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An event study on Chinese stock market reaction to the issuance of the "bio-industry development plan"

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ABSTRACT

This paper conducts an event study methodology to investigate how Chinese stock market responds to the issuance of the "Bio-industry Development Plan". In this paper, we examine 123 listed companies under the influence of bio-industry with an event window of twenty-day. The empirical results indicate a significantly positive relation between the announcement of the "Bio-industry Development Plan" and the stock prices of these firms. Namely, the new plan increases both the companies' value and shareholders' wealth in a short period around the announcement date. Our paper not only highlights the new plan's important guiding effect to bio-industry development, but enriches the existing related literature.

KEYWORDS

Event study; Chinese stock market; Bio-industry development plan; Listed companies.

INTRODUCTION

In recent years, the global biotechnology industry presents the trend of accelerating the development of the major developed countries and emerging economies have made arrangements for the development of bio-industry, as an important area to obtain the technologies of the future economic competitive advantage. Promote biotechnology research and development and industrial development in China for more than 30 years of history, but China's bio-industry trade management mechanism is not perfect, imperfect market access policy and regulatory system, scientific research and industrial combination does not close, leading enterprises lack the core competitiveness and innovative vitality of small business groups other outstanding problems in the development process will be facing increasingly fierce international competition, in order to solve the outstanding problems and promote the sustained, rapid and healthy development of China's biological industry, the State council issued the "Bio-industry Development Plan" (referred to as "BID plan") on January 6, 2013.[1]

Bio-industry is one of the seven strategic new industries China aims to cultivate according to its 12th Five-Year Plan for the 2011-2015 period. Bio-industry development (referred to as "BID") is very important for the health of the population, grain security, energy conservation and emission reduction. (Xinhuanet, Feb. 6, 2013)[2] During the past years, China has just seen double-digit growth in its biotechnology industry and has gone from being one of the slowest to one of the fastest nations in the adoption of new biotechnologies. The biotech sector is seen in China and internationally as a core area of national scientific and economic development, due to its potential to ease the food crisis, combat disease and hereditary problems. The Chinese biotech industry grew 30% annually to $3 billion between 2000 and 2005. By 2010, the Chinese biotech market is projected to reach US$9 billion.[3] The central government has set a goal of keeping the total output of its biological industry up at least 20 percent each year through 2015. (Xinhuanet, Feb. 6, 2013)[2]

Thus the bio-industry as a strategic emerging industry, its development has received strong support from Chinese Government. It is good signals to bio-industry listed firms, which maybe lead stock investors have high expectations for the bio-industry. This paper adopt a standard event study methodology to study the stock price changes before and after the BID plan was announced based on the research sample of these quoted from China's listed firms of bio- industry.

The remainder of the paper is organized as follows. Section 2 presents a series of literatures concerning the bio-industry. Section 3 describes the study sample selection methodology and the data sources. Section 4 provides an analysis of results revealed by our data set and also finds the nature of the response. Section 6 outlines the conclusions of this research.

LITERATURE REVIEW

The BID plan plays an important guideline for the development of whole bio-industry. It stipulates the major fields of bio-industry to include its applications in medicine, medical engineering, agriculture, manufacturing, energy, environmental protection and services, the last category of which is newly introduced in the guideline. (Xinhuanet, Feb. 6, 2013)[2]

Previous research on the bio-industry has generally fallen into two distinct categories. One category of previous research has focused on standardization research, this type of research has often studied the bio-industry's development situation, the evolution and governance of the bio-industry, how to improve the BID in China, the pathways of BID, and so on. For example, Yantai Chen, Laijun Luo, Yaguang Zhang (2011) examined China's biotechnology industry from a global perspective and explores how its development trajectory differs from that of countries that are leaders in biotechnology.[4] Kai Wang, Liang Zhu, Jin Hong, Dora Marinova (2007) analyzed the evolution and governance of the biotechnology industry of China.[5] Zailin Yu Professor, Yuehan Dai (2006) presented the Chinese biotech industry has to tackle the critical issue of innovation, which should be the driving force for China's development into an advanced and responsible country.[6] Professor Albert Cheung-Hoi Yu, Ph. D. (2011) discussed how to promote biotechnology in Hong Kong.[7] Mi-Ae Jung, Joseph Wong (2010) reviewed the various pathways to biotechnology industrialization.[8] The other category of research has concentrated upon empirical research, this type of research has often studied the relationship between the BID and other factors, often used empirical method and data to discuss a question. For example, Véronique Bastin, Georges Hübner (2006) conducted a composite return-generating model with an industry-specific patent-based factor to study the biotechnology stocks.[9] David H. Austin (1993) estimated the private values of patents and the effects of selected patents on rival firms with an event study approach.[10]

The bio-industry is a strategic emerging industry, the sustained, rapid and healthy development of China's biological industry is especially important, examining whether its guiding policies are reasonable is also important. One of the simplest ways to test this is using the event study method to verify the wealth effect of the policy on stock market during a short period around the announcement date.

However, up to now, an empirical analysis of the effects of the bio-industry of China's listed firms on shareholders has been received little attention. The aim of our study is to measure the economic effect of the BID plan and verify the rationality of the plan further. As is known to us, China is one of the largest energy consumers in the world. Therefore, it

seems necessary and valuable for us to conduct an event study to investigate the stock price changes before and after the announcement of the 123 quoted firms by using a window empirical analysis method.

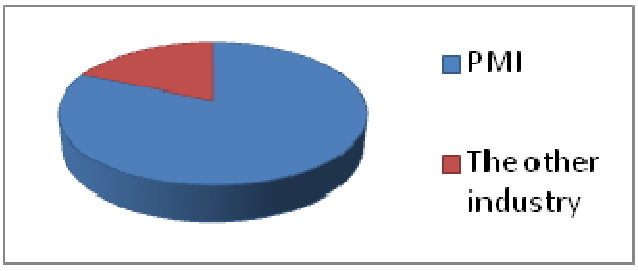
DATA AND EVENT STUDY METHODOLOGY

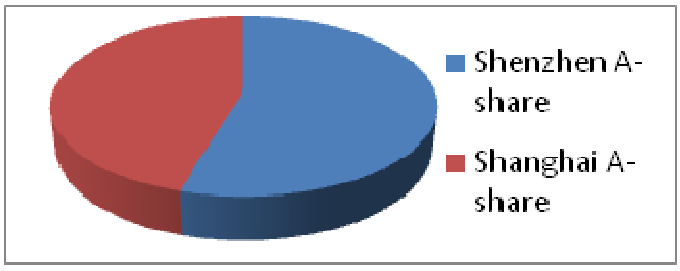
Data

This paper makes an event study methodology on Chinese stock market responses to the issuance of the BID plan. In this paper, we examine 123 listed companies under the influence of bio-industry. We use daily stock returns, all the data was drawn from the GSMAR database. To ensure the accuracy and reliability of the data, we exclude the companies whose daily stock returns are zero when calculating the AAR and CAAR. All the sample firms are selected randomly from the 162 biopharmaceutical industry listed companies on the internet. Before selection, we removed all the listed companies not listed in the A-share market. We find that the vast majority of listed firms in the bio-pharmaceutical industry belong to pharmaceutical manufacturing industry. Besides, there are also a small part of listed firms belong to agriculture, forest, animal husbandry and fishery, service industry, chemical materials and chemical products manufacturing and so on. Thus a majority of sample firms belong to pharmaceutical manufacturing industry. TABLE 1 shows the descriptive statistics of all the sample companies. From TABLE 1, we can directly conclude there are 81.30% sample companies belong to pharmaceutical manufacturing industry, the other 18.70% sample companies belong to other industry. It is consistent with the distribution of bio-pharmaceutical industry listed firms. Also, TABLE 1 indicates that the stock market distribution of sample firms is very balanced. Therefore, the selection of our sample is valid. They can represent the situation of the bio-pharmaceutical industry effectively.

TABLE 1: The descriptive statistics of the sample companies

	Industry Type		**Stock Market Type**	
	PMI	The other industry	Shenzhen A-share	Shanghai A-share
Number	100	23	67	56
Percentage（%）	81.30	18.70	54.47	45.53





Note :PMI referred to as "pharmaceutical manufacturing industry".

Event study methodology

The event study methodology such as Brown and Warner (1980, 1985) has been extensively and successfully applied in corporate finance. For example, to investigate whether a policy announcement is a good news or bad news for related firms, event study approach can be applied to examine how the stock market reacts to such announcement.[11] This paper conducts an empirical research by the standard event study approach based on the data of 123 listed firms under the influence of the BID plan announcement with a time window of 20 days. Here, the event is defined as the date when the State Council announces the BID plan. And we define the event day as t=0, but since the event day is Sunday, there is no data existing about the listed firms. Thus we define the event window as (-10, 10) excluding the day t=0, which means 10 trading days before and after event occurrence point.

-10,-9,-8,-7,…,-2,-1, +1,+2,…,+7,+8,+9,+10

We suppose that the new BID plan is good news for listed firms of bio-industry, which increase both shareholders' wealth and the value of those firms in a short period around the announcement day.

There are alternative models for carrying out an event study (MacKinlay, 1997). For example, the market model, the capital asset pricing model (CAPM) and the three-factor model. In this paper, we chose the CAPM to evaluate the return of any security. Here is the capital asset pricing model:

$$R_{it} = R_{ft} + \beta_i(R_{mt} - R_{ft}) + e_{it} \quad \textbf{(1)}$$

with $E(e_{it}) = 0$, $Var(e_{it}) = \delta^2$

Where:
R_{it}: the rate of return on security i on day t,
R_{ft}: the risk-free rate,
R_{mt}: the rate of return on the market Index,
β_i: the sensitive parameter, we can use the Ordinary Least Square (OLS) method to estimate it,
e_{it}: the random error term associated with security i.
Then the Abnormal Return (AR) for firm i in period t (say, day t) in the event window is defined as follow:

$$AR_{it} = R_{it} - \hat{R}_{it} \quad \textbf{(2)}$$

To test the persistence of the impact of the event during a period t_1 to t_2 (the event window), the abnormal returns of a given security can be added to obtain the Average Abnormal Returns (AAR). When we add AAR from a period t_1 to t_2, we can get the Cumulative Abnormal Average Return (CAAR) of each stock on every day during the event window. The calculate formulas are given by:

$$AAR\ t=\sum_{i=1}^{n} AR_{it}/n \quad \textbf{(3)}$$

$$CAAR_{t1,\,t2}=\sum_{t=t1}^{t2} AAR_t \quad \textbf{(4)}$$

Finally, under the null hypothesis we build a statistics to test whether the CAAR is statistically different from zero. Here is:

$$t_{CAAR}=\frac{CAARt}{\frac{S(CAARt)}{\sqrt{n}}} \sim t\ (n-1) \quad \textbf{(5)}$$

Thus, a t-test can be conducted to test for the statistical significance of CAAR.

EMPIRICAL RESULTS AND ANALYSIS

The following TABLE 2 provides the values of AAR t and CAAR t of all sample companies during the event window.

From TABLE 2 and figure 2 we can clearly see that the value of AAR and CAAR experience a similar change trend during a short period around the BID plan announcement date. But the value of CAAR changes more significantly than the value of AAR, namely the fluctuation of AAR is in a smaller range. From figure 2, we can directly conclude that before the event day both AAR and CAAR experience a downward trend. When the date t=-1, the value of AAR and CAAR rise distinctly, and during a short period after the issuance of BID plan their value keeps a growth trend on the whole. In conclusion, from the TABLE 2 and figure 2, we can obviously conclude that during the ten trading days before and after event occurrence point, the whole bio-industry listed companies' value and shareholders' wealth showed a "V" change trend. That means the investors have no confidence to the forthcoming BID plan, so the companies' value and shareholders' wealth declined before the release day. However, when the BID plan is issued, the investors found benefits from the new plan and they are willing to invest the bio-industry. Thus the companies' value and shareholders' wealth increase sharply. The change trend is consistent with our hypothesis.

To examine the hypothesis further, this paper conducts a t-test to verify whether the CAAR is statistically different from zero. We chose different event windows to ensure the accuracy and reliability of conclusion. TABLE 3 presents the conclusion.

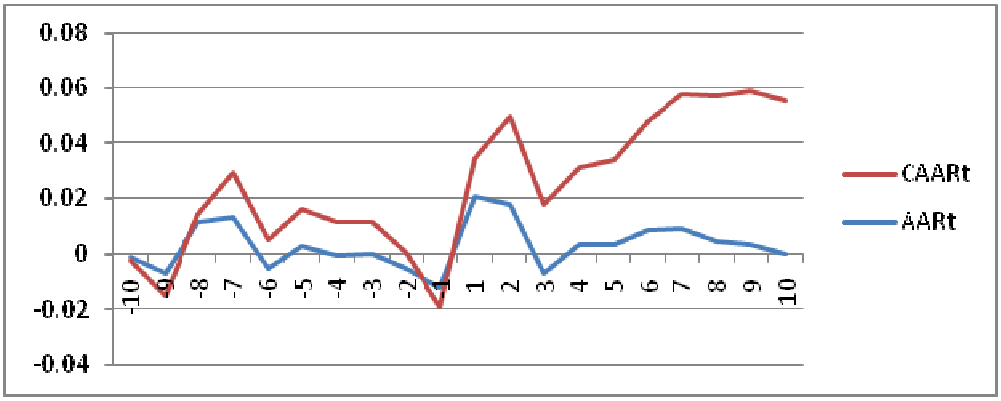


Figure 2: Attachment abnormal returns for sample firm

TABLE 2 : AAR t and CAAR t during the event window

Date	AAR t	CAAR t
-10	-0.00129	-0.00129
-9	-0.00711	-0.00839
-8	0.011394	0.002999
-7	0.013073	0.016072
-6	-0.00545	0.010627
-5	0.00267	0.013296
-4	-0.00112	0.012179
-3	-0.00059	0.011589
-2	-0.00565	0.005944
-1	-0.0126	-0.00665
1	0.020577	0.013924
2	0.017742	0.031666
3	-0.00714	0.024527
4	0.003038	0.027565
5	0.00323	0.030795
6	0.00829	0.039084
7	0.009084	0.048169
8	0.004389	0.052557
9	0.002981	0.055538
10	-0.0003	0.055237

TABLE 3: T-Test Conclusion of Sample

	t	Df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
					Lower	Upper
CAAR (-10,10)	4.817***	19	0.000***	0.2177	0.0123	0.0312
CAAR (-10,6)	4.032***	15	0.001***	0.1400	0.0066	0.0214
CAAR (-8,4)	4.446***	11	0.001***	0.0136	0.0069	0.0204
CAAR（-7,9)	5.533***	15	0.000***	0.0266	0.0164	0.0369
CAAR（-5,5)	4.290***	9	0.002***	0.0165	0.0078	0.0252
CAAR（-3,3)	2.439*	5	0.059*	0.0135	-0.0007	0.0277

Note: * significant at 10% level; ** significant at 5% level; * significant at 1% level.(Two-tailed test).**

TABLE 3 present that all of the t-test results are significant, namely our hypothesis above is acceptable. From TABLE 3 we can see that the mean values of CAAR (-10, 10), (-7,9) gets 0.000 and have a marked under the level of 1%, the mean values of CAAR (-10,6), (-8,4), (-5,5) all have a marked difference from 0 at the level of 1%. However, in the short event window (-3, 3), the significance of the CAAR value decreased. Perhaps, the reason is that the stock markets in developing country are not efficient enough, and it is possible that the market reaction starts long before or after the actual release of the BID plan. In conclusion, TABLE 3 present that all of the t-test results are significant, namely our hypothesis above is acceptable. That illustrated it is a piece of good news for stock market, the issuance of BID plan has an active influence on the stock market. It increases both the companies' value and shareholders' wealth. From the other perspective, it means the BID plan is accepted by the investors. The BID plan can be a effective guideline to the sustained, rapid and healthy development of China's biological industry to some extent.

CONCLUSIONS

This paper investigated how stock market reacts to the issuance of the BID plan by using a standard event study methodology. In this paper, we examine 123 cases of Chinese bio-industry listed companies under the influence of the BID plan.

Using an event study approach, we come to two conclusions: first and foremost, the announcement of the BID plan has got a significant positive impact on these bio-industry listed companies' stock price, namely the issuance of the BID plan has exert certain positive influence on the behaviors of investors in this market. Second, the BID plan as a guideline to lead the development of China's biological industry, and it's issuance increase both the companies' value and shareholders' wealth, which means it is accepted by the investors, they give a high judgment to the BID plan. Thus to some extent, it indicates the effectiveness of the plan. As for Chinese governments, they should carry out more detail measures to guide the whole bio-industry keep a sustained, rapid and healthy development.

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