The Impact of Information Overload on Investment Decisions under the Information Disclosure System of STAR Market

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Abstract: Due to the rise of the STAR Market, the information disclosure system has become a crucial component of registration, while a growing information overload issue has also emerged. This paper uses an experimental economics approach to investigate how information overload will affect investors in the STAR Market. And besides, this paper introduces investor experience as a moderating variable to analyse whether investor experience has an impact on the mechanism of action between information overload and investor decision making. The results show that in a stock market formed by real data, as the rate of effective information disclosure decreases, investors' returns decline and investors tend to make more rational decisions, with investor experience having less impacts on the moderating effect between the two. In response to this conclusion, this essay provides investors and policymakers with some options for fostering the growth of the STAR Market.

Keywords: STAR Market, Information Disclosure, Information Overload, Investment Decision, Experimental Economics.

1. Introduction

With innovation-driven becoming a national strategy, the STAR Market, which officially opened in June 2019 [1], is a brand-new board independent of the main board market, targeted at science and technology innovation enterprises and focused on supporting high-tech sectors and strategic emerging industries. As an imperative element in the process of socialism modernization construction with Chinese characteristics, the STAR Market has become a major new research hotspot due to its novelty [2].

The trial implementation of the STAR Market registration system has accelerated the integration of financial capital with science and innovation enterprises. This has provided strong support for China's capital market's internationalisation and marketization [3]. As the market for science and innovation boards continues to develop, the information disclosure system, which constitutes the core of the registration system, has become a significant problem of information overload. Studies and policies concerning information disclosure for listed companies focus primarily on the completeness of the information disclosed while disregarding the effectiveness of the information for the receiver [4]. Moreover, the majority of the STAR market companies are in emerging sectors. Therefore, investors also need to spend a lot of effort to understand the relevant information, thereby exacerbating the problem of information overload.

In practice, authorities prefer to adhere to the maxim "the more, the better" when it comes to information disclosure, mandatorily requiring or encouraging the revelation of vast quantities of data while disregarding the cost and quality of information disclosure. In order to comply with the mandatory disclosure obligations, listed companies disclose a lot of information to the market, which meets the regulatory requirements but in fact only increases the amount of information. In the face of complicated disclosure documents, it is difficult for investors to find the information they need to make investment decisions [5]. John Healey-Brown pointed out that " Information problems can be solved by providing more information, but when all that is provided is information, more information means less information," and the problem of information overload has serious implications for the effectiveness of disclosure. Excessive information disclosure alienates the system and weakens the function of protecting investors [6]. Too much information is just as problematic as too little information. More disclosure of the information is not better [7]. Under the current disclosure system, prospectuses are lengthy, and the amount of information is increasing, making it difficult for not only ordinary investors to read, but also for the relevant institutions to handle their information [8]. In the current securities market, the length of information disclosure texts is increasing, and the forms of disclosure are more diverse, but homogenisation is also becoming more and more serious, and the trend of formalisation and blurring is increasing. Much of the information that reflects the personality of the company and is important for investment decisions is being obfuscated [9]. Additionally, research indicates that providing decision-makers with more information improves the quality of their decisions. However, when the amount of information reaches a particular threshold, adding more information will diminish the quality of the judgement [10].

In addition, we cannot ignore investors' ability to process information. Investors' experience not only affects their personal beliefs and judgments, but more importantly, it is directly related to their investment behaviour and investment performance [11]. The more accurate an investor's judgement of stock market information means that the more mature and experienced the investor is, the more active the investor will be in trading and the better the return on investment will be.

Given the large amount of information available, current policies and studies on information disclosure by publicly traded companies focus on the completeness of the information disclosed but ignore the effectiveness of the information to the recipient. At the same time, STAR market companies are mostly in emerging sectors, and investors must expend a lot of efforts to understand the relevant data, adding to the problem of information overload. Investors, as the primary participants in the securities market, are heavily influenced in their decision-making by information overload. On the one hand, full information disclosure provides investors with the comprehensive data they require. Too much information, on the other hand, can make it difficult to make good decisions and choices [12,13].

In view of this, this paper draws on the basic methodology of experimental economics to conduct the empirical study by focusing on the impact of the information overload phenomenon on investors' decision making in the science-based venture capital board. Theoretically, the research related to information overload can provide a reference for regulators to optimize the information disclosure system. Practically, improving the quality of information disclosure can not only effectively protect investors, but also enable science-based venture capital companies to provide effective information to win the trust of investors. Thereby, the research in this paper may be beneficial to improve financial efficiency and promote the science and technology innovation activities with the support of capital power, promoting the sustainable development of China's economy.

2.   Literature Review

The reform of the registration system of China's securities market requires continuous improvement of the information disclosure system. Thus, numerous investigations regarding this field have been

done. For example, Sun [14] proposes that, in view of the low quality of disclosure of prospectuses and other documents and the lack of intelligibility, it is necessary to do "subtraction" to reduce the cost of disclosure. Fu and Liao [15] analyse the information disclosure system from the perspective of investors, pointing out that the market composition of China's investors is mainly retail investors, supplemented by institutional investors, and investors' emotions affect their reception and understanding of the information disclosed by the company. In the study of information overload, Xue and Wu [13] raised the question of whether information overload affects investors' use of public information and confirmed that the centralised disclosure of information does not in itself prevent investors from making timely use of information. Pan and Meng [16] used the entropy method to express the degree of information redundancy of each influencing factor on the disclosure of information overload by listed companies, and then analyses the main factors affecting information overload. Zhou et al. [9] found that both the quantity and quality of information disclosure would send positive signals to potential investors and attract them to participate in crowdfunding, and that there was "information overload" in crowdfunding, with an inverted U-shaped relationship between the quantity of information disclosure and the level of price discrimination and crowdfunding performance.

3. Theoretical Analysis and Research Hypothesis

Information overload is a situation where the amount of input to a system exceeds its processing capacity [17]. More specifically, overload occurs when more information is required to process a task than is available and when this external information has a detrimental effect on the quality of the decision. In explaining information overload, Streufert [18] introduced the concept of an information saturation point. Beyond the saturation point, information can be harmful across a range of information types and activities [19].

The disclosure of information by listed companies in China has undergone a process from annual and interim reports to the current quarterly reports, while the regulator is increasingly demanding the amount of information that companies need to disclose amidst the practice of the STAR market [20,21]. This mechanism allows investors to have a more comprehensive and complete understanding of the situation of listed companies, and also promotes the rational allocation of capital market resources. However, the ability of investors to receive and utilise information is limited, and more information that is not available to investors will result in a waste of resources. In particular, the over-concentration of quarterly disclosures and the close proximity between the disclosure of quarterly and annual reports will greatly affect the extent to which investors can effectively use the information disclosed [13]. In addition, the multiple sets of listing criteria set by the STAR Market and the fact that most of the companies therein belong to emerging sectors further increase the burden on investors to receive and understand the information [22]. For individual investors, subjectively people's perception of information also plays a non-negligible role [23]. An individual investor's experience affects one's psychology and judgement, and experience will help investors to have sharper market insight, a stronger ability to process information and achieve higher investment returns. However, compared to mature markets, the Chinese capital market has a predominance of inexperienced investors and a stronger blindness in investment philosophy. It should be noted that, according to the findings of the Shenzhen Stock Exchange survey, as at the end of February 2021, individual investors in China accounted for 99.77% of the total investors and were the key stakeholders of listed companies, so all references to investors in the article refer to individual investors [12].

According to current knowledge of information disclosure and information overload, the following hypotheses are proposed in this paper.

H1: Information control within a reasonable range in the STAR Market will lead to increased rationality in investor decision-making.

Investors need to make appropriate decisions based on the information published by the company, and too little or too much information will affect the investment decision, less information makes it difficult for investors to understand the company's operating conditions, while too much information makes it more difficult for investors to process information, which is not conducive to reasonable decision-making, so we assume that information control within a reasonable range will make investors' decisions more reasonable.

H2: Information overload in the STAR Market will reduce the rationality of investors' decisions.

When companies disclose more information in prospectuses, annual reports and other documents than investors can process, too much information does not help investors' decision-making and adds to the difficulty of investors' investment judgment. It takes more time for investors to extract valid information from a large amount of information. We therefore suppose that too much information will reduce the rationality of investors' decisions.

H3: The direction and extent of the impact of information overload on the reasonableness of investor decisions in the STAR Market is influenced by investor experience.

Investor experience plays an important role in the processing of information by investors, and the process between information disclosure and investor decision making requires the processing of information by individual investors, so we hypothesize that the impact of information overload on investor decision making is moderated by investor experience.

4. Experimental Design and Process

4.1. Experimental Overview

In this paper, an experimental approach is adopted, with the main points of the experimental design referring to the standard laboratory capital market design of Smith et al. [24], in which financial indicators of firms are gradually disclosed to create a relatively simplified simulated stock exchange market. To improve the validity of the experiment and ensure the relevance of the experimental findings, the trading system and environment in the designed experimental market are set up in a way that is fully consistent with the characteristics of the real A-share market and ensures that the behavioural psychology of traders is also similar to that of reality. Using the experimental economics software Z-tree, we built a stock market trading experiment with a total of 7 rounds, each lasting 90 seconds.

4.2. Subjects in the Experiment

The subjects of the experiment were undergraduate students from Jinan University in Guangdong Province. Students majoring in Economics and Management were specifically chosen for the experiment in order to ensure its validity. There are 30 females and 48 males, mainly aged 18-21, all of whom have knowledge of investment in the stock market. Science and technology students are also engaged in the experiment. Participants in the experiment will hold stocks in the A-share market and will take part in the experiment both as a buyer and seller of stocks, as is the normal practice. An overall of 85 volunteers participated in the experiment, and 78 of them were selected through a questionnaire to gauge their knowledge level. The 78 participants were randomly divided into 6 groups of 13 each.

4.3. Initial Endowment

Each trader in the trading system is given trading currency equal to slightly more than 10 times the opening price of the stock on the current experimental board, as well as 10 units of stock to trade in, before the experiment begins [25]. When a trader purchases a stock, he must ensure that he has

sufficient cash on hand to cover the purchase; when a seller successfully sells a stock, he receives the trading currency paid by the other party. Traders can check the amount of trading currency and shares they have at any time during the experiment.

4.4. Transaction Process

Part of the trading process was programmed using a Z-tree computerised trading system that was written in advance to avoid human interference during the experiment. The experiment began with a questionnaire that included questions about stock market and corporate finance knowledge to determine the subject's stock market experience.

The entire stock trading process went as follows: The experiment was conducted in a total of 7 games, with each round of trading lasting approximately 90 seconds and each game lasting approximately 20 minutes. We used computer software to set up a two-way auction mechanism (double auction) in which the trader could act as both a seller and a buyer, with the sell price only being quoted from high to low and the buy price only being quoted from low to high, and the trader could enter each quote via the keyboard, because the A-share market is based on two-way auctions. Through the trading system, the trader has access to fully public and real-time information on quotes and trades.

During the experiment, each trader can only list one unit of stock at a time, and only after the current unit of stock has been successfully traded can the next unit of stock be listed to continue trading; the trader must have sufficient trading currency or number of shares to complete the trade. There will be a 30 second interval at the end of each round where the trading system will automatically calculate and display each trader's trading information for the current round, the number of shares remaining and the cash balance, with each trader only eligible to access their own asset information and the number of shares remaining from the previous round will be calculated as dividends.

To ensure that the experiment is realistic, the order of trading is the same as that of the A-share market, i.e., the highest bidder for the purchase of a stock is given priority, the lower bidder for the sale of a stock is given priority, and the first bidder at the same price is given priority.

At the end of the experiment, each participant was paid a percentage of the proceeds from the experiment in cash. The formal experiment was preceded by a preparatory experiment to familiarise the subjects with the process and to refine the procedure, and the results of the formal experiment were ultimately used for analysis.

4.5. Experimental Design

4.5.1. Experimental Environment

Before the experiment started, the experiment length, initial endowment and bonus rules were configured so that all subjects entered the same experiment and the experiment changed with increasing innings. Round 1 was the fully valid information group; round 2-4 experiments were the high validity group with all information validity above 50%, and round 5-7 were the low validity group with all information validity below 50%. All conditions were the same except that the stock information validity was different. The experimental setting can be shown in Table 1. Besides, different opening prices are provided to different rounds.

Table 1: Experimental environment design.

Number of experimental innings	Opening Price	Effective information rate
1	130	100%
2，3，4	145，154，346	75%，60%，50%
5，6，7	267，250，289	43%，37.5%，33.3%

4.5.2. Fundamental Value

The source of the stock is the actual stock in the A-share market. We convert the actual value of the stock to the value traded in the experiment on a 1:1 ratio. The real value of this stock shows fluctuations and is not monotonically increasing or decreasing, which requires traders to carefully judge the price movements of the company each cycle based on the disclosed financial indicators.

4.5.3. Experimental Variables and Model Construction

The information on the experimental variables is shown in the table above. In the experiment, we changed the effective disclosure rate (Pro) by changing the amount of information disclosed, and the effective disclosure rate showed an overall decreasing trend; we calculated the end-of-period assets of the subjects by summing the results for each cycle and summing the results for all cycles and taking the logarithm to obtain the cycle return (lnProfit), detailed information is shown in the Table 2.

Table 2: Variable Description.

Variable symbols	Variable name	Meaning of variables
$lnProfit$	Periodic returns	Subjects' profits per round are taken as logarithms
Pro	Effective information disclosure rate	Valid information / Total information
$Exper$	Investor Experience	Subjects' length of investment
Num	Number of information	Number of disclosures per round
$lnOpeningPrice$	Opening price per round	Logarithm of opening price per round
$lnFirstPrice$	First sale price per round	First sale price per round is taken as a logarithm
$avGender$	Gender ratio	Proportion of females in each experimental group
$Tradenum$	Number of transactions	Number of transactions per round of experiment

A total of three models were constructed for this study, which were to disregard investor experience, control for investor experience and introduce a cross term for investor experience and information overload [23].

$$lnProfit = \alpha_0 + \alpha_1 Pro + \alpha_2 Num + \alpha_3 lnOpeningPrice + \alpha_4 lnFirstPrice + \alpha_5 avGender + \alpha_6 Tradenum + \varepsilon \quad (1)$$

where α_0 is a constant term and ε is a random perturbation term.

$$lnProfit = \beta_0 + \beta_1 Pro + \beta_2 Exper + \beta_3 Num + \beta_4 lnOpeningPrice + \beta_5 lnFirstPrice + \beta_6 avGender + \beta_7 Tradenum + \varepsilon \quad (2)$$

$$lnProfit = \varphi_0 + \varphi_1 Pro + \varphi_2 Exper + \varphi_3 Pro * Exper + \varphi_4 Num + \varphi_5 lnOpeningPrice + \varphi_6 lnFirstPrice + \varphi_7 avGender + \varphi_8 Tradenum \quad (3)$$

4.6. Transaction Income and Experimental Rewards

The main ways in which each trader receives cash benefits in the experiment are: (1) the difference between the "buy low, sell high" price and (2) the closing price of the previous round for each property owned by the trader at the end of each round. In order to encourage participants to trade carefully and to encourage active participation in the experiment, each participant will be paid and rewarded. Each participant's final experiment payout will be ranked and paid out in varying amounts in order of ranking. Such an incentive will increase the motivation of the subjects. And furthermore, the incentive may avoid negative experiments to increase the validity and authenticity of the experiment.

5. Empirical Test Results and Analysis

5.1. Experimental Data Statistics and Analysis

A total of 78 subjects were recruited for this experiment and all 78 subjects were present in attendance and divided into 6 groups, with 13 people in each group for the experiment. The regression analysis selected the most complete data for the regression and 182 valid data were obtained. Table 3 shows descriptive statistics for cycle returns, effective disclosure rate, number of messages, opening price per round, first traded price per round, gender ratio, number of trades, and relative deviation. As can be seen from the table, the mean value of the sample cycle returns is 7.927 and the standard deviation is 0.314, indicating that the data are less discrete after logarithmic treatment. The disclosure rate of valid information Pro, which has a maximum value of 1, i.e., indicating full disclosure of valid information, and a minimum value of 0.333. The minimum disclosure ratio of information is controlled at 33.3% in the experiment, and the other variables are also relatively stable, as expected from the experiment.

Table 3: Descriptive statistics.

Variables	mean	s	min	max
$lnProfit$	7.927	0.314	7.333	8.555
Pro	0.570	0.220	0.333	1
$Exper$	3.308	2.736	1	9
Num	6	2.006	3	9
$lnOpeningPrice$	5.537	0.381	4.977	6.120
$lnFirstPrice$	5.368	0.371	4.852	5.886
$avGender$	0.385	0.0771	0.308	0.462
$Tradenum$	31.14	4.369	25	40
RD	0.0268	0.0164	0.00664	0.0727

5.2. Correlation Analysis

The correlation analysis in Table 4 shows that there is a negative relationship between investors' returns and information disclosure rate. Since the experimental data selected for this experiment are real data of A-share listed companies on the STAR Market, investors' returns will be influenced by the stock market, and to exclude this interference, the opening price of each round of trading and the first transaction price of each round of trading are selected as control variables, as shown in the regression analysis in Table 4. In addition, the correlation coefficients between the variables were mostly below the critical value of 0.7. Therefore, it can be concluded that the model does not have the problem of multicollinearity.

Table 4: Correlation Analysis.

Variables	lnProfit	Pro	Exper	Num	lnOP	lnFP	avG	Tr
lnProfit	1							
Pro	-0.434***	1						
Exper	0.007	-0.000	1					
Num	0.555***	-0.951***	-0.101	1				
lnOP	0.780***	-0.830***	0.210	0.817***	1			
lnFP	0.341***	-0.838***	-0.002	0.803***	0.612***	1		
avG	-0.002	0.000	0.003	0.000	0.000	0.037	1	
Tr	0.251***	-0.637***	0.001	0.574***	0.519***	0.569 ***	0.000	1

Note: OP means opening price, FP refers to first price, avG is short for avGender, Tr represents *Tradenum*. The vale in parentheses represents the t-statistics ***, **, and * represent the significance level at 1%, 5% and 10%, respectively.

5.3. Regression Analysis and Hypothesis Testing

Table 5 shows the results for the regression models. Hypothesis 1 represented by Model 1 indicates that the independent variable round returns is significantly and positively related to the dependent variable effective information disclosure rate, suggesting that as the effective information disclosure rate decreases, investors' returns will subsequently decrease. Hypothesis 2 is confirmed and also rejects hypothesis 1, that the presence of information overload in the STAR Market will make investors' decisions less rational. From model 2, the results are not significant when investor experience is introduced as a control variable, which shows that investor experience can hardly play an effective role in the case of information overload. In model 3, a cross term between effective information disclosure rate and investor experience was introduced and the cross term was not significant in the model. Therefore, Hypothesis 3 is not valid and the direction and extent of the impact of information overload on the rationality of investor decision making in the STAR Market is not effectively influenced by investor experience.

Table 5: Regression Analysis.

Variables	Model 1	Model 2	Model 3
Pro	2.766*** (19.65)	1.852*** (10.96)	1.873*** (10.50)
$Exper$		0.001 (0.20)	0.004 (0.42)
$Pro * Exper$			-0.006 (-0.38)
Num	0.171*** (13.25)	0.116*** (6.68)	0.116*** (6.66)
$lnOpeningPrice$	1.092*** (28.27)	0.003*** (20.19)	0.003*** (20.14)
$lnFirstPrice$	0.227*** (5.60)	0.001*** (4.22)	0.001*** (4.21)
$avGender$	-0.027 (-0.25)	-0.016 (-0.11)	-0.016 (-0.11)
$Tradenum$	0.001 (0.50)	0.002 (0.59)	0.002 (0.58)
$Constant$	-1.966*** (-4.82)	4.978*** (19.01)	4.966*** (18.78)
Observations	182	182	182
R-squared	0.893	0.821	0.821

5.4. Robustness Testing

To further examine the impact of information overload on investors' decisions and to conduct a robustness check on the above results, we replace the dependent variable with relative deviation, a measure of bubbles. Information overload affects the stock market, and the more the trading price deviates from the base price, the larger the bubble, reducing the level of rationality in investors' decision making, thus, the two indicators should be negatively connected [23]. We calculated the relative deviation (RD) using the following formula.

$$RD = (P^-_{m,t} - FV_{m,t})/FV^-_m \qquad (4)$$

The dependent variable in Model 4 is relative deviation, which is the main indicator of bubbles. Price bubbles tend more towards zero, indicating a more rational price level, and relative deviation is significantly negatively related to the effective information disclosure ratio, indicating that as the information disclosure ratio decreases, investors' decisions deviate from rational decisions. The results of Model 5 and Model 6 are the same as the above results, which can also prove that the moderating variable of investor experience is not significant in the influence mechanism of information overload on investor decision-making.

Table 6: Robustness Testing.

Variables	Model 4	Model 5	Model 6
Pro	-0.091*** (-6.57)	-0.089*** (-6.98)	-0.089*** (-6.61)
$Exper$		-0.001 (-0.003)	-0.001 (-0.000)
$Pro*Exper$			0.002 (0.001)
Num	-0.014*** (-10.72)	-0.013*** (-9.74)	-0.013*** (-9.71)
$lnOpeningPrice$	-0.009** (-2.49)	-0.001*** (-2.23)	-0.001*** (-2.23)
$lnFirstPrice$	0.037*** (9.14)	-0.002*** (9.66)	0.001*** (9.64)
$avGender$	0.028*** (2.61)	0.028*** (2.61)	0.028*** (2.60)
$Tradenum$	-0.002*** (-6.22)	-0.002*** (-6.27)	0.028*** (2.60)
$Constant$	0.055 (1.36)	0.165*** (8.36)	0.165*** (8.27)
Observations	182	182	182
R-squared	0.619	0.628	0.628

6. Conclusion

This paper applies the research method of experimental economics to study the phenomenon of information overload in China's STAR Market by constructing a stock market with different degrees of information disclosure and collecting experimental data to analyse the impact of information overload on investors' decision making. The results show that under a stock market created by real data, as the effective disclosure rate decreases, investors' returns decrease, and investors' decisions deviate more from rational decisions. In the model, a cross term of effective information disclosure rate and investor experience is introduced, which is not significant in the model. This shows that investor experience does not play a significant moderating role in the mechanism of information overload on investor decision making, and the direction and extent of the impact of information overload on the rationality of investor decision making in the STAR Market is not effectively influenced by investor experience. The above findings suggest that the information overload not only fails to benefit investors, but also interferes with their rational judgement, and it is crucial to pay attention to the information overload in the STAR Market.

However, the shortcomings may also exist, for example, based on the operability of the experiment and the complexity of information disclosure in the stock market, we selected key financial indicators for disclosure in order to meet the expectations of the experiment, which are somewhat different from the information overload in the stock market. For the screening of valid and invalid information, we used the literature collection method and the expert opinion method, and the subjective discernment differs from the objective reality. In the experiment, the results regarding the investor experience moderating variable are less convincing since the subjects selected for the experiment were

undergraduate students in school with limited investment experience to compare to experienced individuals in the real stock market. All the above-mentioned deficiencies deserve further investigations and may shed lights for the future research.

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