

The change of the stock market in the COVID-19 and examination of the most suitable portfolio

1. **Purpose.** The basic idea is that when holding stock stocks or financial assets, one acquires financial assets that are likely to be profitable. However, at that time, there is a limit to one's budget and one cannot buy everything. The problem of selecting the optimal financial assets under various limitations such as budget is called the portfolio optimization problem. The influence on markets is immeasurable by the infection spread of COVID-19. Therefore we made two kinds of portfolios of stocks in 3 years (2018, 2020, 2022) and checked the effects of COVID-19.
2. **Method.** We have compared the two kinds of portfolios. The first one is called "the mean variance model without short sale limitations (we call this model (1))" and the second one is called "the mean variance model with short sale limitations (we call this model (2))". We analyzed the changes in 3 years (2018, 2020, 2022). I have expressed risk and the condition of assets via a mathematical formula and generated a portfolio using the programming. We used data of the listed companies in Japan from "Astra Manager".
3. **Results.** In the case (1), the loss risk is unaltered in 3 years, but the expected rate of return was found to rise year by year from 2018. On the other hand, in the case (2), the loss risk at 2020 is the biggest and the risk at 2022 is the smallest in 3 years. In addition, in the case (2), the expected rates of return at 2018, 2020 and 2022 were 0.8%, 0.5% and 1.0% respectively. From these results, we see that the market was under recovery compared to the situation during COVID-19 outbreak in 2020.