408800 days/252) if he chooses cautious strategy with 0.1% of risk.

Definitely he would never ruin to zero during his life if this scenario has been realizing.realized? Would be realized?

But don't forget: the size of profit/loss does not affect the probability to reach to “N” or 0 — only the time to get there.

Of course, 50% by 50% probability for random trade and equal daily profits and losses assumptions are not relevant for stock markets, but I hope generally I have shown the fields of researches which each beginning trader has to study closely.