



The Asymmetry Zone

May 16, 2016

SUMMARY

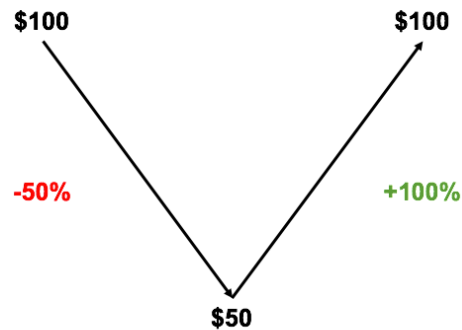
- The math of losses is not a secret: as losses grow, the return required to hit breakeven grows asymmetrically.
- At losses below -15%, this relationship is nearly linear; at higher levels, the gap grows dramatically.
- By *reducing* the “capture ratio” of an investment approach, we can exploit this asymmetry to our benefit.
- This asymmetry can become so extreme that in certain scenarios an investor can actually still come out ahead if their upside-capture is *less* than their downside-capture.

The Asymmetric Math of Losses and Recovery

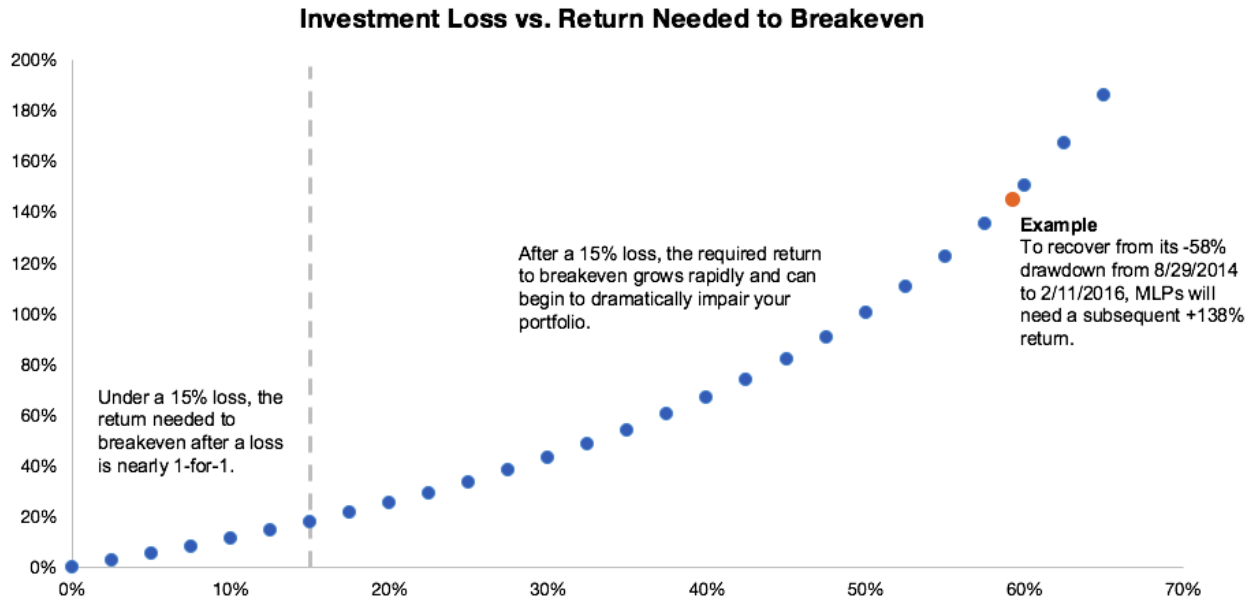
There is an interesting calculus that applies to portfolio gains and losses. For a portfolio to return to breakeven after enduring a loss, it must participate in a subsequent rally that is *larger* in magnitude than the initial loss.

For example, if a portfolio suffers a -10% loss, it will require an 11.1% return to revert to a breakeven level. This is nothing new. You've probably seen a similar concept show up in many strategy decks.

When we start considering more extreme examples, say a -50% loss, we can see how skewed the required gains can become to get back to breakeven.



By plotting investment loss (x-axis) versus the subsequent return needed to hit breakeven (y-axis), however, we start to see a few interesting patterns emerge.



First, at *all* levels of loss the subsequent return required to breakeven is larger than the initial loss.

Second, the magnitude of the difference between the breakeven gain required to recover from a loss is highly asymmetric. For losses below 15%, we can see that subsequent return required to breakeven is nearly 1-to-1.

After 15%, however, the results quickly become skewed. A 35% loss requires a subsequent 53.8% gain. A 50% loss requires a 100% gain. For more extreme losses, these values start to get absurd. A 90% loss requires a 900% recovery while a 99% loss requires a 9900% recovery.

The asymmetric nature of this data proves mathematically a very intuitive idea. Namely, protecting against large losses is more important than protecting against small losses. We believe the asymmetry really begins to kick-in after 15% losses, which is why we do not try to avoid every little dip and dive in the market. Instead, we try to focus on larger losses where the math really turns against the buy-and-hold investor.

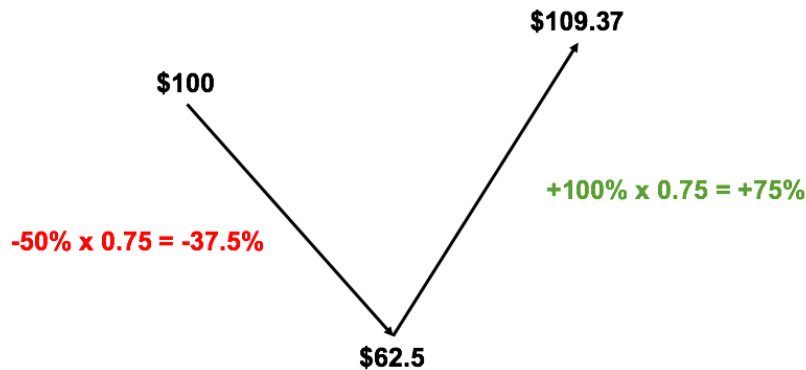
But this asymmetry also creates some curious corollaries...

The Benefit of Lower Capture Ratios

Let's start our discussion by assuming that we have a strategy that captures the same percentage of a loss as it does a gain. We will define this strategy by its *capture ratio*: the amount of both the upside gain and downside loss it experiences. For example, if the capture ratio is 90%, then the strategy will realize 90% of all losses and 90% of any subsequent recoveries.

So our first interesting result of the asymmetric math of losses is that so long as our capture ratio is less than 100%, then our strategy will *a/ways* end up ahead in a market sell-off / recovery scenario.

For example, let's assume the market sells off by 50% and then rallies by 100% to get back to breakeven. A strategy with a capture ratio of 75% will end up with a return of +9.4% at the end of the day.



This benefit holds for any capture ratio less than 100%.

For the mathematically curious, read on. For the less curious, feel free to skip to the next section.

Still with us? Great. So why does the benefit hold for any capture ratio less than 100%? The equation that defines the subsequent rally required to recover from a given loss is:

$$f(x) = \frac{1}{(1-x)} - 1$$

For a given capture ratio c , where $0 < c < 1$, and given a loss of cx , the amount we need to re-capture, $f(cx)$ will be less than the amount we will capture assuming a full market recovery, $cf(x)$:

$$f(cx) < cf(x)$$

We can prove this by assuming the opposite solving until we reach the point of a contradiction. In this case, we end up with $1 \leq c$, which contradicts our assumption that $0 < c < 1$.

So an important takeaway: if you believe the market is going to go sideways, you can theoretically make money by implementing a strategy that has a capture ratio less than 100%. Of course, if the market goes sideways and the drawdowns are less than -15%, the opportunity to take advantage of this asymmetry is vastly diminished.

It is also important to note that the order of returns does not matter. In our example above, the results would be the same had a 100% market rally been followed by a 50% crash. So long as the market makes a round trip, ending up where it started, the results stand.

Benefiting from Asymmetry: Up-capture and Down-capture

Not surprisingly, the math gets even *more* favorable if we have different upside and downside capture numbers.

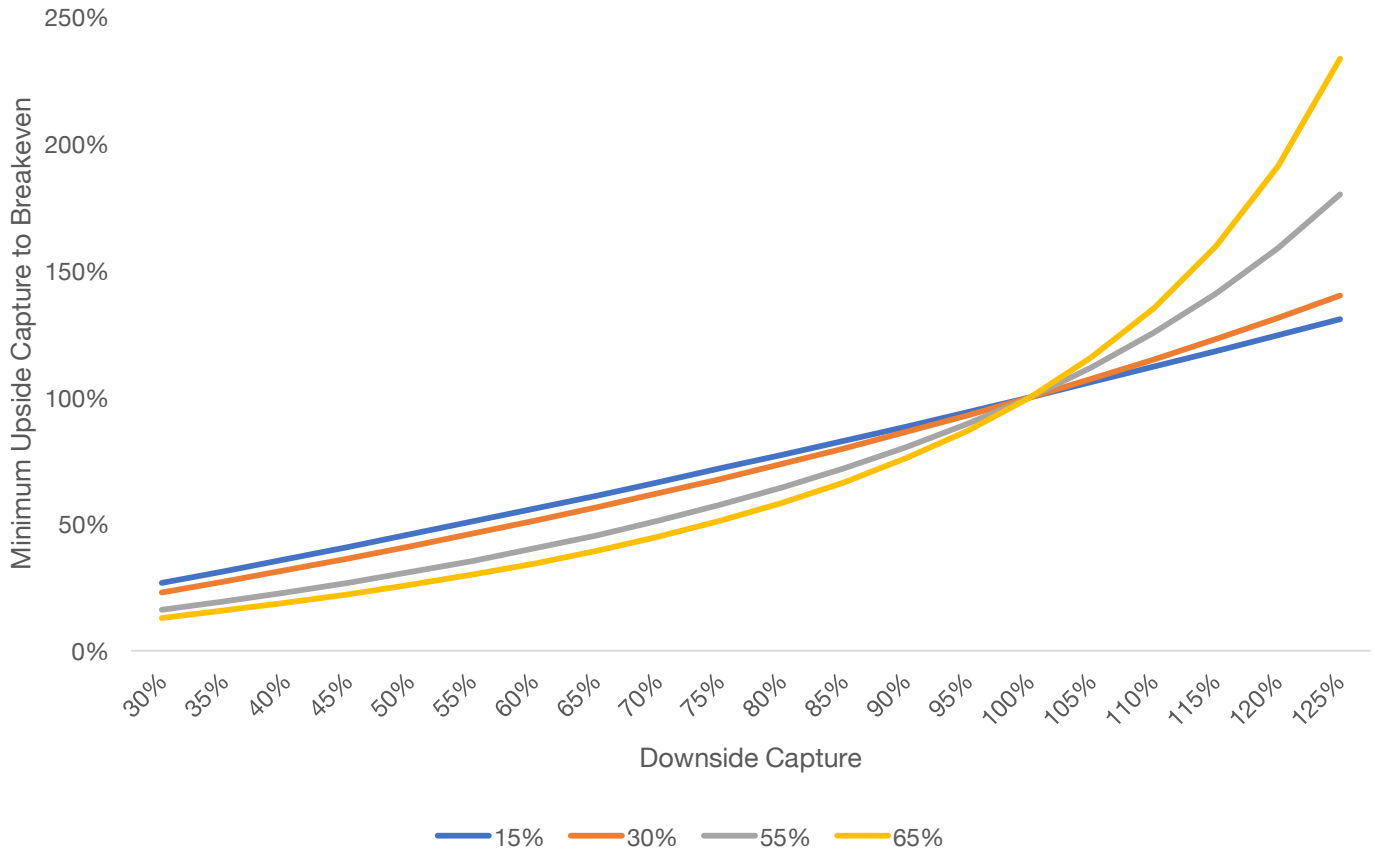
Now, most are probably expecting us to talk about the benefits of having higher up-capture than down-capture.

But would you believe us if we said strategies with a downside capture ratio above its upside capture ratio can still come out ahead?

Consider, again, our simple example of the market falling 50%. If we capture 75% of the downside, our portfolio will be down 37.5%. While the market needs to see a 100% rally to get back to breakeven, we only need to see a 60% return. So if the market does rally 100%, we only need 60% up-capture to get back to breakeven, which is *less* than our down-capture.

Which also means that anything *above* a 60% up-capture is gravy.

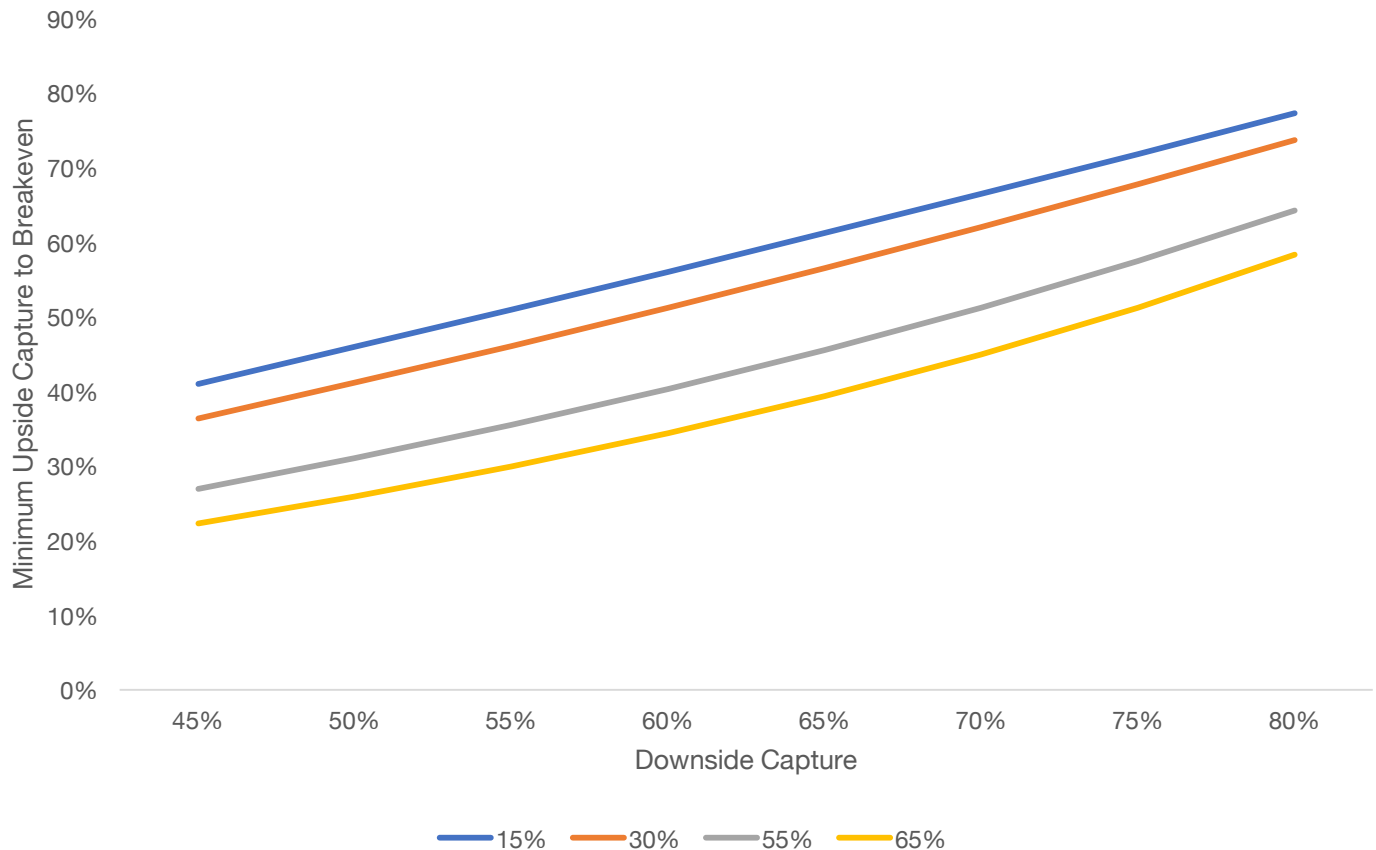
Let's graph how this looks for a couple different loss levels. Each line represents a different loss level; the x-axis shows our downside capture ratio; the y-axis shows the *minimum* upside capture ratio required to hit breakeven, assuming the market recovers to breakeven after the loss.



A couple things we notice:

- The smaller the loss, the less asymmetry benefit we get.
- Above 100% down-capture, the results flip: we need *more* upside to get back to breakeven.
- Below 100% down-capture, required up-capture is always less than down-capture.

Let's zoom in on the 45-80% down-capture region to get a real sense of what we are talking about here.



We can see that for 15% losses, the required up-capture is about equivalent to the down-capture. For larger losses, however, the up-capture can be significantly lower. For example, for a 55% loss with 60% down-capture, only 40% subsequent up-capture is required. What about for a 65% loss, like we saw with MLPs in the last year? Even at a 70% down-capture, you only need an up-capture ratio of 45%.

Conclusion

The math of drawdowns has been extensively covered at a cursory level. To fully recover from an investment loss, a security or strategy must realize a gain of greater magnitude than the loss. The larger the loss, the bigger this gap grows.

What has been less discussed is what this mathematical relationship means for strategy selection. In a perfect world, we want strategies with higher upside capture and low downside capture. While such achievement is always preferable, it turns out that this profile is not necessary to achieve absolute outperformance. In fact, strategies can outperform even when downside capture *exceeds* upside capture. This curiosity becomes more and more prevalent for larger and larger losses. For risk managers and asset allocators, this is great news because it means that timing the market perfectly is

unnecessary. We can comfortably seek to ignore smaller (<15%) losses, focusing instead of major dislocations. We can also afford to wait for confirmation that a bear market has started or ended before we de-risk or re-risk the portfolio.

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