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Research on portfolio optimization of agricultural intellectual property promotion engineering projects

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Abstract

Venture capital which supports the commercialization of agricultural S&T achievements is a new type of investment mode. High earning of agricultural intellectual property venture capital coincides with high risk. How to balance the return on investment against the risk of investment and how to decide the compositions of investment portfolios are what the investment companies most concern. From the perspective of venture capital companies, this paper, which applies expert evaluation method, mean-variance portfolio theory and quadratic programming, studies optimization of intellectual property venture portfolio, proves rationality and feasibility of the model through case analysis, and provides a theory for venture capital companies to optimize their investment portfolios.

Keywords: Venture capital; Agricultural intellectual property; Promotion engineering projects; Portfolio optimization; Quadratic programming

1. Introduction

Agricultural intellectual properties include patents, trademarks, products of place of origin (geographic indication) and the new varieties of plants, etc. The industrialization of agricultural intellectual property needs Venture capital which has become a new type of investment mode to supports the commercialization of agricultural intellectual property. Venture capital plays a more and more important role to promote agricultural high-tech development. Agricultural intellectual property venture Capital has high earnings, coincided with a high risk. How to balance the returns from investments against the risks that may result from them and how to decide the compositions of investment portfolios are what the investment companies most concern. Researches on investment portfolio done by the scholars of China and other countries can be divided into two categories in general:

First, classic investment portfolio theory established on the basis of strict premise and hypothesis. Starting from the study on the relationship between the return rate and the risk arising from risky assets, Harry Markowitz (1952) describes risk with variance and discusses on selection of the optimal asset portfolio in the Uncertain Economic System. Under efficient markets hypothesis, Sharpe William F (1964) and Linter John (1965) suggested balanced Markowitz's model of mean-variance , i.e. capital asset pricing model (CAPM). Ross (1976) made breakthrough in progressing capital asset pricing theory and put forward the Arbitrage Theory of Capital Asset Pricing.

Second, classic investment portfolio theory is built on basis of strict hypothesis, which is where some scholars found it imperfect. Therefore, many innovative models and corrective models kept springing up. Vesa Kanniainen

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(2003) has innovated the model for investment portfolio. They believed that the consultation strength should be weighed against investment portfolio for venture capitalists to provide enterprises with consultation services. Liu Shuren et al. (2004) worked out the indifference curve by applying the Principle of Effective Selection of asset portfolio to the double curve depicted on the σ-γ plane used for describing the effective frontier of the mean-variance model and then the optimal investment portfolio in terms of effective function. Gao Junjun et al. (2006) proposed the model for measurement of the utilities from the investments by the venture capital companies. On the basis of the analysis on return and risk, Xu Yonglong et al. (2008) established return and risk optimization model by measuring risks with semi-variance, overcoming shortcomings of past research. Chen Guohua (2010) studied the multi-objective securities portfolio investment model. It can be found in the literature dealing with the investment portfolio written by Chinese or foreign scholars which are mentioned above, that most researches, whether Chinese or foreign, focus on the Least-squares Algorithm by Markowitz, CAPM model by Sharpe and Linter and many other corrective and innovative models coming up later one after another, which constitutes the major parts of model investment portfolio theory. However, these investment portfolio models are more used in stocks, funds, futures and other investment means than in the research on the agricultural intellectual property venture.

2. Construction of the model for portfolio optimization of Agricultural intellectual property venture capital projects

2.1 Basic hypothesis

From the perspective of venture capital companies, two interrelated objectives are involved in an investment: first, security; and second, profitability. This paper studies how to achieve the maximum expected investment return with the least investment portfolio risk, with security targets represented by investment portfolio risks and profitability by expected returns from investment.

To facilitate my study, the following hypotheses are proposed in this paper:

First, suppose both venture capital companies and investment experts have learnt so much market information that expected return and variance from each venture capital project can be worked out through expert evaluation method.

Second, suppose that venture capital companies aim their investments either at maximizing returns under given risks or at minimizing their risks under given returns.

Third, the reciprocal relationship between the returns from different investment projects can be described with correlation coefficient.

Fourth, suppose that venture capital companies pay attention only to investment returns and risks from investments in making investment-related decisions.

2.2 Construction of the model involving only one investment project

The expected return from a certain investment can not be exactly figured out and according to mean-variance investment portfolio theory, the classic theory proposed by H.Markowitz, a U.S economist, this paper believes that investment expectation return of risky investment can be described by sample mean (expectation):

$$E(x) = (x_1 + x_2 + \ldots + x_n) / n = \sum_{i=1}^{n} x_i / n \qquad (2.1)$$

where x_i is the grade given by *i*th expert, as an evaluation by the expert on expected return of the investment project; $\bar{x}$ is expected return of investment project; n represents number of experts.

Expected return from an investment describes average profitability out of the investment. However, it is not enough to describe investment effect only with expected return of investment; also it is necessary to measure the tendency of dispersion to describe rise and fall of data, i.e. the size of risks. Typically, the dispersion tendency of a group of expected investment return $(x_1, x_2, \ldots, x_n)$ is measured with the variance, calculated in the following equation, and the standard deviation.