

Retraction

Retracted: Transmission Effectiveness of Resource Allocation Efficiency in Multitier Capital Market System

Discrete Dynamics in Nature and Society

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This article has been retracted by Hindawi following an investigation undertaken by the publisher [1]. This investigation has uncovered evidence of one or more of the following indicators of systematic manipulation of the publication process:

- (1) Discrepancies in scope
- (2) Discrepancies in the description of the research reported
- (3) Discrepancies between the availability of data and the research described
- (4) Inappropriate citations
- (5) Incoherent, meaningless and/or irrelevant content included in the article
- (6) Peer-review manipulation

The presence of these indicators undermines our confidence in the integrity of the article's content and we cannot, therefore, vouch for its reliability. Please note that this notice is intended solely to alert readers that the content of this article is unreliable. We have not investigated whether authors were aware of or involved in the systematic manipulation of the publication process.

Wiley and Hindawi regrets that the usual quality checks did not identify these issues before publication and have since put additional measures in place to safeguard research integrity.

We wish to credit our own Research Integrity and Research Publishing teams and anonymous and named external researchers and research integrity experts for contributing to this investigation.

The corresponding author, as the representative of all authors, has been given the opportunity to register their agreement or disagreement to this retraction. We have kept a record of any response received.

References

- [1] X. Geng, "Transmission Effectiveness of Resource Allocation Efficiency in Multitier Capital Market System," *Discrete Dynamics in Nature and Society*, vol. 2021, Article ID 4977398, 8 pages, 2021.

Research Article

Transmission Effectiveness of Resource Allocation Efficiency in Multitier Capital Market System

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With the continuous development of the capital market, in order to study the effectiveness of the multilevel capital market, the operation status of the multilevel capital market is used as the research object, and the Pareto analysis paradigm is used to study the effectiveness of the transmission mechanism of the resources allocation efficiency of the multilevel capital market. Research has shown that Pareto analysis model can be used to analyze the multilevel capital markets. Investors' irrationality and lack of professionalism further aggravate market volatility. Research on resource allocation of multilevel capital market systems and the effectiveness of the transmission mechanism has certain theoretical significance and practical value.

1. Introduction

With the continuous development of the capital market, the level of the capital market continues to increase. In order to study the effectiveness of the multilevel capital market, the research object is the operation status of the multilevel capital market, based on the perspective of the Pareto effectiveness analysis of resource allocation. The Pareto efficiency standard can be promoted and applied to resource allocation in the capital market. Then, the resource allocation efficiency in the capital market is equivalent to the Pareto efficiency of resource allocation in that market [1]. The Pareto analysis model is an analysis model based on resource allocation. Considering the inherent group of people and allocable resources, in the change from one state of distribution to another, it can make at least one person be better without making anyone worse off. This is Pareto improvement or Pareto optimization. The stratification and refinement of the capital market can achieve the separation and equilibrium of different types of enterprises. This is a typical Pareto improvement, so it is feasible to use the Pareto model to analyze the efficiency of capital market resource allocation. The efficient state of the capital market is defined as the absence of a type of transactions that improves the satisfaction of other parties, without sacrificing the satisfaction of a party [2].

Once the Pareto optimal standard is clarified for the resource allocation efficiency in the capital market, the efficient state, i.e., efficient resource allocation, means that the resource allocation in the capital market achieves Pareto efficiency or Pareto optimality [3]. For the current capital market, the resource allocation can be deemed as optimal, if there is no other feasible allocation for other investors or financiers which makes the situation of all the players in the market at least as good as their initial situation and the satisfaction of at least one investor or financier stronger than the initial level [4, 5].

Early studies (Barry et al. [6] and Diamond [7]), elaborated on the significance of multilayer market system construction in overcoming information asymmetry but lacked a normative analysis within the framework of a complete model. In this regard, Merton et al. [8, 9] have made active explorations and attempts, trying to build an analytical framework based on the separation and equilibrium model based on the analysis framework of the previous research results to provide a complete and standardized theory for the allocation of resources in the multitier capital market explanation. Therefore, on this basis, this article attempts to analyze the Pareto effectiveness of resource allocation in the multitier capital market within the framework of a unified model. It uses securities as a virtual

investment product to analyze the effectiveness of resource allocation as an entry point to analyze the current trading system. It analyzes the loss of resource allocation efficiency in the multitier capital market and analyzes the effectiveness of the transmission mechanism of resource allocation efficiency under the multitier capital market system. The irrationality and lack of professionalism of investors have further aggravated market volatility. Research on the effectiveness of the transmission mechanism of resource allocation in the multilevel capital market system has certain theoretical and practical value.

2. Basic Model of Pareto Efficient Resource Allocation

The Pareto condition for the optimal distribution of goods among consumers is as follows: For any two consumers, the marginal rates of substitution between any two goods must be equal [10]. This condition is illustrated in Figure 1, where U is the indifference curve between consumers, and BL is the budget line of consumers. Then, the optimal consumption combination is the tangent point between the budget line and the difference curve.

Let M and N be two consumer goods; let MU_M and MU_N be the marginal utilities of M and N , respectively. According to economic theory, we have

$$\frac{MU_N}{MU_M} = \frac{P_M}{P_N}. \quad (1)$$

Let P_M and P_N be the prices of M and N , respectively. Then

$$\begin{aligned} \frac{MU_N}{MU_M} &= \frac{P_M}{P_N}, \\ \text{or } \frac{MU_M}{P_M} &= \frac{MU_N}{P_N}. \end{aligned} \quad (2)$$

That is, $(dM/dN) = (P_M/P_N)$. Hence, the Pareto condition that satisfies consumers can be obtained as follows: the marginal rates of substitution between any two goods equal the price ratio of the two goods.

The Pareto condition that optimizes the distribution of goods among consumers also applies to the optimal distribution of financial products among investors [11]. Under the modern financial economy, the demand for financial products comes from the investment behavior in financial assets [12, 13]. The investment portfolio can be optimized if the marginal rates of substitution of various financial products equal the price ratio of these products:

$$\frac{\Delta Y}{\Delta X} = \frac{P_X}{P_Y}, \quad (3)$$

Extend the Pareto optimal conditions of consumer satisfaction to investors in financial products on the capital market, that is, the optimal Pareto optimal conditions of the investor's portfolio, that is, the assumption of Pareto optimal conditions. The marginal rate of substitution of any two financial products is equal to the ratio of the corresponding product prices. This Pareto condition can also be expressed as

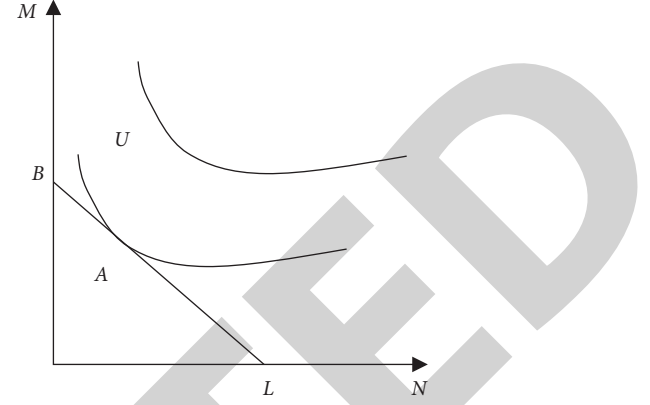


FIGURE 1: Pareto condition for the optimal distribution of goods among consumers.

follows: the marginal returns on investment of any two financial products are equal.

According to the definition of Pareto optimality, the Pareto optimal allocation of financial resources in the capital market is to optimize both the allocation of financial resources between financiers and the allocation of financial resources between investors. The possibility of Pareto optimality is to a certain extent affected by the space of optional financial resources. The greater the space, the more diverse the combination between individuals. Therefore, the possibility of Pareto optimality is positively correlated with individual welfare.

3. Resource Allocation Efficiency Loss

3.1. Influence of Speculative Demand on Security Prices. The supply-demand relationship of virtual investment has a special nature. Researchers must recognize that direct consumption is not the main consumption purpose of investors. The Pareto condition for the optimal distribution of goods among consumers, that is, the hypothetical condition for achieving Pareto optimality, is as follows: for any two consumers, the marginal substitution rate between any two goods must be equal. In essence, the purchase of goods is to pay for an expectation. Different from the situation in the supply-demand relationship of traditional goods, the supply and demand sides of virtual investment could have consistent interests [14]. The expectation of market prices is particularly the case. The economic benefits are not divided between the supply and demand sides under the support of holding this asset but are allocated by the expectation of the future market. This is because the two sides have opposite expectations for the future market: one side wants to provide stocks, and the other is willing to buy stocks [15]. The rise and fall of the stock prices cannot be judged by stock holding or not but are premised on both sides' actual willingness to buy. However, any division method will eventually have an effect on price. In the market, the stock prices are either rising or falling. These changes reflect the overall expectations of the market. Therefore, without considering the level of investor expectations of prices, the following analysis is unfolded around two issues: falling expected price and rising expected price.

3.1.1. *Falling Expected Price (without considering the Level).*

As shown in Figure 2, the market initially rests at equilibrium point E_1 , where the equilibrium price and trading quantity are Q_1 and P_1 , respectively. Under the effect of various factors, the demand will further expand, and the expected price will further decline (drop), causing the total supply to increase. Then, the price increase will face a greater resistance. Therefore, the supply price in this process is often more elastic than the demand price. Besides, the intersection in the actual stock market may be different, because the market regulation is spontaneous to a certain extent. Suppose that the demand shrinks due to the falling expected price of a factor; the demand curve will move left from D_1 to D_2 and intersect the supply curve S_1 at the temporary equilibrium point E' . Meanwhile, the price will fall from P_1 to P' . In the meantime, the supply grows with the falling expected price, and the supply curve will move right from S_1 to S_2 ; D_2 and S_2 will reach a new equilibrium at E_2 , and the price will further decline from P' to P_2 . For specific transactions, if the expected price in the stock market drops, the trading quantity will drop by a smaller amplitude, because the supply curve is more elastic. That is why Q_1 moves towards Q_2 , and price shifts from P_1 to P_2 .

As shown in Figure 3, according to the market relationship, if the expected price of the current stock further decreases, then the demand curve will move further to the left. In this case, the equilibrium price will drop deeper. Meanwhile, the supply curve will move further to the right, making the equilibrium price even lower. This process repeats itself again and again, such that the market equilibrium point shifts continuously from E_1 to E_2 and E_3 .

The above laws are objective in the stock market. Therefore, both security price and trading quantity will decline, if the expected price further decreases.

3.1.2. *Rising Expected Price (without considering the Level).*

As shown in Figure 4, the rise trend is completely different from the drop trend. The initial equilibrium point E_1 is the intersection between D_1 and S_1 . According to the ordinate and abscissa of the coordinate system, the price and trading volume at this moment are denoted as P_1 and Q_1 , respectively. Under the influence of market fluctuations, the growing supply will push up the expected price, which further stimulates the demand. In the market, the stock price will rise rather than fall because of the improvement of stock expectation. Therefore, the demand price is more flexible than the supply price.

As shown in Figure 5, as long as the expected price increases, the process opportunities will inevitably continue in the coordinate system. In this case, the demand curve will move further to the right, while the supply curve will move further to the left. Thanks to the movements, new equilibrium points E_3 and E_4 will appear ceaselessly.

In the meantime, the actual trading price will further grow in the market, because investors have a good expectation of the current stock. The price will move extremely close to the said E_n . In this way, it is possible to obtain the

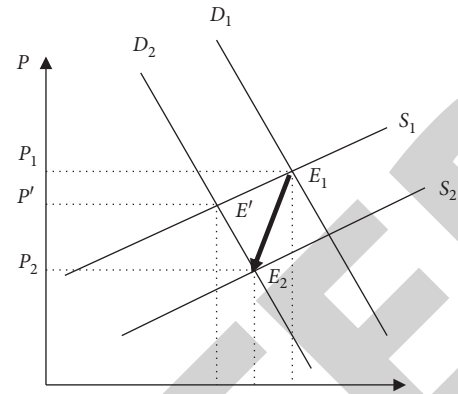


FIGURE 2: Equilibrium changes in security supply and demand under falling expected price.

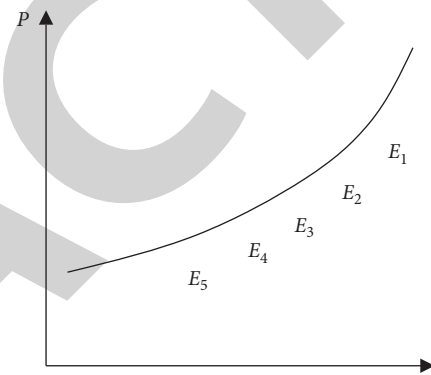


FIGURE 3: Price-quantity relationship of securities at falling expected price.

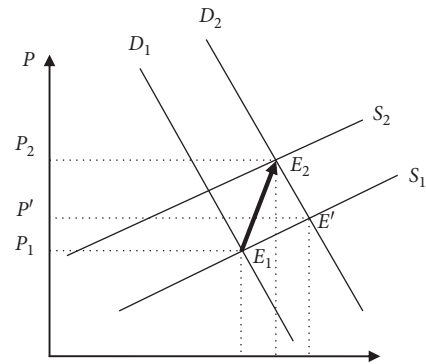


FIGURE 4: Equilibrium changes in security supply and demand under rising expected price.

relationship between price and volume during the rise of expected price.

The above analysis shows that, during the continuous rise of expected price, the actual price and trading volume increase proportionally. This objective correlation can be described mathematically.

As mentioned above, the stock price is fundamentally affected by the price expectation; i.e., $Q = f(pe)$. During the realization of overall market expectation, the relationship between actual price and trading volume, which always

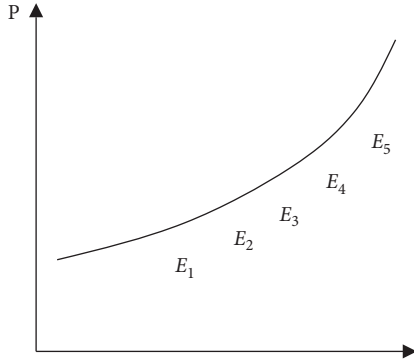


FIGURE 5: Price-quantity relationship of securities at rising expected price.

converges to equilibrium, can be summarized as follows: in the case of rising expected prices, both the price and volume will increase; in the case of falling expected prices, both the price and volume will decline. To put it simply, the two factors always change in the same direction. This is an important theoretical basis for analyzing the stock market with economic statistics.

3.2. Influence of Current Transaction System on Resource Allocation Efficiency in Multitier Capital Market

3.2.1. Efficiency at Rising Expected Price. According to the above analysis, when the price is expected to rise, the new equilibrium price of the stock market will increase above the initial equilibrium price. That is, the equilibrium price will increase from the initial level E_1 to E_2 . It is assumed that the increment from E_1 to E_2 is 10% greater than the upper limit of the increment in symmetric fluctuations. Then, the consumer surplus in the market is composed of the new demand curve D_2 , two coordinates, and the equilibrium price; and the producer surplus in the market is composed of the new supply curve S_2 , two coordinates, and the equilibrium price. That is, the producer surplus and consumer surplus can be, respectively, described as ΔAE_2P_2 and ΔBE_2P_2 . B is the intersection between the extension line of D_2 and the y -axis P . For the lack of space, this point is not specified in Figure 6.

If the expected price rise surpasses the current upper limit, the demand curve D_3 should move to the upper right of the demand curve D_2 at the upper limit, and the supply curve S_3 should move to the upper left of S_2 , forming a new equilibrium price $E_3 > E_2$. At this time, the supplier surplus is ΔCE_3P_3 , and the consumer surplus is ΔDE_3P_3 . D is the intersection between the extension line of D_3 and the y -axis P . For the lack of space, this point is not specified in Figure 6. Judging by the graph, it can be seen that $\Delta CE_3P_3 > \Delta AE_2P_2$, and $\Delta DE_3P_3 > \Delta BE_2P_2$. That is, when the upper limit surpasses the +10% of the current symmetry, both supplier surplus and consumer surplus will increase, and the market will become more efficient. Hence, the upper limit equal to 10% above the current symmetry is not Pareto optimal, leaving a room for Pareto improvement.

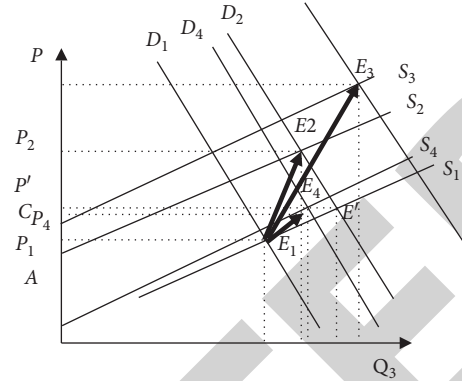


FIGURE 6: Stock supply-demand equilibrium changes at rising expected price.

If the expected price rise is within the current upper limit, the demand curve D_4 should move to the lower right of the demand curve D_2 at the upper limit, and the supply curve S_4 should move to the lower left of S_2 , forming a new equilibrium price $E_4 > E_2$. At this time, the supplier surplus is ΔFE_4P_4 , and the consumer surplus is ΔDE_4P_4 . G is the intersection between the extension line of D_4 and the y -axis P . For the lack of space, this point is not specified in Figure 6. Judging by the graph, it can be seen that $\Delta FE_4P_4 < \Delta AE_2P_2$, and $\Delta GE_4P_4 < \Delta BE_2P_2$. That is, when the upper limit falls below the +10% of the current symmetry, both supplier surplus and consumer surplus will decrease, and the market efficiency will be suppressed. Hence, the market with the current upper limit will face the risk of efficiency.

3.2.2. Efficiency at Falling Expected Price. According to the above analysis, when the price is expected to fall, the new equilibrium price of the stock market will drop below the initial equilibrium price. That is, the equilibrium price will decrease from the initial level E_1 to E_2 . It is assumed that the increment from E_1 to E_2 is -10% smaller than the lower limit of the decrement in symmetric fluctuations. Then, the consumer surplus in the market is composed of the new demand curve D_2 , two coordinates, and the equilibrium price; and the producer surplus in the market is composed of the new supply curve S_2 , two coordinates, and the equilibrium price. That is, the producer surplus and consumer surplus can be, respectively, described as ΔAE_2P_2 and ΔBE_2P_2 . B is the intersection between the extension line of D_2 and the y -axis P . For the lack of space, this point is not specified in Figure 7.

If the expected price drop surpasses the current lower limit, the demand curve D_3 should move to the lower left of the demand curve D_2 at the lower limit, and the supply curve S_3 should move to the lower right of S_2 , forming a new equilibrium price $E_3 < E_2$. At this time, the supplier surplus is ΔCE_3P_3 , and the consumer surplus is ΔDE_3P_3 . Judging by the graph, it can be seen that $\Delta CE_3P_3 < \Delta AE_2P_2$, and $\Delta DE_3P_3 < \Delta BE_2P_2$. That is, when the lower limit surpasses the -10% of the current symmetry, both supplier surplus and consumer surplus will decrease, and the market will become

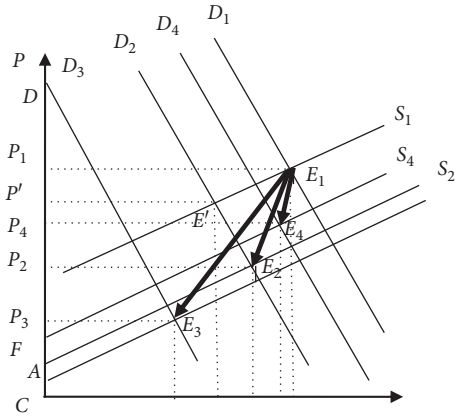


FIGURE 7: Stock supply-demand equilibrium changes at rising expected price.

less efficient. Hence, the lower limit equal to -10% below the current symmetry could bring efficiency loss to the market.

If the expected price drop falls below the current lower limit, the demand curve D_4 should move to the upper right of the demand curve D_2 at the lower limit, and the supply curve S_4 should move to the upper left of S_2 , forming a new equilibrium price $E_4 > E_2$. At this time, the supplier surplus is ΔFE_4P_4 , and the consumer surplus is ΔGE_4P_4 . G is the intersection between the extension line of D_4 and the y -axis P . For the lack of space, this point is not specified in Figure 7. Judging by the graph, it can be seen that $\Delta FE_4P_4 > \Delta AE_2P_2$ and $\Delta GE_4P_4 > \Delta BE_2P_2$. That is, when the lower limit falls below the -10% of the current symmetry, both supplier surplus and consumer surplus will increase, and the market will become more efficient. Hence, the lower limit equal to -10% below the current symmetry is not Pareto optimal, leaving a room for Pareto improvement.

To sum up, the market has the potential for Pareto improvement, under the upper/lower limit equal to $\pm 10\%$ of the current symmetry. The Pareto improvement can be implemented unilaterally, e.g., properly increasing the upper limit on increment or lowering the lower limit on decrement, or bilaterally. There are three possible solutions to bilateral Pareto improvement: raising the upper limit and the lower limit; raising the upper limit and lowering the lower limit, provided that the loss induced by the lowered lower limit is smaller than the improvement brought by the increased upper limit; and lowering the upper limit and raising the lower limit, provided that the improvement brought by the increased lower limit offsets the market loss induced by the reduced upper limit.

4. Transmission Effectiveness of Resource Allocation Efficiency

According to theoretical analysis, the resource allocation efficiency under multitier capital market system belongs to the field of social capital utilization [16, 17]. Because of the irreplaceability of social capital application, the multitier capital market offers a greater and more diverse space than a

single main board market, making it possible to expand the application scope of social capital [18]. Suppose that all investors are rational, and the security market meets the principles of effectiveness. Then, the expansion of social capital application can enhance resource allocation efficiency. This approach is a generalized strategy of Pareto improvement.

After analyzing the specific situation of the capital market, it is assumed that the multitier capital market consists of the Sci-tech Innovation Board Market, growth enterprise market (GEM), small- and medium-enterprise (SME) board market, and the main board market.

The classic Pareto analysis model is based on a single product as the background for analysis. This article analyzes the multilevel capital market. Therefore, the classic Pareto analysis model is not suitable. The improved Pareto model can be clearer and clearer. Accurately it can analyze the real multilayer capital market environment [19]. At the same time, combining the basic principles of market creation and coordinating the relationship between investment risk and return, listed companies in the main board market have the best operational stability, which means that the capital utilization rate of these companies is the most stable; that is, the variance value is the smallest. In the GEM market, listed companies are relatively unstable due to their business nature. These companies have the highest expected value of capital utilization efficiency. However, the capital utilization rate of these companies fluctuates the most; that is, their variance is the largest; the volatility of the GEM market is relatively high. Smaller than the science and technology innovation board market, the situation of listed companies on the small- and medium-sized board market is between the two markets of the ChiNext market and the main board market. Under the multitier capital market system, according to the Pareto efficiency theory, the efficiency of resource allocation can be divided into the optimal welfare state and the producer equilibrium framework. In this process, it is necessary to distinguish different products of listed companies in different markets. The number of products can be expanded to 4, and the two elements are merged into one. At the same time, it can be assumed that the production function of each market enterprise is

$$Y = f_i(K), \quad i = 1, 2, 3, 4. \quad (4)$$

It is assumed that the capital in the above markets has consistent features, and the time lag does not greatly affect investment and financing (i.e., the initial capital formation of the stock market is the financing amount in each year). Let it be the social capital available in year t . Then, the resource allocation results in a single main board market which can be described as

$$Y_{1t} = f_1(K_{t-1} + I_t). \quad (5)$$

According to the resource configuration in multitier capital market, the portion of it invested in each market can be described by

$$Y_t = f_1(K_{1(t-1)} + I_{1t}) + f_2(K_{2(t-1)} + I_{2t}) + f_3(K_{3(t-1)} + I_{3t}) + f_4(K_{4(t-1)} + I_{4t}), \quad (6)$$

where $K_{t-1} = \sum_{i=1}^4 K_{i(t-1)}$, $I_t = \sum_{i=1}^4 I_{it}$, and $K_t = K_{t-1} + I_t$, $i = 1, 2, 3$, and 4 , are the main board market, SME board market, GEM, and Sci-tech Innovation Board Market.

The differential of formula (6) can be obtained by

$$dY_{1t} = \frac{df_1}{dK_t} \frac{dK_t}{dK_{t-1}} dK_{t-1} + \frac{df_1}{dK_t} \frac{dK_t}{dI_t} dI_t = MP_{1K} dI_t, \quad (7)$$

$$dY_t = MP_{1K} dI_{1t} + MP_{2K} dI_{2t} + MP_{3K} dI_{3t}. \quad (8)$$

MP_{iK} is the capital marginal output of the i -th market, which can be considered as the resource allocation efficiency of security market i ; dK is capital increment, which can be

seen as the financing amount in a year. From formula (7), we have

$$\begin{aligned} \frac{\Delta Y_t}{\Delta I_t} &= MP_{1K} \frac{\Delta I_{1t}}{\Delta I_t} + MP_{2K} \frac{\Delta I_{2t}}{\Delta I_t} + MP_{3K} \frac{\Delta I_{3t}}{\Delta I_t} + MP_{4K} \frac{\Delta I_{4t}}{\Delta I_t} \\ &= \alpha MP_{1K} + \beta MP_{2K} + \gamma MP_{3K} + (1 - \alpha - \beta - \gamma) MP_{4K}. \end{aligned} \quad (9)$$

Comparing formulas (6) and (8), the multitier capital market needs to satisfy the following condition to surpass

the single main board market in resource allocation efficiency:

$$\begin{aligned} &\alpha MP_{1K} + \beta MP_{2K} + \gamma MP_{3K} + (1 - \alpha - \beta - \gamma) MP_{4K} \geq MP_{1K}, \\ &(1 - \alpha)(MP_{4K} - MP_{1K}) - \beta(MP_{4K} - MP_{2K}) - \gamma(MP_{4K} - MP_{3K}) \geq 0, \\ &(1 - \alpha)(MP_{4K} - MP_{3K} + MP_{3K} - MP_{1K}) - \beta(MP_{4K} - MP_{3K} + MP_{3K} - MP_{2K}) - \gamma(MP_{4K} - MP_{3K}) \geq 0, \\ &(1 - \alpha - \beta - \gamma)(MP_{4K} - MP_{3K}) + (1 - \alpha)(MP_{3K} - MP_{1K}) - \beta(MP_{3K} - MP_{2K}) \geq 0. \end{aligned} \quad (10)$$

Formula (9) shows that if the enterprises listed in the main board market utilize capital less efficiently than those listed in the SME board, i.e., $E(MP_{1K}) \leq E(MP_{2K})$, and if the SME board-listed enterprises utilize capital less efficiently than the GEM-listed enterprises, i.e., $E(MP_{2K}) \leq E(MP_{3K})$, then the multitier capital market can optimize resource allocation.

The features of the real economy indicate the importance of capital allocation efficiency. In the long run, however, the efficiencies of different market structures should be consistent as much as possible, owing to the critical roles of public expectation and market information transmission. From formulas (7) and (9), the variance between multitier capital market and single board market in market resource allocation can be calculated by

$$\text{VAR}\left(\frac{\Delta Y_{1t}}{\Delta I_t}\right) = \sigma_{1t}^2 = \text{VAR}(MP_{1K}), \quad (11)$$

$$\begin{aligned} \text{VAR}\left(\frac{\Delta Y_t}{\Delta I_t}\right) &= \sigma_t^2 = \alpha^2 \sigma_{1t}^2 + \beta^2 \sigma_{2t}^2 + (1 - \alpha - \beta)^2 \sigma_{3t}^2 \\ &\quad + 2\alpha\beta\sigma_{12} + 2\alpha(1 - \alpha - \beta)\sigma_{13} + 2\beta(1 - \alpha - \beta)\sigma_{23}. \end{aligned} \quad (12)$$

If the listed enterprises are independent in capital utilization, formula (12) can be changed into

$$\text{VAR}\left(\frac{\Delta Y_t}{\Delta I_t}\right) = \sigma_t^2 = \alpha^2 \sigma_{1t}^2 + \beta^2 \sigma_{2t}^2 + (1 - \alpha - \beta)^2 \sigma_{3t}^2. \quad (13)$$

The difference between formulas (12) and (11) is the gap between multitier capital market and single main board market in terms of market fluctuations. Given condition

(10), it is possible to judge the suitability of founding a multitier capital market. To optimize the real economy operation, it is important to make the constructed market

structure satisfy the condition for better resource allocation during the market construction. Therefore, the optimal model for the multitier capital market can be established as

$$\begin{aligned} \min & \left\{ \begin{aligned} & \alpha^2 \sigma_{1t}^2 + \beta^2 \sigma_{2t}^2 + (1 - \alpha - \beta)^2 \sigma_{3t}^2 + (1 - \alpha - \beta - \gamma)^2 \sigma_{4t}^2 + 2\alpha\beta\sigma_{12} + 2\alpha\gamma\sigma_{13} \\ & + 2\beta\gamma\sigma_{23} + 2\alpha(1 - \alpha - \beta - \gamma)\sigma_{14} + 2\beta(1 - \alpha - \beta - \gamma)\sigma_{24} + 2\gamma(1 - \alpha - \beta - \gamma)\sigma_{34} \end{aligned} \right\} \\ \text{s.t.} & (1 - \alpha - \beta - \gamma)(MP_{4K} - MP_{3K}) + (1 - \alpha)(MP_{3K} - MP_{1K}) - \beta(MP_{3K} - MP_{2K}) \geq 0. \end{aligned} \quad (14)$$

By solving formula (14), the optimal model can be obtained, such that the capital allocation meets the requirement of Pareto optimality. Through the above analysis, the condition for multitier capital market was obtained. However, it must be noted that formula (14) implies an important condition: $\sigma_1 < \sigma_2 < \sigma_3 < \sigma_4$, the main board market has the least risk, the Sci-tech Innovation Board Market has the largest market risk, followed by the GEM risk, and the small- and medium-sized board market risk lies in the middle of the GEM market and the main board market. This risk relationship must be fulfilled as a precondition for the optimal model. Otherwise, the capital market will not reach Pareto optimality.

5. Conclusions

The more segmented the capital market is, the more conducive it is to improving the equilibrium level of the capital market and providing more financing opportunities for more companies. Therefore, in the development practice of the capital market, most of them choose the development path of multilevel construction. From a macro point of view, for the existing market system, the refinement of layers and the creation of new market levels are a typical Pareto improvement, which can improve the overall efficiency of the market, from the microstructure within the market system. From the above point of view, the new market and the existing market have different enterprise types, scales, and development stages, and their demand characteristics are different. Therefore, the operation of different market-level sectors should have a certain degree of complementarity.

This article starts from the basic mode of Pareto effectiveness of resource allocation, takes the multilevel capital market as the research object, and uses the Pareto analysis model to analyze the effectiveness of the transmission mechanism of resource allocation efficiency under the multitier capital market system. The information releases are frequent and irregular, and policy-related information has a large impact. The irrationality and lack of professionalism of investors further aggravate market volatility. Research on the effectiveness of the multitier capital market system's resource allocation transmission mechanism has certain theoretical and practical value.

Data Availability

The data used to support the findings of this study are available from the corresponding author upon request.

Conflicts of Interest

The author declares that there are no conflicts of interest.

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