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Research on Asset Chain Pricing under Asymmetric Information

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Abstract: This paper investigates the asset pricing problem in the context of asymmetric information, focusing on the asset chain, and derives an expression for equilibrium asset prices. The findings of this study contribute to our understanding of how information asymmetry affects asset prices and can be used to inform investment decisions in markets with asymmetric information. Future research could explore the implications of these results for other types of assets or for different market conditions. Moreover, policymakers and regulators could also use these findings to design better disclosure requirements and improve market transparency, which could ultimately benefit investors and promote market efficiency. It is essential to continue investigating the impact of information asymmetry on asset prices to develop a more comprehensive understanding of financial markets. Using this equilibrium price expression, the author demonstrates that asset chain-based pricing can help mitigate the volatility of the equilibrium price. This finding could have significant implications for investors and policymakers seeking to stabilize asset prices in volatile markets. Further research could also investigate the practical applications of this pricing model in real-world investment scenarios. The study sheds light on the role of asymmetric information in asset pricing and highlights the potential benefits of asset chain-based pricing.

Keywords: Asymmetric information, asset chain, equilibrium price.

1. Introduction

Asset pricing is the core issue of modern finance, which can be traced back to "Asset Selection: Effective Diversification of Investment," published by Markowitzin (1991) in the "Financial Monthly" in the 1950s. On this basis, Sharpe (1964), Lintner (1975), and Mossin (1966) independently proposed the CAPM model in the 1960s, realizing the leap from asset portfolio theory to an asset pricing model and creating a milestone in asset pricing. The CAPM model is one of the theoretical cornerstones of modern investment and financial management. Its core is that the price of assets is related to the systematic risk in the market equilibrium state. That is, the rate of return is directly proportional to the risk. Because the premise of the CAPM

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model is too harsh, financial economists have made a lot of attempts to relax restrictions and have proposed many improved CAPM models – for example: Black's (1972) "Zero Beta CAPM" model; Brennan's (1971) "CAPM with unequal borrowing or lending rates"; and "CAPM with inflation" proposed by Friend (Friend et al., 1976). The above theoretical models are all based on single-period economic assumptions. Merton (1987) obtained the "Intertemporal Capital Asset Pricing Model (ICAPM)" in multi-period situations, and Breeden (1979) gave the "Consumption-Based Asset Pricing Model (CCAPM)." The "stochastic discount factor theory" was formed based on the consumption-based asset pricing theory. Campbell and Cochrance (2005) incorporated all asset pricing issues into the general framework of stochastic discount factors and integrated the asset pricing theory into the theoretical framework of the stochastic discount factor that maximizes the utility of expected consumption. These pricing theories start from the optimization problem of investors, obtain the first-order conditions of the optimization problem, and then use market clearing to give the equilibrium price of financial assets. This pricing method is called the equilibrium pricing method.

Another main line of asset pricing theory revolves around the no-arbitrage thought of F. Modigliani, the typical representative of which is the arbitrage pricing theory (APT) of Ross (Ross, 2013) and Black and Scholes (1973) option pricing. This kind of pricing under the no-arbitrage principle is a comparative pricing method. The APT suggests that the expected return on an asset can be explained by a linear relationship with various macroeconomic factors, while the Black-Scholes model provides a mathematical framework for pricing options based on the underlying asset's volatility and time to expiration.

The asset price theory in this stage is based on individual rationality and an efficient market, forming a perfect and rigorous theoretical system. However, since the 1980s, finance has encountered many financial phenomena that current theories, called financial anomalies, cannot explain – such as scale effect, inertia effect, reversal effect, value effect, etc. These anomalies are considered abnormal phenomena in the market that challenge the efficient market hypothesis. Schwert and Malkiel (2003) argue that these anomalies can persist over time and cannot be easily explained by traditional economic theories.

Financial economists have made unremitting efforts to explain these abnormal phenomena, forming different research fields, such as behavioral finance, which aims to reveal the impact of irrational investor behavior on asset pricing, and seeks to open the black box of asset price formation process market microstructure theory and corporate finance research on corporate performance based on corporate governance structure. So far, for the research on these anomalies, the industry is still in separate confirmation and interpretation of various monsters. A systematic and complete theoretical system has not yet been formed. This lack of a comprehensive theoretical system hinders the understanding and management of these anomalies, which can have significant implications for various industries and communities. Therefore, further research and collaboration are needed to develop a unified approach to studying these phenomena.

Brennan (1971) proposed an "asset pricing theory based on asset chain" starting from the source of financial assets. His article points out that the financial market continues to develop and deepen under the impetus of financial innovation. Brennan's theory highlights the importance of understanding the origins of financial assets and how they are priced in the market. As financial innovation continues to shape the market, it is crucial to keep track of new developments and their impact on asset pricing. The performance of assets changes with financial innovation, forming an asset change chain. Assets grow from industrial assets used in production and operation (such as shareholder equity) to tradable capital assets (such as stock assets, etc.), and from capital assets to financial derivative assets. This asset change chain is driven by the increasing demand for liquidity and risk management, leading to the creation of new financial instruments and markets. As financial innovation continues to evolve, the asset change chain will likely continue to expand and diversify. Along with the asset form evolution, the asset relevant value is also constantly transferring or evolving, forming an intricate asset change chain and its value (or price) change chain in the financial market. Starting from the asset change chain and its value change chain, Brennan proposed a new capital asset pricing theory method, laying the foundation for establishing a more unified asset pricing theory. This method takes into account the correlation between an asset's value and the overall market, as well as the risk associated with holding that asset, providing a more comprehensive understanding of asset pricing. Brennan's method has been widely used in financial markets to determine fair prices for various assets.

Based on the asset chains theory proposed by Brennan, this paper studies the asset pricing problem under the condition of asymmetric information under the framework of Grossman and Stiglitz (1980) and obtains an equilibrium price expression. From the equilibrium price, it can be seen that after considering the asset chain's influence, the equilibrium price's volatility is weakened.

This article is arranged as follows: The first part briefly introduces the theory of the asset chain and obtains the decomposition of the return rate of the asset; the second part discusses the different factors based on asset chain symmetric information pricing and how the equilibrium price is obtained; and the third part is the conclusion. The theory of the asset chain provides a useful framework for understanding the sources of return in an asset. By decomposing the return rate, we can identify which factors are driving the performance of the asset. This analysis can then be used to inform investment decisions and develop pricing models based on symmetric information.

2. Decomposition of return on assets

Hypothesis 2-1: The equity value of a company has nothing to do with the number of shares in the stock; that is, any split or merger of shares will not affect the company's equity value. Proposition 2-1: Under assumption 2-1, stock price *P*, book value per share *B*, and price-to-book ratio *Qb* satisfy.

$$P = Q_b \times B \qquad (1)$$

And N_b has nothing to do with B.

Proof: Let *M* represent the company's total market value; *V* represent the company's total book value, and the company's total number of shares be *N*.

$$Q = \frac{P}{B} = \frac{P \times N}{B \times N} = \frac{M}{V}$$

If the total number of shares increases by $\triangle N$, then the price per share becomes $P_1 = \frac{M}{N+\triangle N}$, and the net asset per share is $B_1 = \frac{V}{N+\triangle N}$, but:

$$Q_{b1} = \frac{P_1}{B_1} = \frac{M/(N+\Delta N)}{V/(N+\triangle N)} = \frac{M}{V} = Q_b$$

That is, the price-to-book ratio has nothing to do with book value.

Hypothesis 2-2: The company's book value increase is entirely derived from the company's net profit, that is, $\frac{dB_t}{B_t} = Roe_t$, where Roe_t is the asset from *t* to $(t + \triangle t)$ time.

Hypothesis 2-3: When the company does not distribute cash dividends and the share capital does not change, then $\frac{dP_t}{P_t} = r_t$, where *r* is the rate of return of assets from t to $(t + \triangle t)$ time.

In order to obtain the asset's rate of return decomposition, we examine the relative change of the asset price *Pt* (that is, the asset's rate of return r_t), differentiate both sides of equation (1), then:

$$dP_t = dQ_b \times B + Q_b \times dB + o \ (\triangle) \qquad (2)$$

Divide both sides by Pt at the same time, then:

$$\frac{dP_t}{P_t} = dQ_b \times \frac{B}{P} + Q_b \times \frac{dB}{P} + o(\triangle) \qquad (3)$$

Use r_t to represent the income of assets from t to $(t + \triangle t)$. When taking the first-order approximation to the above formula, ignore the higher-order items, and the return on investments when the equity does not change.

$Q_b = \frac{P}{B}$ into Equation (3), we get:

$$r_t = Roe_t + \frac{dQ_b}{Q_b} \qquad (4)$$

The first term Roe_t on the right side of equation (4), depends on the performance of listed companies, and the second term $\frac{dQ_b}{Q_b}$ on the right side, is related to market behavior. That is when the company does not distribute cash bonuses and stock.

In the case of constant capital, the return on assets can be decomposed into the return on net assets reflecting the performance of listed companies and the rate of change in the price-to-book ratio reflecting market behavior.

Let $r_t^B = \text{Roe}_t, r_t^L = \frac{dQ_b}{Q_b}$, then:

$$r_t = r_t^B + r_t^L \quad (5)$$

Then take the mathematical expectation on both sides of equation (5), record $E(r_t) \equiv r, E(r_t^B) \equiv r^B, E(r_t^L) \equiv r^l$, then:

$$r = r^B + r^L \quad (6)$$

Equation (6) indicates that the expected rate of return on assets from t to $(t + \triangle t)$ is divided into two parts. One part comes from the company's return on net assets Roe, which depends on the behavior of listed companies. The other part comes from the relative change rate of the price-to-book ratio. The benefits brought about are related to market behavior. The price-to-book ratio is an important metric used to evaluate the value of a company's stock. When the relative change rate of this ratio is positive, it indicates that investors are optimistic about the company's future prospects and are willing to pay more for its stock. In the long run, the return on net assets from listed companies will play a significant role, which is the most fundamental source of stock returns. For the convenience of discussion, r^B is referred to as the primary value rate of return, and r^L is the market transaction rate of return. Since the data of r^B is relatively low-frequency and changes slowly, while the data of r^L is relatively high-frequency and changes rapidly over time, r^B can also be considered as a medium-term rate of return, and r^L can be regarded as a short-term rate of return. The distinction between r^B and r^L is important in investment analysis, as investors need to consider both short-term and medium-term returns when making investment decisions. Additionally, understanding the difference between these two rates of return can help investors better manage their portfolio risk.

3. Asymmetric information pricing based on asset chain

Grossman and Stiglitz (1980) believe that price plays a crucial role in transmitting information from the informed to the uninformed, but this transmission is imperfect. In this section, under the framework of Grossman and Stiglitz (1980), we combine the asset chain theory to investigate the asset pricing problem under asymmetric information. The asset chain theory provides a useful framework for understanding how information is transmitted through different stages of production and consumption. By incorporating this theory into the analysis, we can gain a more comprehensive understanding of how asymmetric information affects asset prices.

3.1. Basic assumptions

To study the asset price problem based on the asset chain under asymmetric information, we make the following assumptions:

(1) Assume that the economy is a two-period economy. In a two-period economy, individuals make decisions about how much to consume and save in each period, taking into account their income and interest rates. These decisions have implications for the allocation of resources and the overall level of economic activity in both periods.

(2) There are only two types of assets in the market: risk-free assets, where the income is *R*, and the price of unit assets is 1; and risky assets, where the income is *r*, and the initial price is *P*. According to the theory of asset chain, the rate of return *r* of risk assets can be decomposed into:

$$r = r_b + r_l + \epsilon \quad (7)$$

Among them, ϵ is white noise, r_b is the basic return rate, and r_L is the market transaction return. r_b and r_l are both subject to normal distribution, the mean is $\bar{r}_b$ and $\bar{r}_l$, the variance is σ_b^2 and σ_l^2, And the correlation coefficient between r_l and r_b is ρ, and ϵ, r_b, r_l obey multivariate normal distribution, and the rate of return of risky assets satisfies.

$$E(\epsilon) = 0, \text{Var}(r \mid r_b, r_l) = \text{Var}(\epsilon) = \sigma_\epsilon^2$$

(3) Investors are rational investors, divided into informed and uninformed.

Assuming that the distribution of the introductory rate of return r_b of risk assets is information known to all investors, this can be achieved through a strict information release mechanism. Whether an investor is informed, depends on whether he/she spends information cost *c* to obtain r_l. The demand of informed traders for risky assets depends on r_b and r_l and asset price *P*, while the order of uninformed traders depends on r_b and price *P*.

The purpose of the investor's investment is to maximize the expected benefit, and the investor's utility function is the constant absolute risk aversion utility function (CARA).

$$V(w) = -e^{-aw} \quad (8)$$

where a is the risk aversion coefficient.

(4) Assuming that informed traders understand the supply x of risk assets, λ represents the ratio of knowledgeable traders, so the price at the equilibrium moment should be a function of λ, x, r_b and r_l, recorded as $P\lambda(r_b, r_l, x)$ and is the price that makes the total supply of risky assets equal to the total demand. It is not sufficient for an uninformed trader to obtain information through the price $P\lambda(r_b, r_l, x)$ because he/she does not know x, so he/she cannot accurately judge whether the change of aggregate supply or the information of the informed trader causes the price change. Prices can only partially reveal information to the uninformed.

For any investor i, at the initial stage $(t = 0)$ owns M_{i0} risk-free assets and X_{i0} risky assets. Let W_{i0} be the initial wealth, then:

$$W_{i0} = PX_{i0} + M_{i0}$$

Let W_{i1} denote its terminal wealth, then:

$$\begin{aligned} W_{i1} &= RM_{i1} + rX_{i1} = R(W_{i0} - PX_{i1}) + r_b X_{i1} + r_l X_{i1} + \epsilon X_{i1} \\ &= RW_{i0} + X_{i1}(r_b + r_l - RP + \epsilon) \end{aligned} \quad (9)$$

Let Θ represent the information set owned by each investor, and divide investors into informed and uninformed according to the different information possessed by investors. The information set of the knowledgeable person is $\Theta = (r_b, r_l)$, and the information set of the uninformed person is $\Theta = (r_b, P)$. Each investor uses their information to make decisions to maximize terminal utility. The objective function of personal utility maximization is:

$$\underset{X_i}{\text{Max}_i} EV(W_{i1} \mid \Theta)$$

3.2. The optimal risk asset holdings of the insider

According to the assumption, the insider knows the r_b, r_l of the risky asset, so the objective function is:

$$\text{Max}_{X_i} EV(W_{i1} \mid r_b, r_l),$$

$$\text{st} \qquad PX_{i0} + M_{i0} = W_{i0} = M_{i1} + PX_{i1},$$

Since r_b and r_l obey normal distribution, and $W_{i,1} = RW_{i0} + X_{i1}(r_b + r_l - RP + \epsilon)$, $W_{i,1}$ also obeys normal distribution.

$$EV(W_{i1} \mid r_b, r_l) = -\exp\left(-aW_{i0}R - a(r_b + r_l - RP)X_{i1} + \frac{a^2}{2}\sigma_\epsilon^2 X_{i1}^2\right)$$

FOC:

$$-a(r_l + r_b - RP) + a^2\sigma_\epsilon^2 X_{i1} = 0 \quad (10)$$

Solve to get the optimal holdings of risky assets of the insider:

$$X_i = \frac{r_l + r_b - RP}{a\sigma_\epsilon^2}$$

Obviously, X_{i1} has nothing to do with the initial wealth W_{i0}. Therefore, all informed persons' optimal holdings of risky assets are consistent. Consequently, we remove i_1 from the table below and mark X_I as the optimal holding of risky investments for each insider, namely:

$$X_I = X_I(r_b, r_l, P) = \frac{r_l + r_b - RP}{a\sigma_\epsilon^2} \quad (11)$$

3.3. Optimal risk asset holdings for the uninformed

Also according to the assumption, the information set of the uninformed person $\Theta = (r_b, P)$ so the objective function is:

$$\begin{aligned} &\underset{X_i}{\text{Max}} EV(W_{i1} \mid r_b, P) \\ &\text{st} \qquad PX_{i0} + M_{i0} = W_{i0} = M_{i1} + PX_{i1}, \end{aligned} \quad (12)$$

Because $W_{i,1}$ obeys normal distribution, and:

$$W_{i,1} = RW_{i0} + X_{i1}(r_b + r_l - RP + \epsilon)$$

So:

$$EV(W_{i1} \mid r_b, P) = -\exp\left(-aRW_{i0} - a(E(r \mid r_b, P) - RP)X_{i1} + \frac{a^2}{2}\mathrm{Var}(r \mid r_b, P)X_{i1}^2\right)$$

FOC:

$$-a(E(r \mid r_b, P) - RP) + a^2\mathrm{Var}(r \mid r_b, P)X_{i1} = 0$$

Solve to obtain the optimal holdings of risky assets for the uninformed:

$$X_{i1} = \frac{E(r \mid r_b, P) - RP}{\mathrm{aVar}(r \mid r_b, P)}$$

Similar to the risk asset holdings of the informed person, we mark X_U as the optimal risk asset holding amount of each uninformed person, namely:

$$X_U = X_U(r_b, P) = \frac{E(r|r_b,P) - RP}{a\mathrm{Var}(r|r_b,P)} \quad (13)$$

3.4. Distribution of equilibrium prices

Let x represent the supply of risky assets per capita, and λ represent the proportion of informed investors among all investors. Through the joint distribution process of uninformed continuous learning (r_l, P_λ) and thus (r, P_λ), the equation for selecting an investment asset when supply and demand are in equilibrium is as follows:

$$\lambda X_I\big(r_b, r_l, P_\lambda(r_b, r_l, x)\big) + (1-\lambda)X_U\big(r_b, P_\lambda(r_b, r_l, x)\big) = x \quad (14)$$

Definition:

$$\omega_\lambda(r_b, r_l, x) = \begin{cases} \frac{\rho\sigma_l}{\sigma_b}(r_b - \bar{r}_b) - ax\left(\sigma_\epsilon^2 + \sigma_l^2(1-\rho^2)\right) + r_b & \lambda = 0 \\ r_l + r_b - \frac{a\sigma_\epsilon^2}{\lambda}(x - Ex) & \lambda > 0 \end{cases}$$

It will be shown below that the equilibrium price $P\lambda$ is a linear function of ω_λ.

Theorem 1: If the distribution of (r_b, r_l, x, ϵ) is a non-degenerate joint normal distribution, and r_b, x, ϵ and $r_l, x, \epsilon$are all pairwise independent, then equation (14) exists with the following form—The solution:

$$P_\lambda(r_b, r_l, x) = B_1\omega_\lambda + B_2$$

Among them, β_1 and β_2 are real-valued functions about λ. If λ = 0, the price $P\lambda$ does not contain any information about r_l.

Proof: (a) When λ = 0: formula (14) is transformed into:

$$X_U(r_b, P_0) = x$$

Put (13) into the above formula to get:

$$\frac{E(r \mid r_b, P_0) - RP_0}{\mathrm{aVar}(r \mid r_b, P_0)} = x$$

Organized:

$$P_0 = \frac{E(r_l|r_b,P_0) + r_b - \mathrm{aV}\quad(r|r_b,P_0)}{R} \quad (15)$$

According to the assumption, we know that r and x are not related, since there is no insider, P_0 does not contain the information of r_l, so $P_0 = P_0(r_b, x)$. So:

$$E(r_l \mid r_b, P_0) = E(r_l \mid r_b) = \bar{r}_l + \frac{\rho\sigma_l}{\sigma_b}(r_b - \bar{r}_b)$$
$$\mathrm{Var}(r \mid r_b, P_0) = \mathrm{Var}(r_b + r_l + \epsilon \mid r_b) = \sigma_\epsilon^2 + \mathrm{Var}(r_l \mid r_b) = \sigma_\epsilon^2 + \sigma_l^2(1-\rho^2) \quad (16)$$

Substitute (16) into (15) to get:

$$P_0 = \frac{r_b + \bar{r}_l + \frac{\rho\sigma_l}{\sigma_b}(r_b - \bar{r}_b) - ax\left(\sigma_\epsilon^2 + \sigma_l^2(1-\rho^2)\right)}{R} = \frac{\bar{r}_l}{R} + \frac{1}{R}\omega_0 \quad (17)$$

(b) When 0 < λ ≤ 1: Substitute (11) and (13) into (14):

$$\lambda\frac{r - RP_\lambda}{a\sigma_\epsilon^2} + (1-\lambda)\frac{E(r \mid r_b, P_\lambda) - RP_\lambda}{\mathrm{aVar}(r \mid r_b, P_\lambda)} = x$$

$$P_\lambda = \frac{\frac{\lambda r}{a\sigma_\epsilon^2} + \frac{(1-\lambda)E(r \mid r_b, P_\lambda)}{\mathrm{aVar}(r \mid r_b, P_\lambda)} - x}{R\left(\frac{\lambda}{a\sigma_\epsilon^2} + \frac{(1-\lambda)}{\mathrm{aVar}(r \mid r_b, P_\lambda)}\right)}$$

Make:

$$\omega_\lambda = r_b + r_l - \frac{a\sigma_\epsilon^2}{\lambda}(x - Ex)$$

And assume:

$$P_\lambda = \beta_1\omega_\lambda + \beta_2$$

Can be simplified to (18):

$$P_\lambda = \frac{\frac{\lambda\omega_\lambda}{a\sigma_\epsilon^2} + \frac{(1-\lambda)E(r \mid r_b, \omega_\lambda)}{a\mathrm{Var}(r \mid r_b, \omega_\lambda)} - Ex}{R\left(\frac{\lambda}{a\sigma_\epsilon^2} + \frac{(1-\lambda)}{a\mathrm{Var}(r \mid r_b, \omega_\lambda)}\right)}$$

$$E(r \mid r_b, \omega_\lambda) = \frac{\lambda^2(1-\rho^2)\sigma_l^2\omega_\lambda + a^2\sigma_\epsilon^4\sigma_x^2\left(\bar{r}_L - \frac{\rho\sigma_l\bar{r}_b}{\sigma_b}\right) + a^2\sigma_\epsilon^4\sigma_x^2\left(1 + \frac{\rho\sigma_l}{\sigma_b}\right)r_b}{a^2\sigma_\epsilon^4\sigma_x^2 + (1-\rho^2)\lambda^2\sigma_L^2}$$

$$\mathrm{Var}(r \mid r_b, \omega_\lambda) = \frac{a^2\sigma_\epsilon^4(1-\rho^2)\sigma_l^2}{a^2\sigma_\epsilon^4\sigma_x^2 + \lambda^2(1-\rho^2)\sigma_l^2}\sigma_x^2 \tag{18}$$

Tidy up:

$$\beta_1 = \frac{\lambda a^2\sigma_\epsilon^4(1-\rho^2)\sigma_l^2\sigma_x^2 + \sigma_\epsilon^2(1-\lambda)\lambda^2(1-\rho^2)\sigma_L^2\left(a^2\sigma_\epsilon^4\sigma_x^2 + \lambda^2(1-\rho^2)\sigma_l^2\right)}{R\lambda a^2\sigma_\epsilon^4(1-\rho^2)\sigma_l^2\sigma_x^2 + R(1-\lambda)\sigma_\epsilon^2(a^2\sigma_\epsilon^4\sigma_x^2 + \lambda^2(1-\rho^2)\sigma_l^2)} \tag{19}$$

$$\beta_2 = \frac{a^2\sigma_\epsilon^6\sigma_x^2(1-\lambda)\left(\bar{r}_L + \rho\frac{\sigma_l}{\sigma_b}(r_b - \bar{r}_b) + r_b\right)\left(a^2\sigma_\epsilon^4\sigma_x^2 + \lambda^2(1-\rho^2)\sigma_l^2\right)}{R\lambda a^2\sigma_\epsilon^4(1-\rho^2)\sigma_l^2\sigma_x^2 + R(1-\lambda)\sigma_\epsilon^2(a^2\sigma_\epsilon^4\sigma_x^2 + \lambda^2(1-\rho^2)\sigma_l^2)} \tag{20}$$

Then (18) can be transformed into:

$$P_\lambda = \beta_1\omega_\lambda + \beta_2$$

Theorem 1 is proved.

4. Conclusion

If $r_b = 0$, the result returns to the conclusion of Grossman and Stiglitz (1980). It can be seen from (20) that:

Nature 1: After considering the introductory rate of return r_b, the equilibrium price of assets rises; if the income of stocks fluctuates significantly, the price falls, and the efficiency of the capital market is further improved. The equation (20) shows that the equilibrium price of assets is affected by both the introductory rate of return and the income of stocks, indicating that investors need to carefully analyze market trends before making investment decisions. This highlights the importance of conducting thorough market research and analysis before investing in any asset. Additionally, it emphasizes the need for investors to keep a close eye on fluctuations in stock income to make informed investment decisions.

Nature 2: The price P and $\omega\lambda$ have the same information content, so $\omega\lambda$ can be used to measure the information transmitted by the price to uninformed investors.

$$\mathrm{Var}(\omega_\lambda) = \sigma_L^2 + \sigma_b^2 + 2\rho\sigma_l\sigma_b + \frac{a^2\sigma_\epsilon^4}{\lambda}\sigma_x^2$$

This is a measure of the information transfer mechanism based on asset-linked pricing, and the equation represents the inaccuracy of information. By using ωλ as a measure, researchers can better analyze the impact of pricing on investor behavior and market outcomes. The measure is commonly used in finance to assess the efficiency of markets and the extent to which asset prices reflect all available information. This shows that the equilibrium price is equal to ωλ in terms of information transfer, and from its definition, we can see:

Obviously, r_l is the information that every uninformed person wants to know, but the noise x prevents $\omega\lambda$ from transmitting the information of r_l, and the degree of information transmission. Therefore, the higher the noise x, the lower the degree of information transmission and the less efficient the market becomes in terms of transmitting information.

According to $\mathrm{Var}[\omega_\lambda \mid r_b, r_l]$, when $\mathrm{Var}[\omega_\lambda \mid r_b, r_l]$is *0*, $\omega\lambda$ completely transmits the information of r_l, and all uninformed people have obtained the information transmitted by $\omega\lambda$, so they know r_l .

On the other hand, when $\mathrm{Var}[\omega_\lambda \mid r_b, r_l]$ is very large, $\omega\lambda$ hardly transmits information, so the main factor determining the price system's transitivity is $\mathrm{Var}[\omega_\lambda \mid r_b, r_l]$. This suggests that the value of ωλ plays a crucial role in determining the effectiveness of transmitting information through the price system. Additionally, it highlights the importance of understanding how different factors impact the transitivity of prices in order to make informed decisions in financial markets. For instance, changes in market conditions or external shocks may affect the value of ωλ and thus alter the efficiency of price transmission. Therefore, it is necessary to continuously monitor and analyze these factors to ensure that market participants can make accurate and timely decisions.

Another decision determines the price of the transitivity factor of the system is very small, which is $\frac{a^2\sigma_\epsilon^4}{\lambda}$, when a is small (that is, the individual is not very risk-averse), or σ_ϵ is small (that is, the information is very accurate and the noise is low), information traders' demand for risky assets follows closely with r_l, so $\frac{a^2\sigma_\epsilon^4}{\lambda}$ is small, and the uninformed find it very easy to get information from prices. In other words, the transitivity of prices is influenced by factors such as risk aversion, accuracy of information, and noise levels. Understanding these factors can help investors make better decisions in financial markets. For instance, when risk aversion is high, investors may be willing to pay a premium for a safe asset, leading to higher prices. Similarly, when noise levels are low and information is accurate, prices may reflect the true underlying value of the asset, making it easier for investors to make informed decisions. Additionally, when the transitivity factor is small, it indicates that information traders' demand for risky assets closely follows the prices, making it easier for uninformed individuals to obtain information from prices.

To summarize: The equations show that the equilibrium price of an asset is affected by both the initial return and the earnings of the stock, suggesting that investors need to carefully analyze market trends before making an investment decision. Investors should also consider other factors such as market volatility, political events, and economic indicators to make informed investment decisions. Additionally, diversifying their portfolio can help minimize risk and maximize returns. According to the study's conclusion, ωλ is a measure of the price-based information transmission mechanism associated with an asset and is commonly used in finance to assess market efficiency and the extent to which asset prices reflect all information available. It is equal to ωλ in terms of information transmission, and the main determinant of the bridging of the price system is noise x. Therefore, the study suggests that the noise x should be reduced to improve market efficiency and ensure that asset prices reflect all available information. Additionally, ωλ can be used as a useful tool for investors to evaluate the effectiveness of their investment strategies. The value of ωλ plays a decisive role in the efficiency of information transmission through the price system. Therefore, reducing noise x can lead to a more efficient rack system, as it allows for clearer information transmission. This highlights the importance of minimizing external factors that can disrupt the flow of information in the market. When ωλ is small, information traders' demand for risky assets closely follows prices, making it easier for uninformed individuals to obtain price information. This suggests that price transitivity is influenced by factors such as risk aversion, information accuracy, and noise level. Understanding these factors can help investors make better decisions in the financial markets. For example, if investors are risk averse, they may be willing to pay a premium for a stock that is considered less risky. In addition, accurate and timely information can reduce noise levels in the market and improve price convertibility.

The paper explores the asset pricing problem in the context of asymmetric information, with a focus on the asset chain, and proposes an equilibrium asset pricing expression. The research contributes to understanding how information asymmetry affects asset prices, which can be used to inform investment decisions and improve market efficiency through better disclosure requirements and market transparency. The study also demonstrates that asset chain-based pricing can reduce the volatility of equilibrium prices, providing a potential solution for stabilizing asset prices in volatile markets. Future research could extend the findings to other assets and market conditions, as well as exploring practical applications in real-world investment scenarios. Overall, the study sheds light on the role of asymmetric information in asset pricing and highlights the potential benefits of asset chain-based pricing.

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