Proceedings of the 2nd International Conference on Financial Technology and Business Analysis
DOI: 10.54254/2754-1169/73/20230524

Impact of Performance Commitments on Stock Pricing Efficiency

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Abstract: Performance commitments have become an important means of credit protection in the M&A process and can provide good expectations for the counterparties to the transaction. However, due to information asymmetry, performance commitments sometimes lead to the transmission of misinformation affecting stock pricing efficiency. And stock pricing efficiency is of great significance for capital market stability. Existing research theories have less research on the impact of performance commitment on stock pricing efficiency. Therefore, in this paper, stock pricing efficiency is calculated by using rolling regression and 20 pharmaceutical industry companies with mergers and acquisitions and restructuring with performance commitments from 2018-2023 are studied and analyzed using a graphical method. It is found that performance commitments have the effect of first decreasing and then recovering on the stock pricing efficiency of the company in the short term, while in the long term, it reduces the stock pricing efficiency of the company.

Keywords: Pharmaceutical industry, mergers and acquisitions, performance commitments

1. Introduction

A performance commitment is a guarantee of the target enterprise's operating results during a certain performance commitment period in a merger, acquisition and reorganization transaction. It reflects an enterprise's bottom-line assurance of its own business and can provide good expectations for the counterparty to the transaction. When an enterprise makes a performance commitment to a counterparty, it also agrees on a performance compensation arrangement, i.e., how to compensate the listed company in the event of failure to meet the commitment in order to protect the interests of listed minority shareholders in the company. Pricing efficiency refers to the ability of a security's price to reflect information or the speed and accuracy with which the price reflects all relevant information. Studying the impact of performance commitment on stock pricing efficiency links the capital market with the real economy, which is more conducive to the supervision of the capital market, promotes the benign development of the real economy, and prevents the economic development "from real to virtual". Therefore, this research direction is of great significance.

DOI: 10.54254/2754-1169/73/20230524

An analysis of the existing literature shows that the factors affecting pricing efficiency in the stock market have not been adequately studied, so in this paper, we test the effect of performance promises on stock pricing efficiency using a graphical approach.

2. Literature Review

For the research on factors affecting pricing efficiency, scholars have studied some factors in the past.

Bo Wang [1] studied investor sentiment and stock market pricing efficiency and concluded that CSI 300 and SSE A shares are most affected by the sentiment factor. Jun Lu and Jichao Yang [2] in their study on the impact of financing and securities trading on market price discovery, demonstrated that the implementation of financing and securities trading can improve the overall price stability but reduce the pricing efficiency of stocks. Qing He [3] investigates the impact of regulatory sanctions on stock pricing efficiency and concludes that when firms are sanctioned, their stock pricing efficiency has an inverted U-shape dynamic change characterized by an increase and then a decrease.

Guanqun Jian [4] and others argue that performance failure increases the risk of large goodwill impairment; shareholders try to avoid compensation for failure by pledging equity, but they become loss-bearers in a multi-interest game. Qiuyu Chen [5] based on multi-case analysis to study the performance promise on high premium merger and acquisition risk inhibition utility performance promise in high premium mergers and acquisitions. Hong Miao [6] proposed that the stock payment method is more conducive to the realization of performance commitment, cash payment and equity payment, two different payment methods under the performance commitment fulfillment effect is significantly different. Yang Chao, Xie Zhihua and Song Di [7] obtained through sample empirical analysis that the higher the commitment performance target, the more rigorous the performance threshold setting, the lower the degree of information inequality between the merging and acquiring parties, the better the performance of listed companies' mergers and acquisitions. Wang Gaiyun [8] found that the performance commitment can protect the economic interests and timely adjust the development strategy, but the failure of the performance commitment will also have a greater negative impact on the profitability and debt repayment ability of the main merger and acquisition parties. Jingyi Guan, and Epping Liu [9] in the study of stock price overvaluation, performance commitment and performance realization, found that the more the stock price is overvalued, the more the acquirer will tend to acquire the target company with a high commitment growth rate.

Dong Xiuliang, Zhang Ting and Guan Yunpeng [10] found that the coefficient of response of the stock price of the underlying stock of Shanghai Stock Connect to the information about future surpluses decreases rather than increases compared to the period before the implementation of Shanghai-Hong Kong Stock Connect. George O. Aragon [11] concluded through his study that there is a negative relationship between stock restrictions and the liquidity of the fund's portfolio, which investors use as the stock illiquidity premium.

3. Theoretical Analysis and Research Hypotheses

Although performance promises are proposed to supplement the existing public information, existing studies generally agree that performance promises make the process of corporate mergers and acquisitions (M&A) mispriced, and both parties to the M&A overvalue the target firms, which conveys misinformation to the market. Therefore, this paper proposes the following hypotheses

H1: Performance commitments make stock pricing less efficient.

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3.1. Experimental Design

3.1.1. Data Sources

Based on the performance commitment status as well as the pharmaceutical industry data integrity and availability considerations, this paper selects 334 companies in the pharmaceutical industry, selected companies with M&A and reorganization behavior in 2018-2023 and complete M&A completion of 20 companies, according to their disclosure of information we find that there are 9 of them have a performance commitment, and 11 of them have no performance commitment. The relevant data mainly comes from the CSMAR database, annual reports of each listed company, official websites of listed companies, and financial news.

3.1.2. Selection of Variables

This paper focuses on measuring the impact of performance commitments on stock pricing efficiency. Since there is no direct measure of stock pricing efficiency, we refer to Hou and Moskowitz and construct a regression model (1), which conducts a rolling regression of the lagged effects of individual stock returns, market returns, and market returns, with a rolling window of 100 trading days, and this paper adopts the daily data for the and three stock pricing efficiency, and the lag is set to 4 days, since there are 5 trading days per week.

$$r_{i,t} = \alpha_i + \beta_i market_t + \sum_{n=1}^{4} \beta_{i,t-n} \times market_{t-n} + \in_{i,t} \quad (1)$$

Where $r_{i,t}$is the return of stock i at time t, $market_t$is the market return at time t, and $market_{t-n}$ is the return in n lags at time t, which is the error term. The individual stock return $r_{i,t}$ in this formula is calculated according to equation(2), and the data is obtained from the CSMAR database. The market returns and their lagged period returns data are obtained from the CSMAR database.

$$r_t = \frac{P_t - P_{t-1}}{P_{t-1}} \quad (2)$$

The coefficients on individual stock returns and market returns are significantly non-zero if individual stocks can respond to the information in a timely manner, and if the coefficients on the lagged variables are significantly non-zero, the information on individual stocks depends on lagged information, indicating less efficient pricing. In addition, the larger the lag n is, the more lagged the information on which individual stock price adjustment depends, the slower the adjustment, and the less efficient the pricing.

Therefore, in order to express the impact of lag effect on stock pricing, the efficiency index 1, ($efficiency1_i$)(3), Responding to the percentage of lagged information's impact on stock pricing efficiency, the lower the efficiency index 1, the lower the proportion of lagged information to total information, and the higher the pricing efficiency.

$$efficiency1_i = \frac{\sum_{n=1}^{4} |\beta_{i,t-n}|}{\beta_i + \sum_{n-1}^{4} |\beta_{i,t-n}|} \quad (3)$$

The second indicator for calculating the efficiency of stock pricing is the use of deterministic coefficients to estimate the speed of information reflected in stock prices. First, model (1) is estimated to obtain the original goodness-of-fit R^2, and in addition, model (1) is constrained to obtain the constrained goodness-of-fit r^2 y assuming that the coefficients of the lagged effects are all 0. Constructing the Efficiency Index 2 ($efficiency2_i$)(4) measure the portion that can be explained by

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the lagged period return, as a proportion of the sum of the current period and lagged period market returns can be explained.

$$efficiency2_i = 1 - \frac{{r_{i,t}}^2}{R^2} \quad (4)$$

$Efficiency2_i$reacts to the speed of individual stock′s reaction to the information, the larger the $efficiency2_i$ is, the greater the effectiveness of lagged information interpretation is, the slower the reaction speed is, and the lower the efficiency of stock pricing is.

3.1.3. Method Setting

In this paper, the stock pricing efficiency of different companies will be depicted through images by graphical method.

Step1: In order to test whether there is a significant difference in pricing efficiency between companies with performance commitment and companies without performance commitment, 9 companies with performance commitment will be set as the experimental group and 11 companies without performance commitment will be set as control group, and the descriptive statistics results will be analyzed, and if there is a significant difference in the mean value, it means that there is an effect of having performance commitment on the pricing efficiency level.

Step2: In order to test the effect of performance commitment before and after the company's pricing efficiency, the pricing efficiency trend graph of the company with performance commitment is indicated, and the performance commitment time is marked. Analyze the trend of change of the line graph before and after the performance commitment. If there is an upward trend, then the performance commitment significantly improves the efficiency of stock pricing, and if there is a downward trend, then the performance commitment significantly reduces the efficiency of stock pricing. If there are differences in trend changes between different companies, other factors are analyzed.

3.2. Experimental Results

3.2.1. Descriptive statistical results

The descriptive results are shown in Table 1, where a is the company with performance commitment and b is the company without performance commitment. As can be seen from the table, the pricing efficiency of companies with performance commitment is 0.511 and 0.339, respectively, while that of companies without performance commitment is 0.488 and 0.305. Therefore, there is no significant difference between companies with and without performance commitment in terms of pricing efficiency and the stability of the efficiency, but on the whole, the pricing efficiency of companies with performance commitment is higher than that of companies without performance commitment in terms of $efficiency1_i$ and $efficiency2_i$ that is, performance commitment has a negative impact on the pricing efficiency. Without performance commitment, the company, i.e., performance commitment, has a negative effect on pricing efficiency.

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Table 1: Descriptive statistics

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
eff1a	10,035	0.511	0.189	0.0793	0.999
eff2a	10,035	0.339	0.281	0.00231	1.000
eff1b	12,265	0.488	0.185	0.0368	0.998
eff2b	12,265	0.305	0.268	0.000888	1.000

3.2.2. Image Result Analysis

Figure 1-9 shows the trend graph of pricing efficiency of performance commitment companies, from which it can be seen that in the short term after the performance commitmen $efficiency1_i$ and $efficiency2_i$ have a small period of upward and then downward trend, i.e., the pricing efficiency of the stock firstly declines and then rises.

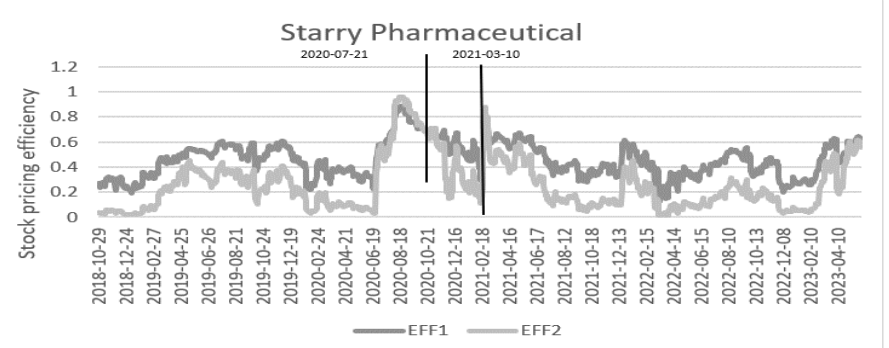

Figure 1: Stock Pricing Efficiency of Starry Pharmacutical

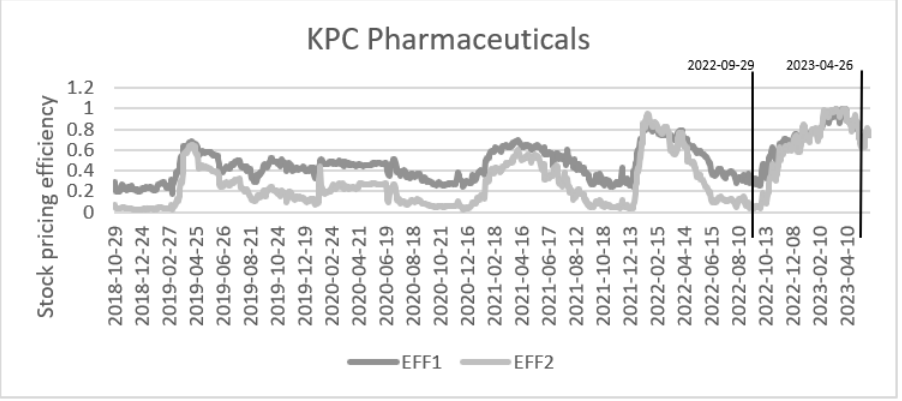

Figure 2: Stock Pricing Efficiency of KPC Pharmacuticals

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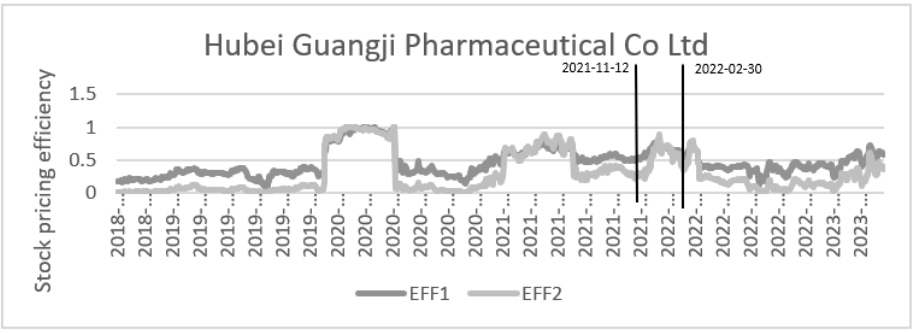

Figure 3: Stock Pricing Efficiency of Hubei Guangji Pharmaceutical Co Ltd

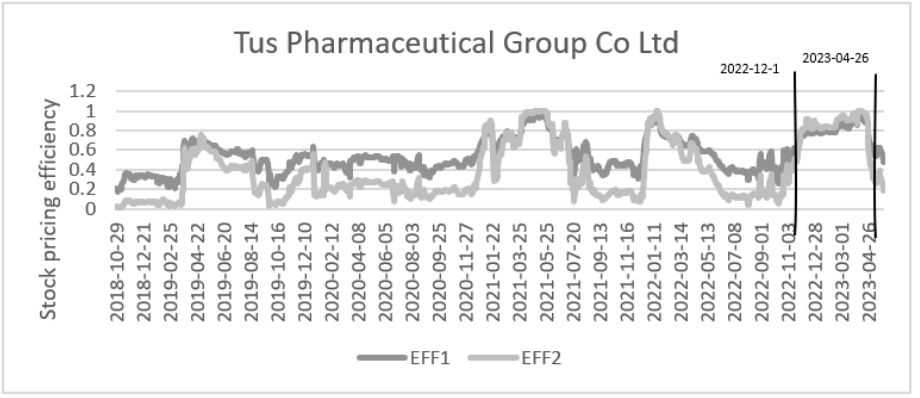

Figure 4: Stock Pricing Efficiency of Tus Pharmaceutical Group Co Ltd

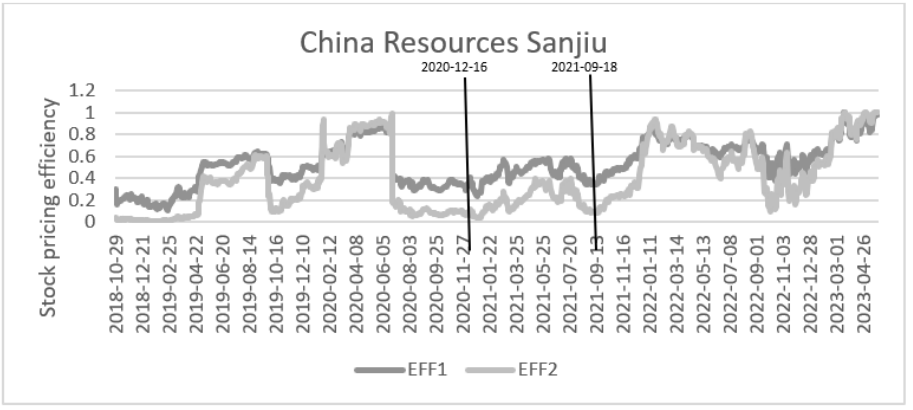

Figure 5: Stock Pricing Efficiency of China Resources Sanjiu

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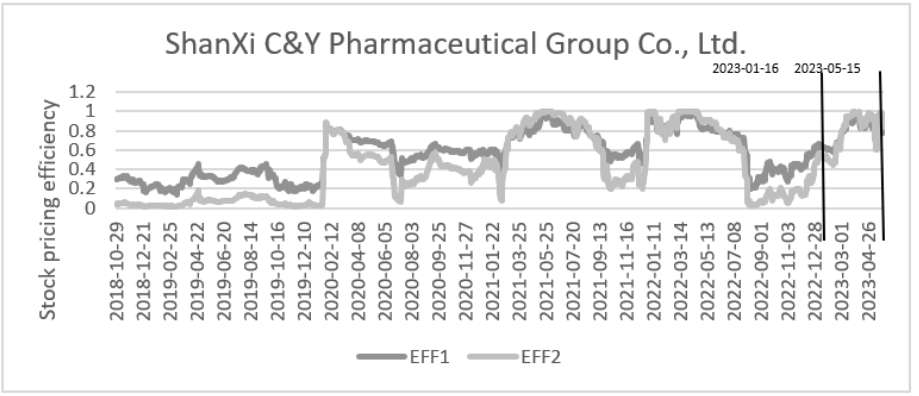

Figure 6: Stock Pricing Efficiency of ShanXi C&Y Pharmaceutical Group Co., Ltd.

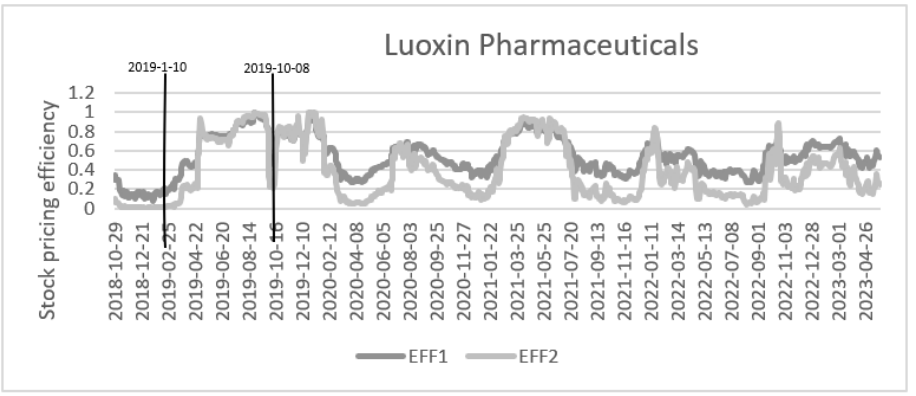

Figure 7: Stock Pricing Efficiency of Luoxin Pharmaceuticals

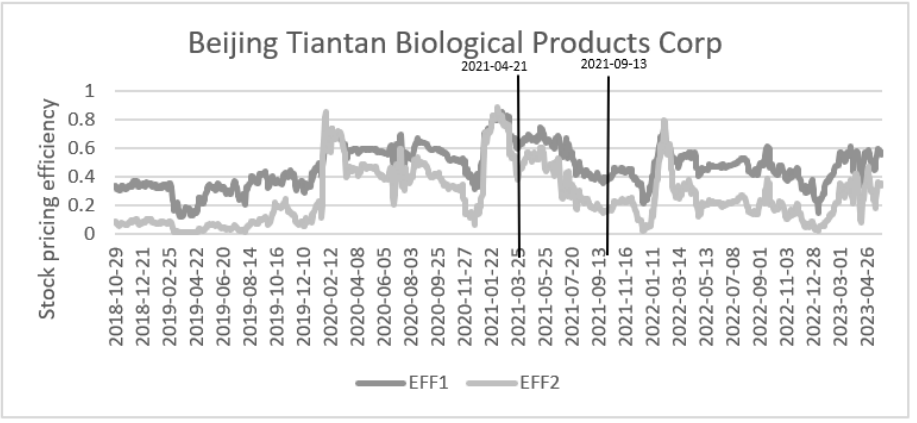

Figure 8: Stock Pricing Efficiency of Beijing Tiantan Biological Products Corp

DOI: 10.54254/2754-1169/73/20230524

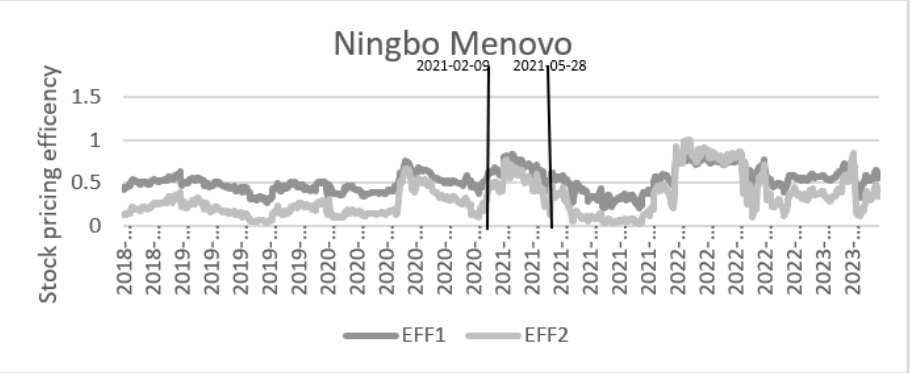

Figure 9: Stock Pricing Efficiency of Ningbo Menovo

3.2.3. Long-term average results

Tables 2-10 show the descriptive statistics of $efficiency1_i$ and $efficiency2_i$ before and after performance commitment for companies with performance commitment, $efficiency1_i$ *and* $efficiency2_i$ are basically larger than the pre-commitment period, i.e., the efficiency of post-commitment is lower than that of pre-commitment. This indicates that performance commitment has a negative effect on stock pricing efficiency in the long run, which is consistent with the results of cross-sectional comparison.

Table 2: Hubei Guangji Pharmaceutical Co., Ltd

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	740	0.459	0.236	0.109	0.999
before2	740	0.298	0.337	0.00671	1.000
after1	375	0.475	0.136	0.120	0.830
after2	375	0.273	0.199	0.00762	0.888

Table 3: China Resources Sanjiu

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	521	0.452	0.204	0.102	0.920
before2	521	0.304	0.295	0.00571	0.991
after1	594	0.601	0.163	0.237	0.999
after2	594	0.457	0.277	0.0350	1.000

Table 4: KPC Pharmaceuticals

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	956	0.447	0.152	0.180	0.896
before2	956	0.246	0.211	0.0193	0.950
after1	159	0.753	0.150	0.324	0.999
after2	159	0.711	0.232	0.0864	0.998

DOI: 10.54254/2754-1169/73/20230524

Table 5: Luoxin Pharmaceuticals

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	121	0.235	0.127	0.0793	0.499
before2	121	0.0594	0.0821	0.00231	0.259
after1	994	0.574	0.181	0.266	0.994
after2	994	0.425	0.291	0.0356	1.000

Table 6: Ningbo Menovo

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	559	0.483	0.0892	0.265	0.750
before2	559	0.237	0.129	0.0343	0.672
after1	556	0.567	0.163	0.196	0.954
after2	556	0.410	0.262	0.0245	0.999

Table 7: Tus Pharmaceutical Group Co Ltd

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	996	0.527	0.168	0.174	0.996
before2	996	0.342	0.265	0.0132	1.000
after1	119	0.788	0.108	0.478	0.972
after2	119	0.788	0.223	0.180	1.000

Table 8: ShanXi C&Y Pharmaceutical Group Co., Ltd.

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	1,032	0.552	0.231	0.136	0.997
before2	1,032	0.412	0.338	0.0109	1.000
after1	83	0.805	0.121	0.582	0.977
after2	83	0.812	0.184	0.446	1.000

Table 9: Starry Pharmaceutical

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	409	0.419	0.115	0.190	0.610
before2	409	0.191	0.130	0.0187	0.455
after1	706	0.482	0.152	0.127	0.888
after2	706	0.296	0.234	0.00775	0.964

Table 10: Beijing Tiantan Biological Products Corp

VARIABLES	(1) N	(2) mean	(3) sd	(4) min	(5) max
before1	608	0.465	0.169	0.118	0.853
before2	608	0.276	0.235	0.00534	0.887
after1	507	0.475	0.107	0.147	0.757
after2	507	0.250	0.139	0.0184	0.794

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4. Analysis of Results

4.1. Analysis of Short-Term Results

The effect of performance commitments on stock pricing efficiency in the short term is that pricing efficiency declines in the short term but picks up in the long term. The main reasons for this are the following

4.1.1. Information asymmetry leads to less efficient pricing

In the process of mergers and acquisitions, the performance commitment performance commitment agreement of the mandatory profit target For future performance improvement provides a guarantee, and reduces the business risk. However, due to the existence of information asymmetry, the subject company will be self-interested motivation to distort the merger and acquisition price so that its merger and acquisition price is higher than the true level of its profitability. In Liu, Jianyong and Qiu, Sihui [12] explore the relationship between performance promises and the risk of stock crash and find that high-performance promises increase the risk of a stock crash, and high premium performance expectations will lead to overvaluation of the stock if it fails to be realized, which will exacerbate the risk of stock crash. The high premium performance promise will reduce the efficiency of stock pricing because it is difficult for the target company to achieve the expected performance, so the performance promise does not show the real information of the company, which leads to the reduction of the efficiency of stock pricing. Therefore, if the performance promise given by the target company does not match its profitability during the M&A process, then the acquirers and investors other than the target company will be overly optimistic about the company's future earnings due to information asymmetry, which will result in the overvaluation of the stock so that its price will not reflect the real situation of the company, leading to a reduction in the efficiency of stock pricing of the target company.

Jingyi Guan and Epping Liu [11] in their study of stock price overvaluation, performance commitment, and performance realization, show that the more overvalued the stock price, the more acquirers tend to acquire the target company with high-performance commitment, and acquirers will take the initiative to create the market timing of stock price overvaluation by positive surplus management, reducing the accounting robustness, and releasing over-optimistic earnings forecasts. The acquirer will use its own known but undisclosed information to create an image of the company as a very good company through information asymmetry with investors, and a large number of investors will buy the company's shares, at which time the company's stock price is overvalued at which time the acquirer can earn a large amount of profit from it, and therefore the efficiency of the stock pricing is very low. However, as more and more information is disclosed over time, investors will be able to evaluate the stock price more accurately after getting more information, making the stock pricing more efficient.

4.1.2. Investor Sentiment and Stock Pricing Efficiency

Rational investors are more likely to be fooled, and their judgment of stock prices should be more accurate. However, overly optimistic performance promises under information asymmetry can also mislead rational investors to fail to make correct judgments. Wang Bo [1] in the empirical study of investor sentiment and stock market pricing efficiency, pointed out that the Chinese stock market is a short-term investment as the main investment strategy, and investor sentiment has a significant impact on the A-share market ETF index. In his study, the turnover rate is an important indicator of investor sentiment, and after comparing the results of the turnover rate of the companies with performance promises in our study, we found that the turnover rate of these companies had a certain

DOI: 10.54254/2754-1169/73/20230524

decline after the disclosure of performance promises, which means that the liquidity of the company's stock at this stage had a certain decline after the announcement of performance promises, and at the same time, according to our calculation results, the pricing efficiency of the stock at this point in time At the same time, according to our calculations, the stock pricing efficiency at this time also has a tendency to decrease, the reason for the decrease in stock pricing efficiency may be that there is less stock trading and less information available to investors, so investors cannot react to the information released by the market in a timely manner and adjust their prices, resulting in a decrease in the efficiency of stock pricing.

According to behavioral finance theory, the overvaluation of stock price means that the company has good development prospects, which sends a positive signal to the company managers and investors, which is more likely to lead to investors' misjudgment of the company's stock price because they are more optimistic about the management of the company's managers and believe that they can fulfill the performance promises, and therefore are more optimistic about the prospects for the company's development. This over-optimistic attitude will lead investors to make irrational investments. They will ignore some of the problems of the company, resulting in the current stock price does not reflect the real situation of the company as well as when the company's managers, in order to obtain the benefits of the release of some over-optimistic information, will have a negative impact on the efficiency of the company's stock pricing. However, it is easier for a company to fulfill its performance promises in the short term than to maintain such performance promises in the long term, so in the short term, the stock pricing efficiency will tend to decrease, but it is more difficult to maintain high premium promises in the long term and to cover up untrue information, when the information accumulates to a certain threshold the company and it is difficult to continue to cover up the information, the company's true situation will be disclosed, and when the information flows into the market, investors will adjust their prices in time. Investors will adjust their prices in a timely manner, thus making stock pricing more efficient.

4.2. Analysis of Long-Term Results

Based on the analysis of the mean of the long-term results obtained, the effect of performance commitments on stock pricing efficiency in the long run is a decrease in pricing efficiency, mainly due to the following reasons.

4.2.1. Performance Commitments Lead to Inflated Goodwill

On the one hand, for the target company, the performance commitment brings additional risks and burdens to the target company, and in order to compensate for this uncertainty, the seller may increase the merger and acquisition pricing, on the other hand, for the acquirer, the performance commitment is equivalent to the credit enhancement commitment provided by the target company to the acquirer, which guarantees the availability of its benefits to a certain extent, and therefore the acquirer is willing to pay a purchase premium higher than the value of the company for it. Therefore, the shareholders of the target assets, in order to realize the high price of the sale, first give a high commitment, followed by the appraiser to give a high valuation. The performance commitment has become a means of realizing the high valuation of the assets, and the appraiser acquiesces to this unreasonable high commitment, thus resulting in the valuation of the company is much higher than its true value.

Performance commitment compensation can theoretically guarantee the future profitability of the target company through the signing of the performance commitment, mergers, and acquisitions on the target company's future development ability and profitability to make a reliable judgment, and can motivate the target company to improve profitability, but mergers and acquisitions of the main managers and decision-makers are often irrational behavior, and their own irrational behavior on the

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whole process of mergers and acquisitions have an impact. Overconfident managers tend to believe that their own superior management ability can help both parties to realize operational synergies, which makes it easy to overestimate the synergies after the merger and overestimate the value of the target company; in addition, some M&A decision-makers believe that they can fully predict the risks of the merger and rely too much on their own information rather than external information. Therefore, overconfident managers tend to overestimate the benefits of M&A and underestimate the risks of the target company failing to fulfill its performance promises, thus ultimately creating inflated goodwill.

4.2.2. Mismatch between High Valuation and Accounting Treatment of After-the-fact Compensation

International accounting standards stipulate that the premium in the process of purchase is recognized as goodwill. China's accounting standards also stipulate that for business combinations not under the same control, the purchase price is recorded as goodwill, and the goodwill is not amortized but only impaired, and the impairment amount is recorded in the provision for impairment of assets and is also charged to profit. For mergers and acquisitions involving performance incentives and performance compensation, which is essentially a kind of contingent consideration, should be measured at fair value in accordance with the financial instruments in "Accounting Standard for Business Enterprises No. 22 - Recognition and Measurement of Financial Instruments", and gains and losses arising from changes in fair value are recognized in profit or loss for the current period. However, in current practice, most listed companies directly recognize all the portion of the purchase price higher than the fair value of the net assets as goodwill during the initial measurement of the M&A, without valuing the contingent consideration or simply identifying the fair value of the contingent consideration as zero. This leads to, in the subject asset performance commitment can not be realized, the goodwill recorded in the previous period will face impairment, especially in the current purchase of assets is generally "overestimated", goodwill will face a huge amount of impairment due to the impairment of goodwill directly against the net profit, so it will greatly affect the performance of the current period from the accounting treatment of compensation after the point of view, because the current From the accounting treatment of post-compensation, since the Accounting Standards for Business Enterprises (ASBE) has not made clear provisions on the accounting treatment of performance compensation, most companies in practice will include the cash compensation and share compensation in the "capital surplus - other capital surpluses" instead of profit and loss. The result is that the listed company recognized the "overvalued" goodwill when purchasing the assets, and when the performance promise is not fulfilled, the large amount of impairment will reduce the profit, while the payment of performance compensation does not increase the profit, the accounting treatment is inconsistent, and because the accounting treatment belongs to the company's internal information, the investor can not access, so the investor and the company Since the accounting treatment is internal information of the company, investors cannot obtain it, so there is information asymmetry between investors and the company, which reduces the pricing efficiency.

4.2.3. Lack of Awareness of Subsequent Goodwill Impairment Risks Leads to Reduced Timeliness of Goodwill Impairment

The provision of goodwill impairment will not only directly reduce current earnings but also bring a negative impact on the listed company's stock, resulting in many opportunistic behaviors of listed companies in goodwill impairment. Hayn and Hughes, Gao Duan [13], and other studies found that the provision of corporate goodwill impairment lagged three to four years more than the impairment of the economic value of goodwill, and there is a common situation of untimely provision of goodwill impairment. Lu Xiaozhe and Zhu Nanjun [14] found that if management is overconfident in mergers

DOI: 10.54254/2754-1169/73/20230524

and acquisitions, it usually pays higher merger premiums and reorganizations and has insufficient knowledge of the risk of subsequent goodwill impairment, which leads to a reduction in the timeliness of goodwill impairment. Zhang Junmin [15] and other research found that listed companies have the phenomenon of untimely goodwill impairment, the average delay of goodwill impairment is at least 1 to 2 years, and the negative media reports will further exacerbate the phenomenon of untimely goodwill impairment of listed companies. The phenomenon of untimely goodwill impairment of listed companies means that the information of listed companies' goodwill assets is distorted, and the distorted goodwill assets reduce the quality of listed companies' information disclosure and information transparency, and it is difficult for investors to obtain the real information of listed companies' goodwill value.

5. Conclusion

This paper adopts the rolling regression method to calculate two kinds of stock pricing efficiencies $efficiency1_i$ and $efficiency2_i$. and analyzes the results graphically to obtain that the stock pricing efficiencies of the firms with performance promises will be reduced firstly and then recovered in the short term, in which the information asymmetry and investor's emotion will lead to the reduction of stock pricing efficiencies of the firms but will recover when more information is disclosed and the investors become more rational. Information asymmetry and investor sentiment will lead to a decrease in pricing efficiency, but as more information is disclosed and investors become more rational, pricing efficiency will recover. In the analysis of long-term pricing efficiency, it is found that the performance promise will lead to the reduction of stock pricing efficiency in the long run, mainly due to the impact of the failure to fulfill the performance promise on the goodwill of the company and the impact of the mismatch of compensation on the pricing efficiency.

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