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Derivative Securities in Risk Management for Capital Market Investments

Received 20 October 2004; accepted 2 November 2004

An investor who has selected a security to invest (a stock) can enhance the profile of her position by forming a portfolio combining the stock with some derivative securities, whose underlying security is the chosen stock. We analyse this position from the point of view of risk–return dilemma. The classical portfolio theory takes the standard deviation of the rate of return as a measure of risk. Given some level of the expected rate of return the investor chooses a portfolio minimizing the standard deviation.

Other approach, which we follow, is based on specifying the level of risk (standard deviation) and choosing a portfolio with such a risk and best available expected rate of return. From this point of view the investments in

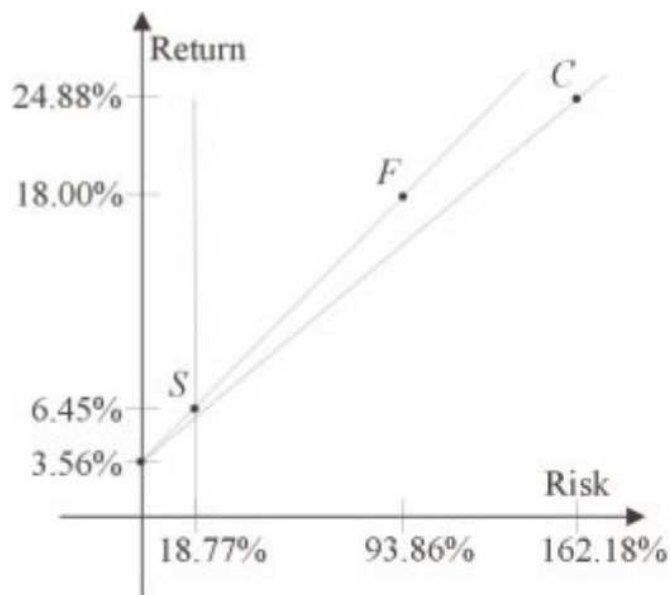
- > the stock,
- > a suitable portfolio of long forward position and risk free asset
- > a suitable portfolio of call option and risk free asset

have similar characteristics as an example in the table below shows (where forward contract is assumed to include some initial deposit). This analysis requires computing the rate of return and the standard deviation of the rate of return, which is performed in the full version of the paper.

An example in discussed, where the stock selected has 6.45% expected rate of return and 18.77% standard deviation of the rate of return (the stock is modeled within the Black–Scholes framework)

The figure below shows the ingredients of the portfolios considered: stock (S), forward with deposit (F) and call option (C). The straight lines show all possible portfolios obtain from these ingredients combined with the risk free asset (risk free rate assumed at 3.56%). Having chosen the standard deviation at 18.77% we select the vertical line and the portfolios in question are found at the intersections.

If the investments are examined bearing in mind the Value at Risk as a risk measure (the level of loss at a given probability) these investments differ substantially. Portfolios including derivative securities turn out to be much safer than the investment in stock only. The first portfolio is based on the forward contract where a deposit equal to 20% of the value of the underlying stock (the weight of such a forward position in forward–risk–free portfolio is



20%). The second portfolio is built of call option with strike price equal to the current stock price, (the weights of call options being 11.57%). Such portfolios have the same standard deviation of the rate of return as the stock (18.77%).

| investment | expected return | VaR(5%) | VaR(1%) |
|---------------------------------|-----------------|---------|---------|
| stock | 6,45% | 21,21 | 28,72 |
| portfolio forward – risk – free | 6,45% | 18,18 | 25,69 |
| portfolio call – risk – free | 6,03% | 10,19 | 10,19 |

The example shows that the combination of call and risk-free asset has a great advantage of considerable reduction of Value at Risk while maintaining the expected rate of return at a level similar to the stock itself.

References

T. Bjork. 1998. Arbitrage Theory in Continuous Time. Oxford: Oxford University Press.

Full text is available at www.nsar.wsb-nlu.edu.pl