THE ANALYSIS OF SOME RISK-ADJUSTMENT RULES

Audrius Dzikevičius
Vilniaus Gedimino technikos universiteto doktorantas, Įmonių ekonomikos ir vadybos katedra

Different risk adjustment approaches are analyzed and respective rules are compared in this paper. The goal of this article was to reveal the importance of risk adjustment, describe different risk adjustment rules, and make their analysis from a theoretical point of view.

Risk-adjusted capital allocation and performance measurement is one of the most popular topics at sophisticated banks around the world today [3]. This risk-adjusted approach revolves around the creation of shareholder value.

In investment business it is very important to solve two types of problems:

i) To choose between investment opportunities with different levels of risk and return before the event, and
ii) To evaluate actual investment performance after the event.

In order to distinguish these two aspects it is common in the literature to use the term *risk adjustment* to refer to the first, *ex ante*, aspect, and to use the term *performance evaluation* to refer to the second, *ex post*, aspect [1].

Risk adjustment and performance evaluation criteria are very important because of the number of different uses. The most important use of them is the fact that these measures enables us to compare both different investment opportunities with different levels of expected returns and risks and different portfolios or investment units that made different returns but also took different risks.

Risk adjustment and performance evaluation measures may serve to the management as a guide in allocating internal capital and setting position limits. It a particular trader or investment unit constantly produces higher risk-adjusted profits than the other trader or investment unit then the management of the company may and should reallocate resources from the first trade or investment unit to the other. This idea may be extended to compare the performance of different departments investing in different investment instruments.

If the management of a certain investment bank wants to maximize risk-adjusted profits rather than raw profits, appropriate compensation rules must be development in order to reward a trade or an investment unit producing highest risk-adjusted profits.

Example in Figure 1 illustrates the process of risk adjustment [2]. Imagine we have a number of traders, A to E, who generate the risk-return combinations shown in the Figure below. Trader E makes the highest return, but also takes more risk than the other traders. On the other side, trader A makes the lowest return, but also takes less risk than the other traders. If we rank traders by their returns alone, we would rank E first, followed by D, B, C, and A. On the other hand, if we rank traders by their risks alone, we would rank A first, followed by B, C, D, and E. So we have obviously very different rankings. The first ranking gives too much stress on returns, and the second – too much stress on risk. If we want to account for both returns and risk in a single ranking, we would rank B first, followed by D, E, C, and finally A. So the trader B achieved the best results according to his risk-adjusted return, and the trader A achieved the worst results.

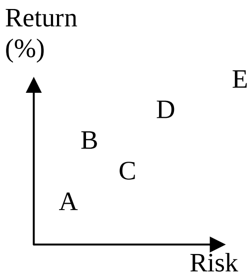

Figure1. Adjusting for Risk

Risk adjustment may be carried out in a number of different ways. Each risk adjustment procedure has its own advantages and disadvantages. Further in the text different risk adjustment procedures are shortly described and their advantages and disadvantages revealed.

Traditional Sharpe rule. Let us start with the best-known risk-adjustment procedure the traditional Sharpe ratio approach (see [5]). Suppose we have a portfolio, p, with a return R_p. We also observe a benchmark portfolio, denoted by b, with return R_b. Let d be the differential return R_p-R_b, and let δ^e be the expected differential return. Then the *ex ante* Sharpe Ratio can be defined in the following way:

$$SR^{ante} = \delta^e / \sigma^e_d \quad (1)$$

where σ^e_d is the predicted standard deviation of d. This ratio shows the expected differential return per unit of risk associated with the differential expected return, and captures the expected differential between two portfolios and the associated differential risk. The traditional Sharpe Ratio gives risk estimates in advance, so this ratio may be very useful for decision making.

Following the same way of thinking we can also define the *ex post* Sharpe Ratio:

$$SR^{post} = \delta / \sigma_d \quad (2)$$

where σ_d is the standard deviation of d over a sample period. Since this ratio deals with ex post returns and the variability of those returns, it may be used for performance evaluation.

The decision rule is to choose position with higher Sharpe ratio.

Information rule. After the analysis of the Sharpe ratio the question may be raised why we should apply it only to *differential* between returns. We can simply use the ratio of portfolio‘s return to its standard deviation. This ratio is known as the information ratio. The information ratio is ratio of return to standard deviation of return. Sharpe demonstrates that this ratio may lead to false results.

The decision rule is to choose position with the highest information ratio.

Treynor-Black rule. The Sharpe Ratio squared is the Treynor-Black ratio. Main problem with this ratio is that squaring obscures information, especially when differential are equal but opposite in sign. The Sharpe ratio would regard them as very different, while the Treynor-Black ratio would regard them as equivalent, and this conclusion would be definitely wrong.

The decision rule is to choose position with the highest Treynor-Black ratio.

Generalized Sharpe rule. Main problem with the Tradition Sharpe ratio is the fact that it presupposes that the return is uncorrelated with the rest of our portfolio. This means that the Sharpe ratio may not give a correct ranking if one or more of the assets involved are correlated with the rest of our portfolio. In order to get around this correlation problem we need to construct two Sharpe ratios, one for the old (or current) portfolio taken as a whole, and one for the new portfolio (or the portfolio we would have if the proposed trade went ahead), also taken as whole. Let the old Sharpe ratio denote by So^{ld} and the new one denote by Si^{new}, the decision rule is:

$$\text{Buy the new asset (i.e., go from old to new) if and only if } So^{ld} \geq Si^{new} \quad (3)$$

According the rule stated above we buy the new assets or go from the old portfolio to the new one if and only if it has a Sharpe ratio greater than that of the old portfolio.

The generalized Sharpe rule has nothing to do with the correlation problem that impedes the application of the standard Sharpe rule.

RAROC rule. The RAROC (*Risk Adjusted Return on Capital*) methodology began in the late 1970’s, initiated by a group at Bankers Trust [4], and now is frequently used as alternative to the Sharp rule. The RAROC measure is defined in the following way:

$$RAROC = R / VaR \quad (4)$$

where R is position‘s realized returns. It seams than this measure is appropriate for risk-adjustment purposes: it rises when returns rise, and falls when risk rises, and vice versa. Despite that, the RAROC measure has a number of drawbacks. To start with them, let VaR of the position goes to zero. Then the RAROC measure goes to infinity. It is showed in [3] that the RAROC methodology may even destroy shareholder value if applied without care.

The decision rule is to choose position with highest ratio of return to VaR.

We can *conclude* that risk adjustment process is very important in investment business for a number of uses. Firstly, risk adjustment enables us to choose between different investment options and to evaluate performance of different traders or investment units who generate certain profits and take certain risks. Secondly, risk adjustment process may serve as a guide in allocating internal capital and setting position limits. Finally, performance evaluation shows to the management how employees should be rewarded.

After the brief theoretical analysis of different risk adjustment approaches we can state that the generalized Sharpe rule is superior to existing approaches of risk adjustment and performance measurement. It is better than the standard Sharpe ratio because it is valid regardless of the correlations of the investments being considered with the rest of the portfolio, and it is also free of the problems of the RAROC measure. The generalized Sharpe rule is easy to implement and use in the day-to-day operations.

References

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KAI KURIŲ VERTINIMO PAGAL RIZIKĄ TAISYKLIŲ ANALIZĖ

Santrauka

Šiame straipsnyje nagrinėjami skirtingos vertinimo pagal riziką taisyklės. Vertinimas pagal riziką investavimo versle yra labai svarbus dėl visos eilės jo pritaikymo galimybių. Pirma, vertinimas pagal riziką leidžia mums iš anksto pasirinkti skirtingas investavimo galimybes bei įvertinti skirtingus dylerius ar investicijų skyrius, generuojančius tam tikrus pelnus ir prisiimančius tam tikro dydžio rizikas. Antra, vertinimas pagal riziką gali nurodyti gaires vidiniam kapitalui paskirstyti ir pozicijų limitams nustatyti. Trečia, vertinimas pagal riziką gali būti naudingas kuriant teisingą darbuotojų motyvavimo sistemą.

Atlikus skirtingų vertinimo pagal riziką metodų teorinę analizę, galima daryti išvadą, kad apibendrinta Sharp taisyklė pranoksta visus kitus žinomus vertinimo pagal riziką metodus. Šis metodas neturi kitiems metodams būdingų trūkumų ir jis gali būti lengvai taikomas kasdienėse investavimo operacijose.