# Research on the Impact of Investor Sentiment on IPO Underpricing of GEM

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## Abstract

IPO underpricing appears when its closing price far exceeds issuance price on the first day of stock issuance, which is a common phenomenon all over the world.
This paper first expounds the related concepts of investor sentiment and IPO underpricing, and then introduces the two perspectives of behavioral finance. Based on these two perspectives, this paper expounds the impact path of investor sentiment on IPO underpricing. Combined with the characteristics of investor sentiment, the proxy indicators of the composite indicators are selected, and the comprehensive indicators of investor sentiment are obtained by using the principal component analysis method, which are combined with the financial indicators that can reflect the market conditions. Taking the data of GEM stocks issued from January 2015 to December 2021 as the research sample, SPSS is used for stepwise regression analysis. From the results of the empirical research, there is a positive correlation between investor sentiment and IPO underpricing. Finally, this paper puts forward suggestions from two aspects: first, we should give correct and reasonable guidance to investors, and implement access policies; Second, in terms of macro policies, we should strengthen the audit of listed companies, establish an authoritative information disclosure mechanism, and put the expansion of GEM on the agenda.

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# 1. Introduction

The Growth Enterprise Market (GEM), also referred to as the Secondary Board Market, serves as a financing avenue and growth opportunity for enterprises that currently fail to meet the listing criteria of the main board but demonstrate growth potential. IPO, or Initial Public Offering, denotes the process where a company issues its shares to the public for the first time. Through this method of direct financing, listed companies can enhance production and development capabilities. This strategy facilitates financing and yields significant benefits in optimizing capital allocation and mitigating financial risks.

Behavioral finance theory diverges from the rational investor assumption upheld by traditional financial theory, proposing that traders' behaviors are influenced by various factors such as education, media coverage, personal traits, and professional expertise. Consequently, their psychology and actions can impact asset pricing. However, due to the relatively relaxed listing requirements of GEM compared to the main and SME boards, coupled with an imperfect disclosure system, IPO underpricing becomes more pronounced. Underpricing occurs when the closing price of a newly listed company significantly exceeds its opening price. Over the past seven years, the average underpricing rate among 692 GEM companies has stood at 86.39%. This phenomenon not only encourages short-term speculative activities, destabilizing the stock market and hindering its long-term growth, but also disrupts fund allocation, leading to resource wastage.

The prevalence of underpricing may incentivize short-term speculative behaviors, exacerbating market volatility and potentially deterring sustained backing from long-term investors. Additionally, underpricing could result in inadequate fundraising for companies, hampering the execution of subsequent development plans. For investors, underpricing poses a risk of diminishing investment returns and eroding confidence in the market.

Based on previous theories, this paper attempts to analyze the irrational behavior of investors in the subscription of new stocks on China's Growth Enterprise Market (GEM) by introducing investor sentiment and IPO underpricing and applying relevant theories from behavioral finance. Furthermore, it will construct a Composite Investor Sentiment Composite Index (CICSI) using principal component analysis and combine empirical research to analyze the factors affecting IPO underpricing. The aim is to contribute to guiding investors towards rational investment decisions and promoting the stable and healthy development of the stock market.

This paper, based on the fundamental principles of behavioral finance, delves into the significant underpricing issue on China's Growth Enterprise Market (GEM) from the perspective of investor psychology. It further explores two aspects: firstly, in the measurement of investor sentiment, it establishes various indices including the raw sentiment index, the sentiment index after extracting the final proxy variables, and the sentiment index after macroeconomic factors are deducted, providing valuable insights for future research in the domain of investor sentiment.

Secondly, in China, research on the relationship between investor sentiment and stock price volatility is still in its nascent stages compared to foreign studies. Many existing studies focus on the correlation between sentiment indices and stock prices. This paper introduces a stepwise regression model and incorporates various financial indicators as control variables, thereby enriching the related research landscape in China.

Traditional finance assumes that investors are rational in processing information and making decisions. However, even in China's stock market, which is weak-form efficient, this assumption does not hold true. Behavioral finance, unlike traditional finance, acknowledges that individual investors often exhibit irrational behavior when making investment decisions, and this irrationality tends to persist in the market. Despite continuous improvements and development in China's stock market, there are still many investors heavily influenced by emotions. The quality of investors varies, and there remains a significant gap compared to mature capital markets abroad.

Investor sentiment was initially defined as the accumulation of investors' erroneous judgments in economic life, leading to the formation of entrenched cognitive biases. Subsequently, researchers identified it as the discrepancy between the actual value of investment products and the value perceived by investors based on their own information. Some scholars define systematic biases in investors' decision-making processes as investor sentiment. Based on these perspectives, here is a summary of investor sentiment: Investors make irrational judgments due to the influence of emotions, psychology, and external environmental factors. Engaging in different investment behaviors without proper judgment often impacts their own interests. All of these are built upon daily erroneous judgments, which accumulate over time and form a fixed mindset.

Extensive research has been conducted on investor sentiment, yielding empirical conclusions that are primarily bifurcated. One perspective posits that investor sentiment can impact the short-term or long-term returns of the securities market, and this effect is difficult to eliminate. Conversely, another viewpoint suggests that investor sentiment does not affect stock price volatility; rather, the returns and volatility in the market can, in turn, influence investor sentiment. This paper posits that investor sentiment, as an objective characteristic possessed by individual investors, who can directly affect the volume of stock transactions, thus has the potential to exert either positive or negative impacts on the stock market.

The measurement of investor sentiment, characterized by its subjective nature, constitutes a nuanced and complex endeavor within financial research. It necessitates a thorough examination of the irrational beliefs and actions exhibited by individual investors to identify indicators, whether subjective or objective, capable of quantifying its magnitude. Within the academic discourse, two primary methodologies have emerged for quantifying investor sentiment: the single index method and the composite index method. These approaches involve the aggregation of various sentiment-related indicators to capture the multifaceted nature of investor sentiment accurately (He, 2021).

The Single Index Method for measuring investor sentiment utilizes a specific variable, further categorized into direct and indirect indicators. Direct indicators typically stem from market surveys, such as bullish or bearish sentiment indices and the CCTV stock-watching index. These surveys often capture the subjective opinions and attitudes of investors, offering insights into the prevailing market sentiment. However, given the plethora of uncertainties inherent in financial markets, the validity, reliability, and objectivity of such indicators have been contentious topics within academic discourse.

Conversely, indirect indicators are constructed through the analysis of extensive securities trading data, reflecting investors' reactions to market expectations. These indicators encompass metrics such as the discount/premium on closed-end funds, the frequency of block trades, overall turnover rates, and market volume. By leveraging market data, these indicators can objectively and accurately portray market volatility and thereby unveil the true dynamics of investor sentiment. Compared to direct indicators, they afford a more objective exploration of investor sentiment.

However, it is crucial to note that indirect indicators represent lagging data. They become ascertainable only post-investment decisions and trades, thus reflecting market data outcomes. Consequently, they may predominantly capture the psychological state of investors from the previous statistical cycle. Unlike direct indicators, which offer immediate insights, indirect indicators lack foresight and may inherently bear biases due to their retrospective nature. This delayed nature underscores the complexity of interpreting investor sentiment and highlights the inherent challenges in predicting market movements solely based on such indicators.

Due to the limitations inherent in both direct and indirect indicators within the single index method, the composite index approach is employed to mitigate their adverse effects. This method utilizes statistical analysis techniques to standardize some direct or indirect indicators, thereby forming a composite index that transcends the measurement of investor sentiment. Scholars abroad have made breakthroughs in measuring investor sentiment, with the most representative research outcome being the BW index. Baker and Wurgler (2006) selected indicators such as trading volume in the New York Stock Exchange, monthly average returns of the U.S. stock market, average first-day returns of U.S. stock market IPOs, number of stocks issued in the U.S. stock market, and the discount rate of closed-end funds, directly obtaining objective capital market data. They utilized principal component analysis to extract the common emotional components from these indicators, constructing the BW index. Building upon this, Brown and Cliff (2004) employed Kalman filtering techniques to extract the common components of various proxy indicators and calculated the remaining data as random factors. In China, to better explain the development status of the domestic capital market, methods for statistical analysis and indicator selection have been developed. Wang and Hao (2014) innovatively applied partial least squares regression in constructing an investor sentiment index, demonstrating good market interpretability.

This study adopts the BW index method and selects five proxy indicators based on

the actual operation of China's stock market. Utilizing a combination of principal component analysis and linear regression, a comprehensive evaluation index is established, aiming to provide a more comprehensive reflection of investor sentiment in China.

## 2.  Literature Review

According to the Efficient Market Hypothesis (EMH), in an efficient market, information asymmetry is minimal, and stock issuance prices are determined by market demand, thus should reflect supply and demand conditions well. However, research and practice abroad consistently show underpricing as a pervasive long-term phenomenon. With the development of behavioral finance, an increasing number of scholars have explored and deeply studied from the perspective of investor sentiment. Long et al. (1990) first proposed the assumption of investor sentiment, believing that individual emotions in investment decisions have a certain influence and indicating the role of emotions in investment. Shleifer and Vishny (1997) pointed out the risk of ignoring investor sentiment in investment strategies. Ljungqvist et al. (2006) argued that in the secondary market, retail investor sentiment is a primary factor leading to IPO price declines. Extensive empirical evidence suggests a universal positive relationship between investor sentiment and short-term high IPO returns.

In measuring investor sentiment, Schmeling (2009) employed a single index approach, which partially reflected investor sentiment. The results indicated that investor sentiment inversely influenced future stock market returns, and certain directional changes could predict future trends in stock market profitability. Baker and Wurgler (2006) constructed a composite index of sentiment, analyzing the impact of investor sentiment on expected returns in different stocks. They found a significant negative correlation between the two.

In terms of methodology, both Baker and Wurgler (2006) and Brown and Cliff (2004) utilized principal component analysis to investigate the impact of investor sentiment on short-term market returns.

Tang (2018), through empirical analysis, found that the phenomenon of IPO underpricing is extremely severe in China's Growth Enterprise Market. Yu (2016) discussed the IPO pricing mechanism, suggesting that investor sentiment can lead to an increase in the stock prices of new issues. Zou et al. (2020) argued that due to the large number of individual investors in China, who are generally more susceptible to cognitive and behavioral biases, the influence of investor sentiment on IPO underpricing is further exacerbated.

Furthermore, Hua (2021) conducted empirical analysis on the phenomenon of IPO underpricing in the Shanghai A-share market from December 2013 to July 2015 and from November 2015 to July 2019. The conclusion drawn was that there is a significant correlation between the IPO underpricing and investor sentiment indicators such as the allotment rate and the first-day trading volume.

Wang and Li (2019) analyzed investor sentiment and oversubscription of new

stocks, finding that both factors positively impact IPO underpricing. Zhang et al. (2021) used a sample of 249 companies listed on the Sci-Tech Innovation Board from 2019 to 2021 and employed a multiple linear regression model to investigate the relationship between information disclosure quality, investor sentiment, and IPO underpricing. The conclusion was that there is a significant correlation between IPO underpricing and the information disclosure quality of listed companies as well as investor sentiment. Xu and Chen (2021) used methods such as PSM-DID, based on data from IPOs on the main board and GEM from January 2018 to March 2021, finding that the implementation of the registration system would further increase the level of IPO underpricing, while investor sentiment would have a significant positive impact on its suppression rate.

Liang (2021), based on the pilot reform of the registration system on the Sci-Tech Innovation Board, thoroughly explored the impact of the registration system reform on IPO pricing efficiency and its mechanism. The results showed that the registration system reform can effectively suppress IPO underpricing and improve IPO pricing efficiency.

In terms of measurement, Mei et al. (2019) employed a direct indicator method and found that the higher the enthusiasm of investors, the higher the overall stock market returns in the next phase; companies with relatively high proportions of retail investors' shareholding exhibit stronger relationships with changes in investor sentiment. Wang (2021) utilized partial least squares regression to select six indicators to construct an investor sentiment index. The research results indicate that the influence of investor sentiment on stock market returns is limited, with industries exhibiting low volatility being more susceptible to sentiment effects compared to those with high volatility.

## 3. Path analysis of influence

### 3.1    Psychological bias

### 3.1.1   The Effect of Sheep Flock

In practical terms, herd mentality is a pervasive phenomenon, manifesting to varying extents among investors, leading to what is known as herd behavior. As individuals navigating social constructs, people are prone to sharing certain preferences and, in contrast to solitary decision-making, tend to lean towards the advice of so-called experts and scholars, resulting in a phenomenon of blind following. For individual investors, constrained by factors such as personal capacity and knowledge, accurate analysis in the vast market of information becomes challenging. Given their disadvantaged position in accessing information, these retail investors are forced into a passive role, accepting prices rather than influencing them due to asymmetrical information. Consequently, retail investors often base their investment decisions on the recommendations of professional institutional investors, thereby generating herd behavior. This effect is particularly evident in stock investments. When a particular stock performs well over several days or even experiences consecutive limit-ups, it may appear that positive news

has attracted many investors to compete for purchases. However, given that a small fraction of institutional investors controls most of the capital in China's stock market, such attractive trends are often dominated by their actions. Many investors do not conduct thorough analysis on such stocks or may not have the opportunity to do so before making purchases, blindly following the crowd. Often, only a small segment of these participants reaps profits, leaving most individual investors vulnerable to the subsequent bear market.

In the Growth Enterprise Market, beyond the previously discussed scenarios, the initial phase of public listing is characterized by the relatively small scale of the listed companies and a stock supply significantly lower than market demand, resulting in a notably low online lottery rate in the secondary market. This low lottery rate acts as a signal indicating a positive outlook for the company, with widespread pursuit among investors, which further decreases the chance of winning the lottery. Investors who did not subscribe to shares in the primary market consequently shift their capital to the secondary market, continuing to purchase new stocks. This behavior contributes to the rise in stock prices on the IPO's first day, eventually leading to a formation of either an elevated or a depressed stock price.

### 3.1.2   Speculation and noise trading

Due to excessive optimism and overconfidence, individual investors' investment behavior tends to be speculative. Past experiences have shown us that IPO first-day returns are usually high. Coupled with the packaging by underwriters and the high growth expectations of companies listed on the Growth Enterprise Market (GEM), strong positive messages are sent to retail investors. Consequently, they engage in a large amount of speculative trading in the secondary market. Additionally, some retail investors also trade based on rumors, which are market noise. Irrational decisions based on noise, without relying on value and actual information, are referred to as "noise trading" in individual investors' investment decisions. It is precisely because of the existence of speculation and noise trading that the first-day trading volume of new stocks is excessive, manifested specifically by a high turnover rate on the first day of listing. Therefore, we can measure the speculative and noise trading in the secondary market by the turnover rate of stocks on the first day of listing. If there is a high turnover ratio, it indicates significant demand in the secondary market, causing the stock price to continuously rise, resulting in a significant deviation from the issue price, namely, a higher underpricing rate.

### 3.2     Cognitive bias
### 3.2.1   Loss aversion

Loss aversion is a prevalent cognitive bias among investors (excluding speculators), whereby individuals experience much stronger negative emotions from losses compared to the positive emotions generated by equivalent gains. This mentality is primarily manifested in the eagerness to sell stocks that have accrued profits, while holding onto losing stocks tightly, refusing to sell. Consequently, this behavior leads

to meager profits and potentially increased losses due to being locked into other company's stocks. Thus, investors' aversion to losses results in an increase in trading volume on the first day.

### 3.2.2   excessive optimism

Zhai et al. (2022) pointed out that investors' excessive confidence in cognition can have a certain impact on stock prices, and this cognitive bias is an important factor leading to high returns on the first day of IPOs. In a hot market scenario, retail investors are easily influenced by excessive optimism, making it difficult for them to invest rationally like institutional investors. Initially, perhaps only a few investors are overly optimistic, but as more and more new stocks are listed, more people will join the IPO queue. Due to the limited supply of IPO stocks, on the IPO day, overly optimistic investors will flock in, causing demand for new stocks to far exceed supply, resulting in a rise in the stock price of new stocks and thus high returns (Zhang and Chen, 2004).

## 4.  Empirical Research

### 4.1      Data collection

For the underpricing rate, this study collected the first-day issuance prices and closing prices of all companies listed on the Growth Enterprise Market from January 2015 to December 2021. After excluding missing values over time, a total of 692 listed companies' data were analyzed.

Based on the discussion above, several proxy indicators describing investor sentiment were identified, including closed-end fund discount rates, trading volume, IPO quantity, consumer confidence index, and the number of new investor accounts opened, to measure the positive or negative impact of investor sentiment on IPO underpricing rates. Following the method proposed by Bao Wei, in addition to selecting the comprehensive sentiment index CICSI as the independent variable, this study also included some financial indicators used by investors for rational analysis of the IPO market, including turnover rate (TR), first-day price-to-earnings ratio (PE), and issue size (TV). These variables were sampled from 84 monthly observations spanning from 2015 to 2021 and were sourced from the CSMAR database.

### 4.2      Measurement of the dependent variable

Initial Public Offering (IPO) refers to the first-time issuance of stocks by a company to the public to raise capital, thereby facilitating various strategic developments of the company. IPO underpricing, as one of the three major unsolved mysteries of new stock issuances, has been a subject of considerable scholarly attention. According to the Efficient Market Hypothesis, information asymmetry is minimal in an efficient market, and the quantity and price of issuance are determined based on the actual market demand. Therefore, on the first day of trading, the price of new stocks should not significantly exceed their offering price. However, in reality, IPO

underpricing is prevalent in both domestic and international securities markets. This phenomenon can significantly impact the interests of small and medium-sized individual investors. On the day of IPO, most stocks close at a price higher than their offering price, with some experiencing gains exceeding 100%, allowing investors who purchased these stocks in the primary market to reap substantial returns. The phenomenon of the IPO issuance price being severely underestimated on the IPO day is referred to as "IPO underpricing." Typically, the underpricing level is measured using the first-day return rate:

$$AIR = (P_1 - P_0) / P_0 \tag{1}$$

In this context, AIR represents the underpricing rate, P1 denotes the closing price on the first day of trading, and P0 represents the offering price of the stock at listing. The phenomenon of IPO underpricing spans a wide range of time periods. Research and practice abroad consistently demonstrate that IPO underpricing is a pervasive phenomenon with a considerable duration. Due to the relatively late development of China's capital markets and the immaturity of its institutional framework and investors compared to Western developed countries, IPO underpricing has been prevalent in the early stages of stock market development in China, far exceeding levels observed in Western nations.

## 4.3    Measurement of the core explanatory variable

We need to select indicators that can reflect the information mentioned above to construct a composite index of investor sentiment. This study draws on the method proposed by Chinese scholars Yi and Mao (2008) to construct a composite index called the Composite Investor Confidence Sentiment Index (CICSI) for the domestic stock market (Li, 2017). Following the research by Bao (2010), the CICSI index selects monthly data on the discount rate of closed-end funds, trading volume, IPO quantity, consumer confidence index, and the number of new investor accounts as component indicators.

Firstly, the discount rate of closed-end funds (DCEF) is considered. When retail investors have positive expectations for the fund and market sentiment is optimistic, the demand for the fund increases, causing the trading price of stocks to rise, thereby reducing the discount rate or increasing the premium of the fund. Conversely, if investors have pessimistic expectations for the fund, it leads to reduced demand and lower trading prices, resulting in a decrease in the discount rate or premium of the fund. The second indicator is stock trading volume (TURN), which is an objective measure representing the number of stocks traded successfully by both buyers and sellers at an agreed price. The third indicator is the number of IPOs (IPON). The timing of a company's IPO decision reflects its assessment of the current investor sentiment. This serious decision involving the company's actual interests warrants careful analysis and can be considered a representative index for constructing the composite investor sentiment index. The fourth indicator is the number of new

investor accounts (NIA). Given the unstable structure of investors in China and the prevalence of noise traders, when investors have optimistic expectations for the stock market, they actively engage in investment, leading to a continuous increase in the number of new accounts opened. Since the number of new accounts opened in the market has a significant impact on reflecting the psychological state of investors in the Chinese stock market, it can be used as an intermediary indicator for constructing the investor sentiment index. The final indicator is the Consumer Confidence Index (CCI). Among the constituent indicators, the Consumer Confidence Index is the only subjective one. Choosing this indicator is because it is based on our consumers' views on the overall economic fundamentals and their forecasts for the future, which can more comprehensively reflect the country's economic situation and therefore better reflect the psychological state of investors.

## 4.4    The process of Principal Component Analysis (PCA)

### 4.4.1   Data Standardization

To eliminate unit differences between the various proxy indicators while preserving the optimistic and pessimistic information contained in the indicators, the current indicators $DCEF_t$, $RIPO_t$, $NIPO_t$, $NIA_t$, $TURN_t$, and $CCI_t$, as well as their respective lagged one-period variables $DCEF_{t-1}$, $RIPO_{t-1}$, $NIPO_{t-1}$, $NIA_{t-1}$, $TURN_{t-1}$, $CCI_{t-1}$, were standardized using the SPSS data analysis software.

### 4.4.2   Applicability Analysis

Prior to formal analysis, it is necessary to assess the strength of commonality between variables and the suitability of principal component analysis (PCA) through the Kaiser-Meyer-Olkin (KMO) measure and Bartlett's test shown in Table 1.

**Table 1: Results of KMO and Bartlett Tests**

| KMO Sampling Adequacy Measure | | 0.675 |
|---|---|---|
| Bartlett's Test of Sphericity Approx | Chi-Square | 750.151 |
| | Degrees of Freedom | 45 |
| | Significance | 0.000 |

In the KMO test, the overall KMO value is 0.675, which exceeds 0.5, indicating the presence of correlations among the variables and thus the research significance of this study. The Bartlett's test yielded a p-value of 0.000, leading to the rejection of the null hypothesis, indicating that the correlation matrix of the variables representing investor sentiment and their lagged variables is not an identity matrix. Based on the above analysis, the five proxy indicators and their lagged variables selected in this study demonstrate no issues, meeting the feasibility criteria for principal component analysis. Consequently, the study can proceed to the next stage of research.

### 4.4.3   Initial index synthesis.

Principal Component Analysis (PCA) was applied to the standardized data, selecting factors with initial eigenvalues greater than 1. Three principal components were extracted, explaining a cumulative variance of 82.447%, which exceeds 80% and indicates good explanatory power and shown in Table 2.

**Table 2: Explained Variance Matrix**

| Components | Total | Initial Eigenvalue Variance Percentage | Cumulative% | Total | Extracted Loadings Squared Sum Percentage | Cumulative% |
|---|---|---|---|---|---|---|
| 1 | 4.631 | 46.312 | 46.312 | 4.631 | 46.312 | 46.312 |
| 2 | 2.173 | 21.728 | 68.04 | 2.173 | 21.728 | 68.04 |
| 3 | 1.441 | 14.407 | 82.447 | 1.441 | 14.407 | 82.447 |
| 4 | 0.644 | 6.439 | 88.886 | | | |
| 5 | 0.367 | 3.672 | 92.558 | | | |
| 6 | 0.267 | 2.668 | 95.226 | | | |
| 7 | 0.24 | 2.395 | 97.621 | | | |
| 8 | 0.135 | 1.348 | 98.969 | | | |
| 9 | 0.064 | 0.643 | 99.612 | | | |
| 10 | 0.039 | 0.388 | 100.000 | | | |

Based on the eigenvalues and eigenvectors, we can compute the coefficients corresponding to each component index which is shown in Table3.

**Table 3: Factor Loading Matrix**

| Variables | Factor | | |
|---|---|---|---|
| | 1 | 2 | 3 |
| $ZDCEF_t$ | -0.728 | 0.327 | -0.513 |
| $ZTURN_t$ | 0.873 | 0.074 | 0.144 |
| $ZIPON_t$ | 0.069 | 0.896 | 0.012 |
| $ZNIA_t$ | 0.722 | 0.382 | -0.009 |
| $ZCCI_t$ | -0.689 | 0.208 | 0.663 |
| $ZDCEF_{t-1}$ | -0.724 | 0.356 | -0.46 |
| $ZTURN_{t-1}$ | 0.885 | 0.022 | 0.1 |
| $ZIPON_{t-1}$ | 0.061 | 0.88 | 0.052 |
| $ZNIA_{t-1}$ | 0.774 | 0.366 | -0.001 |
| $ZCCI_{t-1}$ | -0.655 | 0.182 | 0.702 |

The expression for the first principal component is as follows:

$$Y_1 = -0.3383DCEF_t + 0.4057TURN_t + 0.0321IPON_t + 0.3355NIA_t - 0.3202CCI_t$$
$$-0.3364DCEF_{t-1} + 0.4112TURN_{t-1} + 0.0283IPON_{t-1} + 0.3597NIA_{t-1} - 0.3044CCI_{t-1} \quad (2)$$

The expression for the second principal component is as follows:

$$Y_2 = 0.2218DCEF_t + 0.0502TURN_t + 0.6078IPON_t + 0.2591NIA_t + 0.1411CCI_t$$
$$+0.2415DCEF_{t-1} + 0.0149TURN_{t-1} + 0.5970IPON_{t-1} + 0.2483NIA_{t-1} + 0.1235CCI_{t-1} \quad (3)$$

The expression for the third principal component is as follows:

$$Y_3 = -0.4274DCEF_t + 0.1200TURN_t + 0.0100IPON_t - 0.0075NIA_t + 0.5523CCI_t$$
$$-0.3832DCEF_{t-1} + 0.0833TURN_{t-1} + 0.0433IPON_{t-1} - 0.0008NIA_{t-1} + 0.5848CCI_{t-1} \quad (4)$$

Based on the principal component expressions and the eigenvalues, we can calculate the comprehensive expression for the principal component analysis：

$$Y = -0.2062DCEF_t + 0.2621TURN_t + 01800IPON_t + 0.2554NIA_t - 0.0461CCI_t$$
$$-0.1923DCEF_{t-1} + 0.2494TURN_{t-1} + 0.1808IPON_{t-1} + 0.2673NIA_{t-1} - 0.0362CCI_{t-1} \quad (5)$$

Next, conduct a correlation analysis between each proxy indicator and the composite index Y, selecting the variables with the highest correlation as the final proxy variables. The results are presented in Table 4：

**Table 4: Correlation Coefficient Matrix**

| Variable | Sample Size | Y | |
|---|---|---|---|
| | | Correlation Coefficient | Significance Level |
| $ZDCEF_t$ | 84 | -0.668** | 0.000 |
| $ZTURN_t$ | 84 | 0.866** | 0.000 |
| $ZIPON_t$ | 84 | 0.337** | 0.000 |
| $ZNIA_t$ | 84 | 0.792** | 0.000 |
| $ZCCI_t$ | 84 | -0.476** | 0.000 |
| $ZDCEF_{t-1}$ | 84 | -0.648** | 0.000 |
| $ZTURN_{t-1}$ | 84 | 0.855** | 0.000 |
| $ZIPON_{t-1}$ | 84 | 0.331** | 0.002 |
| $ZNIA_{t-1}$ | 84 | 0.837** | 0.000 |
| $ZCCI_{t-1}$ | 84 | -0.446** | 0.000 |

Note：**p<0.01,*p<0.05

Therefore, we can select DCEFt, TURNt, IPONt, NIAt-1, and CCIt as the final proxy variables for the second principal component analysis. Following the same steps as described above, we construct the composite index CICSI. The results are as follows:

$$cicsi = -0.2180DCEFt + 0.3912TURNt + 03291IPONt + 0.4426NIA_{t\text{-}1}$$
$$-0.2266CCIt$$

(6)

The correlation analysis between CICSI and Y yields a correlation coefficient of 0.975 at a significance level of 1%. This indicates that even after removing five variables, the constructed CICSI still effectively reflects the magnitude of investor sentiment. Therefore, this operation has minimal impact on the construction of the investor sentiment index.

### 4.4.4   Sentiment Composite Index Excluding Macroeconomic Factors.

Due to the impact of economic cycle fluctuations on sentiment measurement results, it is necessary to exclude macroeconomic factors from the composite investor sentiment index. We choose the Macro Business Cycle Index (MBCI) to measure macroeconomic conditions, with data sourced from the CSMAR database. The exclusion method involves conducting linear regressions between the standardized values of the five proxy indicators and the standardized macroeconomic index. This process yields five autoregressive residual sequences, namely rDCEFt, rTURNt, rIPONt, rNIAt-1, and rCCIt, from which standardized residuals are extracted to obtain the new proxy variables.

Finally, a third principal component analysis is performed on these five variables, resulting in an investor sentiment index that excludes macroeconomic factor.

$$CICSI = -0.1535rDCEFt + 0.4113rTURNt + 0.3983rIPONt + 0.4163rNIA_{t\text{-}1}$$
$$-0.1832rCCIt$$

(7)

### 4.5    Empirical Analysis
### 4.5.1   Descriptive Statistics

Before empirical analysis, descriptive statistical analysis of the variables involved is required, as shown in Table 5.

**Table 5: Descriptive Statistics for Each Variable**

| Variable | Sample Size | Mean | Standard Deviation | Minimum | Maximum |
|----------|-------------|------|--------------------|---------|---------|
| *AIR* | 84 | 0.8639 | 0.8487 | 0.4398 | 3.6516 |
| *CICSI* | 84 | 0.0000 | 1.0912 | -1.8729 | 3.4408 |
| *TR* | 84 | 0.1362 | 0.2402 | 0.0002 | 0.7465 |
| *PE* | 84 | 38.7884 | 19.8619 | 22.8100 | 109.8600 |
| *TV* | 84 | 20.1155 | 0.0589 | 19.2587 | 21.9294 |

Based on the table results, firstly, the average level of CICSI is 0, indicating a range from the highest value of 3.34 to the lowest of 1.82, with a standard deviation of 1.06. This suggests significant fluctuations in investor sentiment in China's Growth Enterprise Market (GEM). Secondly, the sample mean of AIR is 0.87, with substantial differences from the maximum (3.65) and minimum (0.44) values, all exceeding 0, indicating a persistent phenomenon of underpricing in the market. The standard deviation of AIR is 0.86, signifying greater volatility in investor sentiment compared to stock price fluctuations. Thirdly, the highest turnover rate on the first day is 74.65%, the lowest is 0.02%, with an average of 13.62%. This indicates that more than one in eight investors purchase at the issue price, reflecting short-term speculative behavior contrary to the regulatory advocacy of "rational investment" and "value investment." Fourthly, the highest first-day P/E ratio is 109.86, while the lowest is 22.81, highlighting substantial differences in value among different companies. Regarding the issue size, represented in natural logarithms, the adjusted issue size reaches 21.93 billion yuan, with the lowest at 19.26 billion yuan and an average of 20.12 billion yuan. Overall, their relatively small issue sizes align with the positioning of the GEM market, adequately meeting the financing needs of small and medium-sized enterprises.

### 4.5.2   Correlation Test

To determine the correlation between each variable and AIR, this study utilized SPSS software to calculate the Pearson correlation coefficients after standardizing each variable and IPO underpricing rate. The results indicated that, with a sample size of 84, except for CICSI at the 5% significance level, all other variables showed significance at the 1% level. This suggests that all variables are significantly correlated with the IPO underpricing rate, as shown in Table 6.

**Table 6: The correlation between each variable and IPO underpricing**

| Variable | Sample Size | ZAIR | |
|---|---|---|---|
| | | Correlation Coefficient | Significance Level |
| *ZCICSI* | 84 | 0.253* | 0.020 |
| *ZTR* | 84 | 0.753** | 0.000 |
| *TPE* | 84 | 0.664** | 0.000 |
| *ZTV* | 84 | 0.283** | 0.000 |

Note：**p<0.01,*p<0.05

### 4.5.3　Model Establishment and Stepwise Regression Analysis

We established a linear regression model with IPO underpricing as the dependent variable and conducted stepwise regression analysis using SPSS software to obtain the regression results. The regression model is as follows:

$$AIR = \alpha + \beta_1 \times CICSI + \beta_2 \times TR + \beta_3 \times PE + \beta_4 \times TV + \varepsilon \qquad (8)$$

In which, $\alpha$ is the constant term, $\beta_i$（$i$ =1,2,3,4）are the coefficients of each variable, and $\varepsilon$ is the random error term. The process involved a total of 2 steps, and from the computational results presented in Table 7, the stepwise regression equation is obtained as follows:

$$AIR = -6.314 \times 10^{-17} + 0.732TR + 0.123CICSI \qquad (9)$$

Based on the above results, we can derive the empirical conclusions of this study.From Table 8, the model's goodness of fit is 0.582, with an adjusted goodness of fit of 0.572, maintaining a relatively high level. From an economic perspective, there exists a certain correlation between investor sentiment index and IPO underpricing index in the ChiNext board, implying a notable impact of CICSI on AIR. This study posits that in the ChiNext market, investor sentiment is influenced by psychological and cognitive biases, leading to an increase in IPO first-day stock prices. The irrational behavior of retail investors is identified as a primary driver behind the market price surge. Furthermore, the underpricing rate (AIR) is significantly influenced by the first-day turnover rate in a positive manner.

The regression equation results and goodness of fit results are presented in Table 7 and Table 8, respectively.

**Table 7: Regression Equation Coefficients**

| Model | | Unstandardized Coefficients | | Standardized Coefficients | | |
|---|---|---|---|---|---|---|
| | | $B$ | SE | *Beta* | $t$ | Significance |
| 1 | （Constant） | $-7.812*10^{-17}$ | 0.072 | | 0.000 | 1.000 |
| | TR | 0.753 | 0.073 | 0.753 | 10.378 | 0.000 |
| 2 | （Constant） | $-6.314*10^{-17}$ | 0.071 | | 0.000 | 1.000 |
| | TR | 0.732 | 0.073 | 0.732 | 10.026 | 0.000 |
| | CICSI | 0.123 | 0.073 | 0.123 | 1.682 | 0.096 |

**Table 8: Goodness of Fit**

| Model | $R$ | $R^2$ | *Adjusted $R^2$* | Standard Error of Estimate |
|---|---|---|---|---|
| 1 | 0.753 | 0.568 | 0.562 | 0.6615 |
| 2 | 0.763 | 0.582 | 0.572 | 0.6541 |

## 5. Policy Implications

In China's Growth Enterprise Market (GEM), individual investors constitute the primary investment group. They are often disadvantaged in terms of professional knowledge, capital, and information, rendering them unable to make rational investment decisions. In the field of investment, irrational factors prevail, leading to prevalent cognitive biases and psychological distortions among them. Hence, to compensate for these shortcomings and become competent investors, continual enhancement of investment capabilities is imperative. This entails refining professional knowledge, continuously learning and mastering relevant laws and regulations, as well as consistently collecting and analyzing various company data to uncover true company value. Additionally, it involves periodically evaluating and analyzing one's own investment behaviors. In cases where losses are incurred due to personal errors, prompt correction of behavior and making accurate judgments during the investment process become essential. However, relying solely on the efforts of investors themselves is insufficient; external support, education, and the subtle influence of market environment are also indispensable.

In China's investment market, there is a mix of different types of investors, and the majority lack comprehensive financial knowledge and independent judgment. Consequently, any slight market volatility tends to trigger panic among them. Their excessive emphasis on fundamentals makes it difficult for them to make correct and rational judgments. Therefore, besides individual efforts, proactive guidance is also necessary at various social levels.

From the empirical research results, it is evident that the significant emotional fluctuations among investors stem from their lack of systematic understanding of financial theory fundamentals. Hence, there is an urgent need to enhance the quality of investors. This requires the government to strengthen supervision of public news, with robust support from securities firms and the media. Additionally, establishing a stable information channel can ensure the healthy development of the stock market. Introducing basic securities-related questions during non-trading hours when investors log in or check their accounts can enrich their knowledge. Furthermore, integrating financial knowledge into student textbooks is recommended. Only by fundamentally improving the quality of investors can our stock market embark on a healthy trajectory.

On the other hand, individual investors in the Growth Enterprise Market (GEM) bear far greater risks compared to those in the main board market. Therefore, to prevent individual investors from unnecessary losses, regulatory authorities must establish strict entry thresholds. Before individual investors enter the GEM, they must undergo risk assessments. Only investors who have passed the risk assessment can enter the GEM market. By imposing "entry threshold" restrictions, immature individual investors can be excluded, thereby reducing the number of irrational investors in the GEM market, mitigating the volatility of investor sentiment in the market, and consequently reducing the underpricing of stocks in the stock market.

In addition to improving the professional literacy of investors in the Growth Enterprise Market (GEM), macro policies should also be formulated by the government and relevant departments to address the phenomenon of IPO underpricing. This article proposes suggestions from three aspects: strengthening the quality audit of listed companies, establishing an authoritative and efficient information disclosure mechanism, and expanding the GEM market. These measures can not only enhance information symmetry, ensuring that investors make relatively rational analyses of stocks on the first day of listing, but also increase the supply of stocks in the stock market, thereby reducing the presence of IPO underpricing in the GEM from the perspective of balanced supply.

Regulators should rigorously review the qualifications of listed companies to ensure that the information provided by them reflects their true operational and financial status. This can help more high-growth enterprises enter the Growth Enterprise Market (GEM), thereby enhancing the overall quality of the market. The listing of high-growth and high-quality enterprises not only reduces IPO underpricing but also provides investors with a safer investment avenue. Regulatory authorities need to strengthen their scrutiny of listed companies to ensure the accuracy of the information they provide.

In the securities market, individual investors are at a disadvantage due to the lack of information, leading to asymmetric information. Moreover, individual investors are often influenced by misinformation during the decision-making process, resulting in irrational decisions. To reduce the irrational behavior of retail investors, it is essential to provide them with more information. Firstly, establishing an authoritative information disclosure system and rigorously screening relevant

information are crucial to ensure the authenticity of the disclosed information. Additionally, information disclosure should be efficient, with timely dissemination of relevant information. The quicker the information is disclosed, the smaller the spread of rumors, and the weaker the impact on individual investors. To prevent listed companies from providing false information, stricter penalties should be enforced. This study believes that by establishing effective and authoritative information disclosure mechanisms, individual investors can obtain more accurate information, thereby making better-informed decisions.

The number of companies listed on the Growth Enterprise Market (GEM) is insufficient to meet the demand of investors. In this situation of supply shortage, the IPO underpricing rate remains high. Therefore, it is necessary to expedite the IPO process and expand the GEM to increase the supply level, achieve supply-demand balance, curb speculative activities, and reduce IPO underpricing. Additionally, expanding the scale of the GEM market is of great practical significance for the development of China's GEM. Small and medium-sized enterprises (SMEs) are integral to China's national economy, and their healthy development is essential for promoting rapid and healthy economic growth. However, most SMEs face financing difficulties. The establishment of the GEM is aimed at addressing the financing challenges faced by high-growth enterprises and SMEs. Therefore, expanding the scale of the GEM market will provide more financing channels for SMEs, thereby promoting their healthy and rapid development.

## 6. Conclusion

Due to the relatively late development of China's securities market and the high proportion of individual investors, among whom a significant number lack rationality, the sentiments of optimism or pessimism among investors can significantly impact the development of the stock market. As a nurturing ground for small and medium-sized enterprises (SMEs), the Growth Enterprise Market (GEM) exhibits a higher initial public offering (IPO) underpricing rate compared to other market segments. Theoretically, the roots of fluctuations in investor sentiment can be divided into two pathways: psychological biases and cognitive biases. Psychological biases can lead to herd behavior and speculative or noise trading, while cognitive biases can cause loss aversion and excessive optimism among investors. These psychological and behavioral aspects affect the stock market, leading to an increase in the IPO underpricing rate on the day of listing.

In the empirical analysis section, the construction of a comprehensive investor sentiment index was first determined through literature review, utilizing the Principal Component Analysis (PCA) method. Five proxy indicators reflecting sentiment were selected, and macroeconomic factors were excluded to obtain the final sentiment index. Subsequently, a model to study the relationship between sentiment and GEM IPO underpricing was established, specifically a stepwise regression model. After descriptive statistics and correlation tests, three financial

indicators were added as independent variables. Through quantitative and qualitative analysis, the empirical conclusion was reached: investor sentiment significantly affects the IPO underpricing rate.

Based on this research, the paper proposes policy recommendations from two perspectives. Firstly, there is a need for rational guidance of individual investors' investment behaviors, enhancement of education, and implementation of access policies. Secondly, at the macro level, it is advised to raise the review standards for listed companies, suggest a comprehensive information disclosure system, and expand the market. This expansion will provide a broader capital market for SMEs, thereby reducing the IPO underpricing rate and promoting the formation of a healthy and stable securities market.

# References

[1] De Long, B., Shleifer, A., Summers, L.H. and Waldmann, R.J. (1990). Noise Trader Risk in Financial Markets. Journal of Political Economy, 98(4).

[2] Shleifer, A. and Vishny, R.W. (1997). The Limits of Arbitrage. The Journal of Finance, 52(1).

[3] Ljungqvist, A., Nanda V. and Singh, R. (2006). Hot Markets, Investor Sentiment, and IPO Pricing. The Journal of Business, 79(4).

[4] Schmeling, M. (2009). Investor Sentiment and Stock Returns: Some International Evidence Journal of Empirical Finance, 16(3).

[5] Baker, M. and Wurgler, J. (2006). Investor Sentiment and The Cross-section of Stock Returns. Journal of Finance, 61(4), 1645-1680.

[6] Brown, G.W. and Cliff, M.T. (2004). Investor Sentiment and The Near-Term Stock Market. Journal of Empirical Finance, 11(1).

[7] Tang, W.L. (2018). Investor's Sentiment Is Studying the Impact of IPO Underpricing on GEM. Hunan University.

[8] Yu, D. (2016). Empirical Research on IPO Underpricing of Investor Sentiment. Southwestern University of Finance and Economics.

[9] Zou, G., Cheng, Q., Chen, W. and Ginger, M.J. (2020). What Causes the IPO Underpricing? New Evidence from China's SME Market. Applied Economics, 52(23).

[10] Hua, W. (2021). Study on IPO Suspension, Underpricing, and Investor Sentiment in the Chinese Market. Modern Business, (28), 114-116.

[11] Wang, L. Y. and Li, J. S. (2019). The Interaction between Investor Sentiment and New Stock Overallocation and Its Impact on IPO Underpricing: Data Study Based on the Growth Enterprise Market. Shanghai Linxin University of Accounting and Finance, (5), 70-78.

[12] Zhang, X. T., Ran, J. N., Xu, Y. Q., Wang, M. Z. and Yao, R. X. (2021). The Quality of Information Disclosure, Investor Sentiment, and IPO Underpricing in the Sci-Tech Innovation Board. Trade Fair Economy, (12), 74-78.

[13] Xu, X. J. and Chen, K. (2021). The Registration System, Investor Sentiment, and IPO Underpricing. Public Finance Research, (3), 76-89.

[14] Liang, P. (2021). Does the Registration System Reform Contribute to Improving IPO Pricing Efficiency? Evidence from the ChiNext Board. Modern Economic Research, (10), 68-76.

[15] Mei, L. X., Zhang, C. and He, L. (2019). Investor Sentiment and Stock Returns: Empirical Study from the Mobile Internet Sector. South China Journal of Economics, (3), 36-53.

[16] Wang, S. (2021). Study on Investor Sentiment and Stock Returns Based on the PLS Method. China Market, (26), 36-37.

[17] He, B. L. (2021). Research on the Impact of Investor Sentiment on Chinese Stock Price Volatility. Zhejiang University.

[18] Wang, Z. and Hao, G. (2014). Construction Study of Investor Sentiment Index Based on Partial Least Squares Method. Financial Theory and Practice, (07), 1-6.

[19] Li, F. F. (2017). Financial Asset Pricing Model Based on Psychological Biases. Science Technology and Industry, 17(03), 140-143+165.

[20] Zhang, Y. H. and Chen, L. Q. (2004). Review of Studies on Investor Cognitive Biases. Zhejiang Social Science, (02), 193-200.

[21] Zhai, J. N. (2022). Research on the Impact of Investor Sentiment on the High Yield on the First Day of IPO on the SSE STAR Market. China-Arab States Science and Technology Forum, (1), 103-105. https://zakjlt.casttc.org/#/digest?ArticleID=341

[22] Bao, W. (2010). Investor Sentiment and IPO Underpricing-Data from Growth Enterprises Market. Southwestern University of Finance and Economics. https://kns.cnki.net/kcms2/article/abstract?v=IILC1c-FiAGYUp3gxbEKo3ZDTtNrIBsiFKCSmnpPXED9GSfcKsnwwT1dUyr230 Rn5eiZTSVifxv5WbNXU0P_WdSuNFbiXzcAIBAvYL0VfQRrv_VUvxkL9 -fFMg6xz4vfqlrh-dgG2DLUBZWQ-HwE3cvP-- SAV3UP&uniplatform=NZKPT&language=CHS

[23] Yi, Z. G. and Man, N. (2008). Research on Measuring Investor Sentiment in the Chinese Stock Market: Construction of CICSI. Journal of Financial Research, (11), 174-184.