

Performance Measurement for Short Positions

Damien Laker

This paper appeared in the *Journal of Performance Measurement* Spring 2002.

It is reproduced by permission of the *Journal of Performance Measurement*.

*Calculating the return on a short position can sometimes seem like a challenge. However, as this paper shows, there is no need for special logic to calculate the return of a short position. Somewhat counter-intuitively, the return on a short position is exactly the same as the return on a long position. However, because the **weight** of a short position is negative, short positions make a positive contribution to portfolio performance when the holding experiences a negative return. A vital step in understanding the sign conventions for short positions is distinguishing between the **return** of a position, and the **contribution** of that position to the overall portfolio. Since short positions have a negative weight, the return and contribution for these positions will be of opposite signs.*

Introduction

Ryan (2001) proposes a “new consideration” that one should take into account when calculating returns:

“The new consideration for return calculation is to resolve a mathematical Achilles’ heel embedded in every published return calculation the reader has probably seen [...]. [...] The Achilles’ heel is in the denominator. *The denominator should use the absolute value of the beginning market value.* This neutralizes the distorting effect that the sign of the denominator can have on the result. Without employing absolute value in the denominator, suddenly a loss (gain) in a short portfolio produces an erroneous positive (negative) return as a negative (positive) divided by a negative always produces a positive (negative) number. Converting the denominator into its absolute value ensures a gain will always correspond to a positive return regardless of whether the portfolio is long, short or market neutral.”¹

Without worked examples, it is hard to trace out with certainty all the implications of this paragraph. However, we can at least identify some of the important questions it raises. The two principal questions raised by this paragraph are:

1. How to calculate the returns on short positions?
2. If a portfolio makes money by shorting a stock, should the return be positive or negative?

The first of these questions depends – in practice at least – on issues such as the sign conventions that one’s portfolio accounting system uses. Therefore, it would be possible for two people to believe that they disagreed completely about the first question purely because they were using different portfolio accounting systems. Hence there is abundant potential for confusion about the first question.

¹ Ryan (2001) pp 33-34.

The second question is more straightforward. Hence, even though one has to calculate a return before using it, I choose to discuss these questions in reverse order, in the hope of minimizing confusion.

Returns on Short Positions

The last sentence of the above quote from Ryan (2001) seems to suggest that a profitable short position should be measured as a positive return. For example, suppose that a portfolio manager was bearish on stock XYZ, and decided to short-sell 1,000 shares at \$100 each. If stock XYZ subsequently fell to \$70, the portfolio manager's bearishness would be vindicated, and the trade would have been profitable. Probably everyone would agree that the magnitude of this return would be 30%. But should the sign be positive or negative? Ryan (2001) would seem to indicate that the return should be positive since the trade had been profitable.

However, assigning a positive return to this trade creates a few problems.

Firstly, how would one use this positive return in a contribution calculation? Over a single period, the contribution of any holding to the portfolio is its opening weight multiplied by its return. For example, if a portfolio is divided equally between two stocks whose returns are 10% and 30% respectively, the portfolio return will be 20%. The contribution of the first stock will be $50\% \times 10\% = 5\%$, and the contribution of the second stock will be $50\% \times 30\% = 15\%$. These contributions sum exactly to the portfolio return.

In the case of stock XYZ, suppose that the other holdings in the portfolio created a total exposure of \$1.1 million. The short position in stock XYZ would create an exposure of minus \$100,000. Thus, the total exposure of the fund would be exactly \$1 million, and the weight of stock XYZ in the portfolio would be -10% .

If we consider (as Ryan (2001) seems to suggest we should) that the return for stock XYZ should be positive 30%, the result would be contribution of -3% , which makes no sense, because the trade was profitable. On the other hand, a return of minus 30% results in a contribution of $+3\%$, which in fact does make sense. A lesson we can draw from this is that the stock's return *per se* does not tell us whether (or how much) the stock added value to the portfolio – this is what a contribution report is for. This is one area where performance analysts can possibly help their clients by educating them on the difference between a *contribution* and a *return*.

Secondly, the same sort of problem would arise in performance attribution. There is no need to labor the point by going through another example. The weight one used for stock XYZ in an attribution report would also be negative, and the fact that one had a negative weight in a stock that returned -30% would show added value (assuming that the overall benchmark return was higher than -30%).

Thirdly, there is the question of whether it makes sense to say that the return of stock XYZ was minus 30% in a portfolio that was short the stock, while it was $+30\%$ in the index and in a portfolio that was long the stock. This seems to confuse the concept of *contribution* (which *does* depend on whether the portfolio is long or short a stock) with the concepts of *return* (which I argue does *not* depend on whether the portfolio is long or short the stock).

Calculating Returns for Short Positions

As noted above, the inputs to a performance measurement system can differ in sign from one firm to another, purely because of sign conventions in different portfolio accounting systems. Hence there is plenty of scope for fruitless discussion on this topic, arising from confusions about the nature of input data.

However, in the interest of a constructive discussion, here is a brief worked example showing how one might calculate the return for stock XYZ in two cases: long one share, and short one share.

To start with the easier case, if one was long stock XYZ, the starting value would be 100 and the closing value would be 70. The return would be:

$$\frac{70 - 100}{100} = \frac{-30}{100} = -30\%$$

If one was short stock XYZ, the starting value would be -100 and the closing value would be -70. The return would be:

$$\frac{-70 - (-100)}{-100} = \frac{30}{-100} = -30\%$$

Hence, one arrives at the same return, regardless of whether the stock is held long or short. As we saw above, this is exactly the outcome that is desirable for the sake of calculating contribution reports and attribution reports.

Taking the absolute value of the denominator would in fact make the sign of the return different depending on whether it was held long or short. However, as we have seen above, this creates problems when it comes to calculating contribution or attribution.

Conclusion

Since Ryan (2001) did not provide any worked examples of his proposed method using absolute values, it is hard to make any definite statements about how well this method works. It would be useful to see a more extensive exposition of the method, which explains how the method deals with contribution and attribution calculations. However, the arguments above show that:

- contribution and attribution calculations work perfectly well when the sign of a stock's return does *not* depend on whether the stock is held long or short; and that
- no special method seems necessary to calculate the return on a short position (in particular, there is no need to take the absolute value of the denominator).

With the use of hedge fund strategies (such as market neutral funds), there are potentially some very tricky issues to deal with in this area. However, it remains to be proven whether taking the absolute value of the denominator in a return calculation is a useful thing to do.

Reference

Ryan, Timothy P. "Separating the Impact of Portfolio Management Decisions" *Journal of Performance Measurement* Fall 2001, pp. 29-40.