# Analysis of Financial Asset Pricing Model for Portfolio Investment based on Principal-Agent Theory Perspective

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**Abstract.** If investors entering the securities market want to make rational investment decisions, they need to understand whether the current financial asset prices truly reflect the intrinsic value of the market economy, and the important discriminatory basis that can help investors invest accurately is the past theories of securities investment and financial pricing theory. The existing financial asset pricing models do not involve explicit investment variables, and therefore their ability to price financial assets is relatively limited. Based on the above research background, a financial asset pricing model for portfolio investment based on the principal-agent theory perspective is proposed. This paper takes the basic concepts of principal-agent theory as an entry point to study the trend of the economic system of portfolio investment in the general environment of market economy, and then derives the expression form of the financial asset pricing model of portfolio investment based on known indicators of financial asset variables. By analyzing the numerical statistical results of the investment variables of a certain A-share pricing model, it can be seen that when the price to book ratio index remains constant, the higher the valuation level of securities investment, the stronger the liquidity of financial assets. At this time, the derived pricing model can better reflect the change law of financial assets, thus helping investors to make rational securities investment decisions.

**Keywords:** Principal-Agent Theory; Portfolio Investment; Financial Assets; Pricing Models; Investment Variables

# 1    Introduction

With the increasing improvement of the securities investment industry, people's basic standard of living has shown a gradual increase in the state of change, and more and more people have begun to slowly transfer their personal surplus funds from the form of savings into the financial investment market. When they trade in the securities market, the most important thing they should do is to implement whether the current market price of the investment project can match the current actual financial value of the enterprise to which it belongs, which can not only help them make the right investment decision, but also effectively avoid the phenomenon of capital deficit. In the field of securities, the accurate valuation of the financial level of the invested project can only be achieved by implementing the pricing relationship between financial assets and securities investment. Traditional financial asset pricing theory is more adapted to the developed Western countries, for the domestic securities investment environment, such economic assumptions are seriously detached from the reality, not only can not help investors make the right decision, but also disrupt their perception of the financial industry, which eventually leads to the emergence of wrong investment behavior. In order to better adapt to the financial and asset pricing relationship in the domestic securities investment market, Xiaoqi and Liao Hongyan use the perspective of non-financial firms as an entry point to study the ability of financial assets and economic leverage to influence the financial asset pricing model while analyzing the risk level of securities investment, and use this as a basis to infer the development direction of the domestic securities investment market in the coming period [1].

The principal-agent theory is an important financial research result that emerged in the late 1970s. Its application aims to combine modern corporate investment ideas with the concept of information finance, which on the one hand helps the companies themselves and the individuals involved in the investment to gain substantial economic benefits, and on the other hand ensures that the regional financial investment market does not experience significant turbulent performance situations over time. From a macro perspective, the implementation of principal-agent theory is able to satisfy the interests of both economic agents and investment principals, maximizing economic income while promoting a relatively stable circulation of financial assets in the securities investment market environment [2]. Compared with other types of financial development concepts, principal-agent theory avoids the

impact on the personal economic income of investment principals and provides a broader space for the circulation of financial assets in the securities investment market. In the complex socio-economic environment, the financial asset pricing model for portfolio investment can be studied based on the development perspective of principal-agent theory in order to steadily improve the economic returns from portfolio investment.

## 2     The Incentive Role of Principal-Agent Theory for the Securities Economy

Compared with other types of financial systems, the implementation of principal-agent theory pays more attention to the correlation constraint relationship between constrained asset variables and requires that the role relationship between all the variables involved in modeling must satisfy the principle of consistency, which on the one hand can guarantee the rapid accumulation of financial assets and enable investment individuals or investment units to obtain more substantial economic returns in a shorter period of time; on the other hand, it can also avoid the emergence of the phenomenon of capital wastage and make the constant development relationship between financial assets and the economic system be guaranteed. It is also worth mentioning that the principal-agent theory also imposes clear requirements on the economic transmission behavior between the participating investors and the financial asset variables. For the securities investment industry, investors and investment units, as the initial owners of financial assets, are free to allocate their accumulated assets, and no other organization has the right to interfere with the decision-making behavior made by the investors; while financial assets, as dependent variables, do not have the ability to change directly in the process of economic development and accumulation, but will change with the decision-making behavior of the investors. In the process of economic development and accumulation, the physical quantity does not have the ability to change directly, but will change with the change of the investor's decision making behavior, and this change behavior is not necessarily direct accumulation, but also indirect accumulation or direct reduction may exist. The complete process of principal-agent theory in practice is shown in Figure 1.
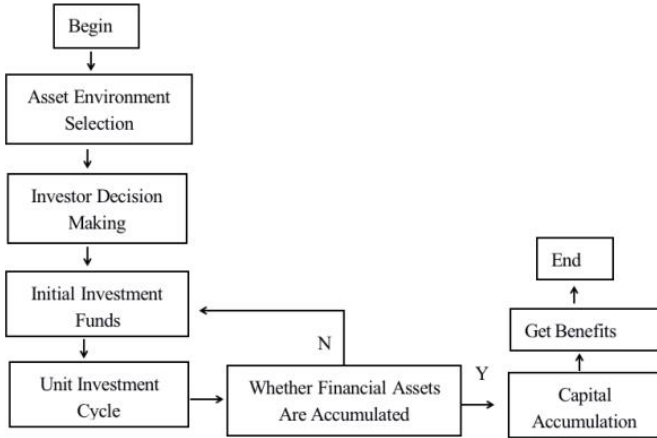
**Fig. 1.** Practice process of principal-agent theory

In the securities investment market, the principal-agent theory can play a certain incentive role for the circulation of financial assets, especially when the economic ownership and management remain separate, so that investors can determine the stability of the securities economy based on the trend of the existing financial assets set, thus avoiding unnecessary losses of personal investment funds while accurately grasping the economic trends.

Let an investor put Q yuan of start-up capital into the securities market at the moment t = 0. Assuming that the investment return received by the investor at t = 1 is Q1, the relationship between Q1 and Q with principal-agent weight $\delta \neq 0$ can be described as:

$$Q_1 = \frac{(t_1 - t_0)Q}{\delta \times |w_1^2 - w_0^2|} \qquad (1)$$

where $w_0$ denotes the financial asset assignment value of the start-up capital Q and $w_1$ denotes the financial asset assignment value of the investment income Q1. The inequality condition that $w_1 > w_2$ holds constant for $\delta \neq 0$.

From the perspective of principal-agent theory, if an individual portfolio investor can afford a larger amount of start-up capital, the return on financial assets per unit

investment cycle will be relatively larger; conversely, if an individual portfolio investor can afford a smaller amount of start-up capital, the return on financial assets per unit investment cycle will be relatively smaller. In summary, it can be seen that, in the cognition of principal-agent theory, the influence of portfolio investment on financial asset accumulation behavior satisfies the positive incentive relationship, i.e., the higher the investment cost, the more obvious the asset accumulation behavior. Therefore, in order to promote the rapid development of the securities economy, the securities investment industry can be promoted to present a flexible development by absorbing investors, increasing the initial investment amount, extending the unit investment cycle, and controlling the financial asset empowerment difference between the start-up capital and the investment return, so as to provide a relatively reliable environment for the accumulation of financial assets.

# 3      Derivation of Financial Asset Pricing Models

## 3.1    Securities Market Line

According to principal-agent theory, the investment risk in the securities industry can be measured by a coefficient p and the relationship between this risk coefficient and the investor's economic return can be described by the securities market line. The securities market line describes the constraint relationship between the risk of securities investment and the investor's expected return payoff, defined by the following equation:

$$I = Q_1 \left[ I_0 + p \left( I_\alpha - I_\gamma \right) \right] \qquad （2）$$

where $\alpha$ and $\gamma$ denote two different nodes of portfolio investment returns, $I_\alpha$ denotes the necessary investment return based on node $\alpha$, $I_\gamma$ denotes the necessary investment return based on node $\gamma$, and $I_0$ denotes the initial value of the portfolio investment return.
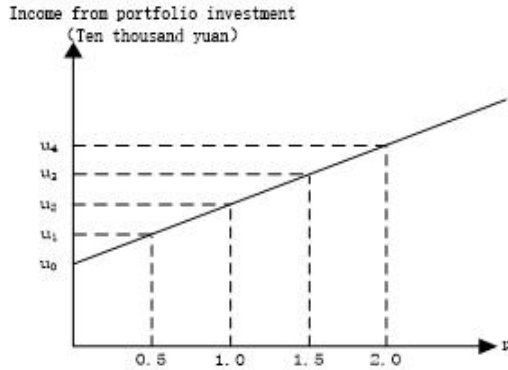
**Fig. 2.** Stock Market Lines

Analysis of Figure 2 shows that even in the case where the coefficient $P$ takes the value of "0", the return on portfolio investment is not equal to "0", and this value (u0 in Figure 2) is recognized as the starting return on portfolio investment, which means that in the perception of principal-agent theory, the securities market always has a certain financial regulation ability, and on the basis of maintaining the initial return value of "0", with the continuous injection of outside investment, the return on portfolio investment always maintains a rising trend, but its average growth rate is not fixed.

## 3.2    Financial Market Line

In the financial asset pricing model, the expected return value represents the risk return that securities investors are likely to get. When the financial economic share remains unchanged, the trade-off relationship between the expected return and the standard investment financial difference is called the financial market line. The specific solution expression is as follows:

$$K = \frac{I \times (K_\alpha - K_\gamma)}{\beta \cdot \Delta H} \qquad (3)$$

In the above equation, $K_\alpha$ denotes the financial return coefficient based on node $\alpha$, $K_\gamma$ denotes the financial return coefficient based on node $\gamma$, $\beta$ denotes the

investment share of initial financial assets, and $\Delta H$ denotes the cumulative number of units of portfolio investment financial assets.

The following figure represents the financial market line based on the principal-agent theory perspective.
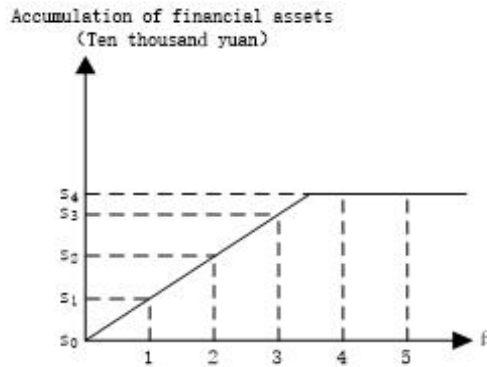


**Fig. 3.** Financial Market Lines

Analysis of Figure 3 shows that, with the increase of the initial investment ratio of financial assets, the accumulated amount of financial assets shows a numerical change trend of increasing and then gradually stabilizing, when the investment ratio is "0", the accumulated amount of financial assets is also "0", which means that In the securities investment industry, the accumulated amount of financial assets is directly influenced by the investment behavior, and when the former value increases, the latter value also increases, and when the former value decreases, the latter value also decreases, and when the investment ratio reaches a certain value standard, the accumulated amount of financial assets will not continue to grow, and the development state of the securities investment industry is most stable at this time.

## 3.3    Pricing Model Expressions

Because of the limitations of principal-agent theory, the following aspects should also be noted when solving the expressions of the portfolio investment financial asset pricing model.

### 3.3.1. The Initial Capital Injection Value of Securities Investment Cannot be "0".

In the market economy environment, no matter whether the financial assets are surplus or not, the initial capital injection value of securities investment can not be equal to "0", especially in the case of a relatively large number of investors, any kind of economic effect will lead to changes in the accumulation of financial assets, but the performance direction of this change behavior is not fixed.

### 3.3.2.Investors Must Assume a Certain Level of Economic Risk When Making Decisions.

Since the performance of the act of accumulation of financial assets is not controllable, the economic returns brought by the securities investment industry do not necessarily remain cumulative, and losses of varying degrees may occur, while the investment risks faced by investors as a direct audience group are always uncontrollable.

### 3.3.3.Any Investment Behavior Must Bear a Certain Amount of Taxes and Transaction Costs.

In the securities investment industry, both the initial capital injection and the income from the financial assets occupy a certain financial share. Therefore, in order to promote the stable development of the economy, the relevant securities institutions and organizational units will charge a certain amount of tax as a reward on the basis of the original financial assets. However, when the economic income is not enough to pay the transaction costs, the individual investors shall bear all the expenses.

The expression for solving the financial asset pricing model for portfolio investment in the principal-agent theory perspective is as follows：

$$Z = \frac{(fK)^2 - |H|^2}{\sum_{\sigma=1}^{+\infty} v_1 \cdot v_2 \cdots \cdot v_n} \qquad (4)$$

In the above equation, $f$ denotes the cumulative coefficient of financial assets, $H$ denotes the transaction cost, $\sigma$ denotes the initial assignment of the taxation coefficient of portfolio investment, and $v_1$, $v_2$ and $v_n$ denote $n$ different measures of financial asset return risk.

# 4    Empirical Studies

An A-share is selected as an experimental object to analyze the relationship between the numerical changes in the volume of its portfolio investment and the accumulation of financial assets under the action of the principal-agent theory pricing model. Let $\theta$ denote the price-to-book ratio indicator, $\lambda$ denote the valuation of portfolio investment, and $m$ denote the financial asset liquidity coefficient. With the support of the above physical quantities, the expression for the solution of the financial assets accumulation $\omega$ can be defined as

$$\omega = Z + \theta X + \lambda C + mZ \qquad (5)$$

where X, C, and Z denote three unequal economic disturbance terms and the inequality conditions of X > 0, C > 0, and Z > 0 hold simultaneously.

The following table reflects the impact of price to book ratio on the cumulative amount of financial assets.

**Table 1.** Impact of price to book ratio on the cumulative amount of financial assets

| Item | $\theta$ | $\lambda$ | $m$ | $Z$ | $X$ | $C$ | $Z$ | $\omega$ |
|------|------|------|------|------|------|------|------|------|
| 1 | 1.13 | 2.18 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 3.17 |
| 2 | 1.15 | 2.18 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 3.05 |
| 3 | 1.17 | 2.18 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 3.34 |
| 4 | 1.19 | 2.18 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 2.96 |
| 5 | 1.21 | 2.18 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 2.99 |

Analysis of Table 1 shows that, with the valuation of securities investments and the liquidity coefficient of financial assets remaining constant, the change in the trend of the indicator of financial assets accumulation is not controllable as the value of the price-to-book ratio indicator increases continuously, but the indicator of financial assets accumulation takes the largest value when the price-to-net ratio indicator is equal to 1.17, and the indicator of financial assets accumulation takes the smallest value when the price-to-net ratio indicator is equal to 1.19.

The following table reflects the ability of portfolio valuation to influence the amount of financial assets accumulated.

**Table 2.** Impact of valuation of portfolio investments on the accumulation of financial assets

| Item | $\theta$ | $\lambda$ | $m$ | $Z$ | $X$ | $C$ | $Z$ | $\omega$ |
|------|------|------|------|------|------|------|------|------|
| 1 | 1.17 | 2.36 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 3.39 |
| 2 | 1.17 | 2.39 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 3.44 |
| 3 | 1.17 | 2.42 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 3.48 |
| 4 | 1.17 | 2.45 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 2.51 |
| 5 | 1.17 | 2.48 | 3.04 | 1.41 | 1.22 | 1.31 | 1.25 | 2.56 |

Analysis of Table 2 shows that, with the value of the price-to-bookratio indicator and the liquidity coefficient of financial assets remaining unchanged, the indicator of financial assets accumulation shows an increasing value change as the valuation of portfolio investments increases. Therefore, it can be considered that the valuation of securities investment is the key factor affecting the accumulation capacity of financial assets.

The following table reflects the ability of the financial asset flow factor to influence the amount of financial assets accumulated.

**Table 3.** Impact of financial assets flow coefficient on the accumulation of financial assets

| Item | $\theta$ | $\lambda$ | $m$ | $Z$ | $X$ | $C$ | $Z$ | $\omega$ |
|------|------|------|------|------|------|------|------|------|
| 1 | 1.17 | 2.18 | 3.53 | 1.41 | 1.22 | 1.31 | 1.25 | 3.27 |
| 2 | 1.17 | 2.18 | 3.54 | 1.41 | 1.22 | 1.31 | 1.25 | 3.33 |
| 3 | 1.17 | 2.18 | 3.55 | 1.41 | 1.22 | 1.31 | 1.25 | 3.35 |
| 4 | 1.17 | 2.18 | 3.56 | 1.41 | 1.22 | 1.31 | 1.25 | 2.38 |
| 5 | 1.17 | 2.18 | 3.57 | 1.41 | 1.22 | 1.31 | 1.25 | 2.40 |

It can be seen from the analysis in Table 3 that when the price to book ratio index value and securities investment valuation remain unchanged, the larger the value of the liquidity coefficient of financial assets, the more obvious the cumulative behavior of financial assets, and its promotion ability is basically the same as that of the securities investment valuation index. Therefore, it can be considered that the liquidity coefficient of financial assets is also a key factor affecting the cumulative capacity of financial assets.

To sum up, when the price to book ratio index value remains constant, the higher the valuation level of securities investment, the stronger the liquidity of financial assets. In this case, financial assets will show an obvious cumulative change trend. At this time, the establishment of pricing model following the principle of principal-agent theory will not only help to summarize the change law of financial assets, but also help investors master the development form of the securities investment industry, So as to make rational investment decisions.

## 5 Conclusion

In the perspective of principal-agent theory, in order to achieve accurate pricing of portfolio investment financial assets, the following aspects should be referred to simultaneously.

It should be followed the development trend of the market economy, to consider portfolio investment as part of the regional financial economy, to follow the personal wishes of the investor on the one hand, to consider the feasibility of investment decisions, to maximize the benefits while avoiding unreasonable economic expenses; on the other hand, to gather all available economic resources to ensure that financial assets can be accumulated smoothly.

Avoiding non-essential economic risks for investors, all decision-making instructions should be based on personal reality, to avoid excessive, excessive investment behavior, so as to make financial assets surplus, and ultimately achieve the continuous accumulation of personal economic income.

Open up other ways of income, accumulate all available financial assets while investing in securities, and take them as a part of personal economic wealth.

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