Surviving Market Drawdowns

by *Guy R. Fleury*

My last series of articles tried to cover a lot of ground. It was mentioned a number of times that the stock trading strategy used needed some protective measures since drawdowns could have quite a negative impact on long-term performance.

The following is mostly an extract from my upcoming book on building up your own retirement fund. It even covers generational funds made to last decades and decades.

Whatever the type of stock portfolio you have, or want, the objective is to generate long-term returns higher than just market average.

The intention, no matter how you want to play the market, is to make as much as you can without giving it back. In my book, the stated objective is to achieve higher than a 20% CAGR over the long term (meaning over 20 to 100^+ years). It was demonstrated that it was relatively easy to do and depended on administrative decisions made before the trading program even started.

We can give a stock portfolio its classic equation for its endpoints (from start to finish): $F(t) = F_0 \cdot (1 + \bar{g})^t$ where F_0 is the initial capital, $\bar{g}$ the average growth rate, and t the time interval in years over which the fund should appreciate.

We can express the same thing using the following formula:

$$F_0 \cdot (1 \pm r_1) \cdot (1 \pm r_2) \cdots (1 \pm r_{t-1}) \cdot (1 \pm r_t) = F_0 \cdot (1 + \bar{g})^t$$

where the total return depends on the yearly returns (r_i) achieved over each of those years (some positive and others not) with i going from year 1 to year t and where t could be 20, 30, 40 years and more. This last expression does convey the uncertainty over yearly returns with its $\pm$ signs. And the equation also says that we could use $\bar{g}$ as representative for the expression on the left hand side without loss of generality since both expressions do give the same answer.

A stock portfolio drawdown of -50% could be considered as having quite a negative impact on the return series. Usually, we make it back with time and then some. But still, it does have an impact since we would have lost half of our fund in a single year. I opted to use the -50% to emphasize the impact, and because it does happen in the market. But what follows would also apply that the drawdown be smaller or larger. Regardless, the higher the drawdown, the harder it is to recuperate.

The evaluation of the impact of a drawdown is also relative to the portfolio liquidation value at time t. Losing half of your initial \$100k does not have the same weight as losing \$20 million of your \$40 million portfolio in some 20 to 30 years from now. It would be even worse should the portfolio be much higher. Yet, these would be classified as -50% drawdowns. You will feel more regrets seeing that \$20 million or more evaporate before your eyes than losing \$50k.

Adding a -50% drawdown to the first equation is easy, add one year to get:

$$F(t+1) = F_0 \cdot (1+\bar{g})^t \cdot (1-0.50)$$

Take what was there, add one year on one side, and the drawdown on the other.

Whatever the size of the portfolio at the time of the drawdown, it would be cut in half.

You could rewrite part of the equation as:

$$(1 \pm r_1) \cdot (1 \pm r_2) \cdots (1 \pm r_{t-1}) \cdot (1 \pm r_t) \cdot (1-0.50) = (1+\bar{g})^t \cdot (1-0.50)$$

The last term on the left hand side of the equation could be placed anywhere in the series and not change the overall value. This would not change the value on the right hand side either since we could extract that year and put it at the end of the series as it is expressed here.

The impact of this -50% drawdown would reverberate for years and years after the drawdown. It would have the same effect as if going back one doubling time. That the -50% drawdown occurred in a singular year over your portfolio's lifespan, it will remain there.

You can recuperate and do even better. But you cannot make it disappear. Somehow, you will have to live with it and find ways to compensate for the loss. You lost a doubling time, and now you have to make it back. And to make back a -50% decline, that is to break even, you need a 100% rise.

The following chart depicts a 20% CAGR curve over 20 years:

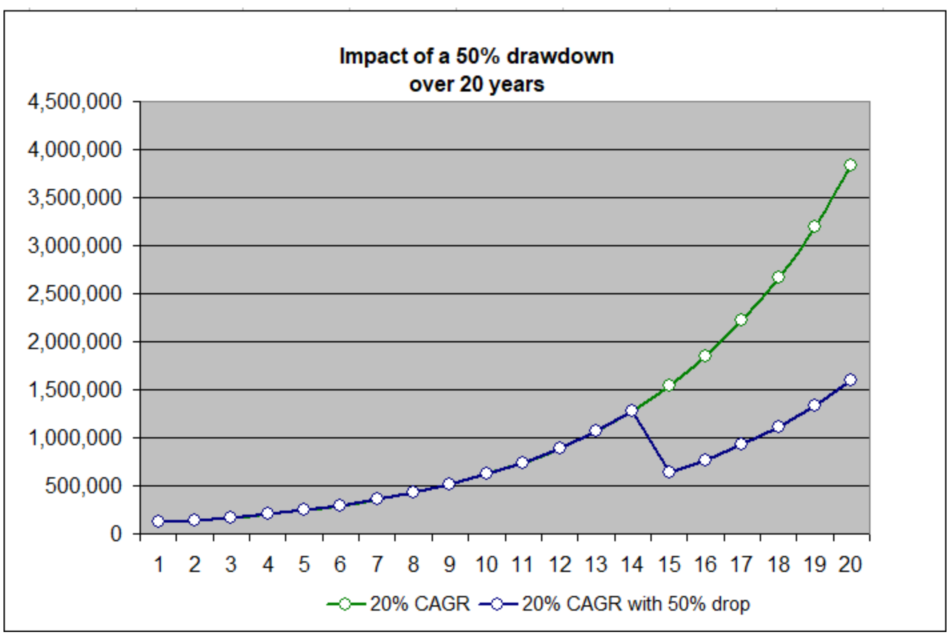

Figure 1: 50% Drawdown in Year 15

The green line has for equation: $F(t) = F_0 \cdot (1 + \bar{g})^t$. The blue curve uses the same equation but has a -50% drop in year 15. The increasing spread between the two curves is entirely due to the -50%

drop since nothing else happened.

We do not have an immediate snapback process in the market, it does not work that way. It operates on what is done, is done.

You will have to recuperate by your own means to go back higher, and it will take time. The blue line had a single -50% drop, all other years were performing at the 20% CAGR level just like the green line. The spread gets to be considerable since it is also growing at a 20% rate. Even on the 20th year, the blue line endpoint (year 20) is still half of the green line for the year prior (year 19).

This is to say: it does not matter in which year the -50% drop occurred. The endpoints would be the same. That is what the equation above is saying, anyway. Here it is rearranged with the drop somewhere on the blue line.

$$(1 \pm r_1) \cdot (1 \pm r_2) \cdots (1 - 0.50) \cdots (1 \pm r_{t-1}) \cdot (1 \pm r_t) = (1 + \bar{g})^t \cdot (1 - 0.50)$$

The drop has quite an impact on the overall performance. The doubling time for a 20% CAGR is about 3.81 years. We can see from the picture that there is no catching up. To catch up, you will have to make it happen.

A View From The Long Term

However, we are in it for the long term. And from that viewpoint, the above picture might not appear so dramatic. From the chart below, if you observe closely, you will see the -50% drop in year 15.

Notice that the spread continued to increase over those added 20 years. The -50% drop became more and more valuable as the years went by. But that spread was not in your trading account. The spread was lost due to that little dip in year 15. From the look of the chart, that little dip could represent quite a lot over time. In year 40, the loss is still half of what could have been achieved on the green line in year 39.

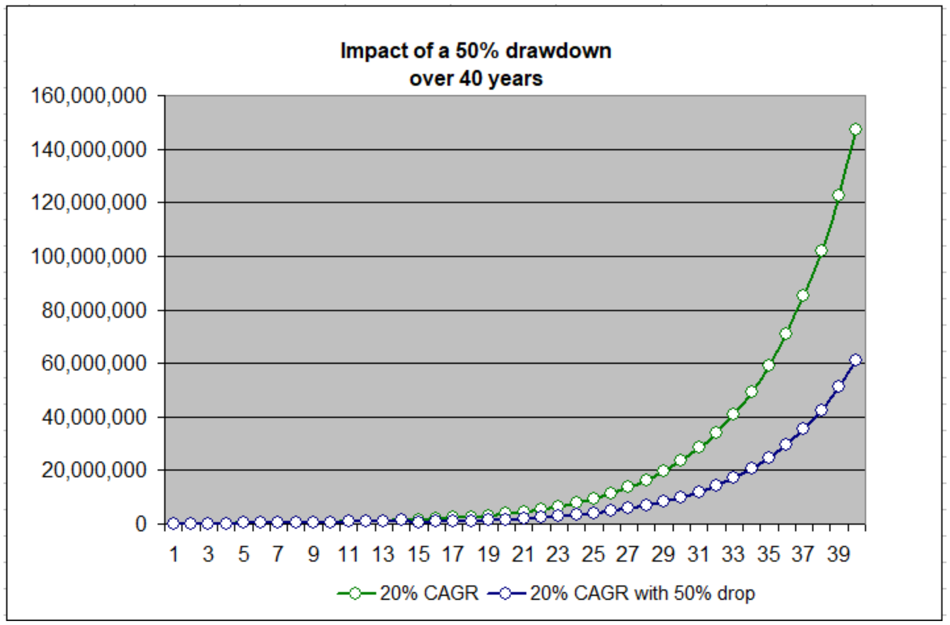

Figure 2: 50% Drawdown in Year 15 - 40 Years

The chart above can help realize the importance of reducing those drawdowns as much as possible since their impact will be felt for the duration of the portfolio if not corrected.

Sure, the lines will be more erratic than what is displayed in those charts. However, the endpoints would remain. The same logic could still be made: the drawdowns do have an impact, and they do propagate onward, they do not simply disappear.

The Remedy

To remedy the situation, you could increase the CAGR after the -50% drop in order to play catch up. But there, you will need to compensate for more than the -50% drop. You will need to also compensate for the growing spread between those two lines.

You have a corrective factor you can apply to compensate for the drawdown: $r_i = \frac{d_i}{1-d_i}$, but it might not be enough. To compensate a -50% drop, we need to double the portfolio value $(1-0.50)\cdot(1+1.00) = 1.00$.

However, to really compensate for the decline, you would have first to compensate for the -50% drop which would require $r_{16} = 1.00$, you would need to compensate for the expected 20% gain in that year of decline, and would need to also get the 20% return for the current year. This would produce for the year after the drawdown the following sequence:

$$F(t+2) = F_0 \cdot (1+\bar{g})^t \cdot (1-0.50) \cdot [(1+1.00) \cdot (1+0.20) \cdot (1+0.20)]$$

This translates to a 288% rise from the low of year 15 to return the portfolio to its 20% CAGR cruising speed. You can view this as a pretty steep rise just to get back on track. Most often, as you must have observed, the comeback does not happen that way or that fast. It takes much longer than a year.

The need was not only to compensate for the -50% decline but also for what should be considered the lost opportunity: the 20% average return on each of those 2 years. And both years were also compounding, which is what the compensating equation above is stating.

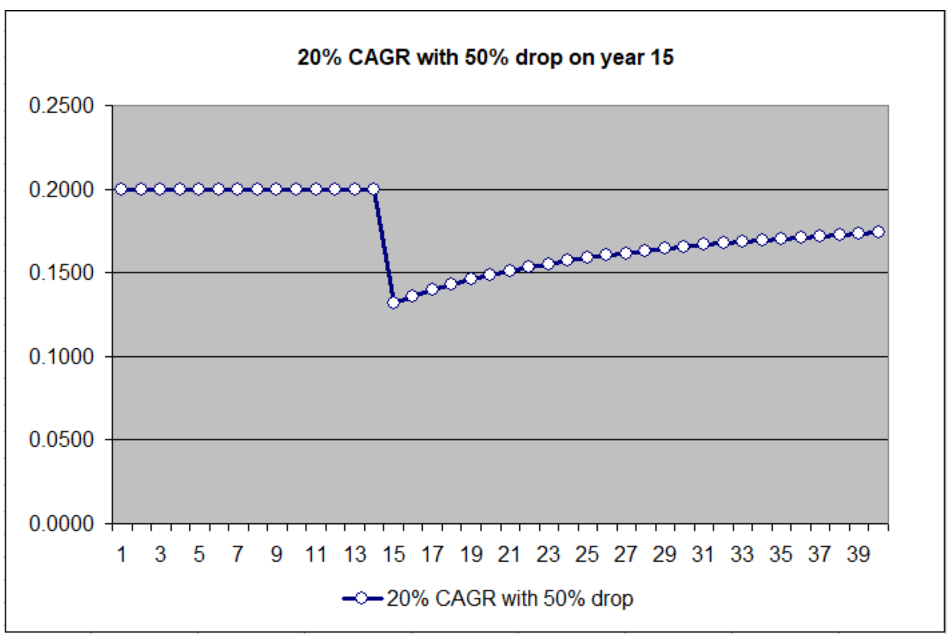

Figure 3: CAGR Rate with Drawdown in Year 15 - 40 Years

The task might look less daunting if you took more time to compensate after that -50% drawdown. Somewhere along the line, you will need a 288% on a single year, or its equivalent, to erase the impact of the -50% drop. Or, you could spread the task over many years by increasing the CAGR going forward.

If you do not correct the -50% drawdown before year 20, then you will have an overall average CAGR of about 14.86% for those 20 years. It does not look like much but still translates into the endpoints of the first chart above.

Nonetheless, as can be seen in the above chart, after the CAGR decline, the CAGR is slowly recuperating simply by going back to its cruising speed of 20%. However, the spread, if not taken care of, will continue to expand indefinitely.

Applying the 288% correction on year 20 would look like the chart below. Once the correction is applied, the CAGR goes back to cruising at its average 20% and does reach the same endpoint in year 40.

This is to emphasize the point that it is not only bouncing back, it is recuperating what was also lost. The what should have been instead of the decline.

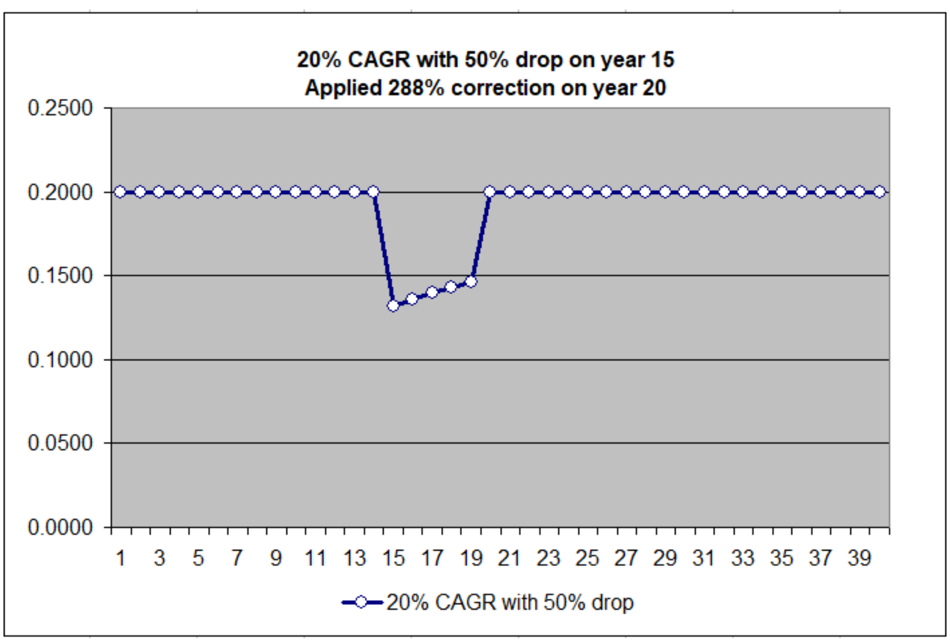

Figure 4: CAGR Rate with Drawdown in Year 15 and Correction in Year 20

To spread the recuperation over the next 15 years would require to increase the CAGR to 27.21% up to year 30. To get back on track by year 40 would need a lesser CAGR of about 24.27%. After reaching those endpoints, you could go back to your 20% CAGR cruising speed since you would have recuperated the -50% drawdown.

If you found ways to increase your CAGR to either 27.21% or 24.27%, I would not go back to simply cruising at a 20% CAGR, I would keep on cruising at the new level. Why would you throw that added alpha away?

From hindsight, it would appear easier to simply add some protective measures to hopefully bypass most of the impact of those dreadful drawdowns.

Increasing alpha in a quasi-randomly evolving stock market is a difficult task. It can be done nonetheless but still demanding.

You have to fight for every alpha point you get. It is all about your portfolio surviving market drawdowns.

That is why we design trading programs in the first place, it is to do that job.

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