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Research Note

A Note on the Present Value of a Risky Asset

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Abstract

In this note, by calculating the present value, we argue that we should avoid adding independent assets to our portfolio.

Keywords: Asset; Conditional expectation; present value; Zero mean variable

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Introduction and main result

Modern portfolio theory has been received considerable attentions in the financial literatures; see Korn and Korn (2001) among the others. In this note, we argue that we should avoid adding independent assets to our portfolio. To this end, note that, the present value (PV) of a risky asset (*Sn*) is given by

$$PV(S_n) = e^{-rn}E(S_n|S_0),$$

where *r* is the free-risk interest rate. Next suppose that ε_n is an another assert such that

$$E(\varepsilon_m) = 0$$

and these two processes are independent. Thus,

$$PV(S_n + \varepsilon_m) = PV(S_n).$$

An example of ε_n is

$$\varepsilon_m = \log(S_{m+dm}) - \log(S_m),$$

where *dm* is a small time increment. One can easily see that

$$E(\varepsilon_m) \to 0$$

as dm goes to zero

.

Now, suppose that ε_{n+1} is also independent of *Sn*. Again, it is seen that

$$PV(S_n + \varepsilon_{n+1}) = PV(S_n).$$

However,

$$\mathrm{var}(S_n + \varepsilon_{n+1}) \geq \mathrm{var}(S_n).$$

That is the risk of $S_n + \varepsilon_{n+1}$ is larger than the risk of alone *Sn*. This argument shows that why we avoid adding independent assets to our portfolio. Next, suppose that ξ_n is another positive return asset. The question is which proportion of ξ_n we should add to *Sn*. The answer is to select w such that

$$\begin{cases} E(S_n + w\xi_n) \geq \mu^*, \\ E(S_n + w\xi_n) \leq \sigma^{2*}. \end{cases}$$

References

[1] Korn, R. and Korn, E. (2001). *Option pricing and portfolio optimization: modern methods of financial mathematics*. American Mathematical Society.