Empirical research on the bio-pharmaceutical listed companies' profitability

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ABSTRACT

Based on the domestic and international studies about the profitability, this paper firstly introduces the general situation of the bio-pharmaceutical industry. Then the concept of profitability is defined. 78 bio-pharmaceutical listed companies from Shanghai stock exchange and Shenzhen stock exchange are chosen as research subjects. The comprehensive evaluation of the bio-pharmaceutical companies' profitability from 2010 to 2012 is calculated by using factor analysis. Then this paper use regression analysis methods to study the factors that may affect the company's profitability. Finally, combined with the analysis above, some suggestions are presented to improve the profitability of the bio-pharmaceutical listed companies in China.

Keywords: bio-pharmaceutical; profitability; factor analysis; regression analysis
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INTRODUCTION

The profitability plays an important role in the enterprise performance evaluation and financial analysis, getting widespread concern of the stakeholders in all aspects. It reflects not only sale level, the ability to get cash-flow and reduce cost, but also the company's operating benefit and ability to evade risk. [1] Therefore, the profitability evaluation is essential for the company. [2] As a new industry, the bio-pharmaceutical industry is recognized as one of the 21st century's most promising industries. Compared with developed countries, the bio-pharmaceutical industry in China started later, but is developing rapidly. The technology gap between the developed country and developing country has been gradually narrowing as the Human Genome Project, stem cells research, insulin research and other researches have reached the leading level. In order to promote the healthy and sustainable development of bio-pharmaceutical industry, the profitability of the bio-pharmaceutical listed companies from Shanghai stock exchange and Shenzhen stock exchange in China is studied.

EXPERIMENTAL SECTION

1.Definition of profitability
Profitability is the ability of the company to obtain profits. It reflects the company's marketing ability, the ability to reduce costs, the ability to avoid risks, andthe enterprise management state. The profitability depends not only on the company's production and operation, but also on the share of economic resources, capital invested, and the value of the product [3].

2. Analysis of the profitability of the bio-pharmaceutical listed companies
2.1 Sample selection and data sources
This paper selected bio-pharmaceutical companies from Shanghai stock exchange and Shenzhen stock exchange, calculate indicators and evaluate the profitability of 78 listed companies from 2010 to 2012.

2.2 Index selection
To calculate the profitability of the bio-pharmaceutical companies, this paper selected 7 financial indicators: operating profit ratio(X_1), sales margins(X_2), return on total assets ratio(X_3), REO(X_4), ratio of profits to cost(X_5), EPS(X_6), per

share cash flow from operations(X_7).

To analysis the factors that may affect the company's profitability, this paper chose 10 financial indicators:assets turnover ratio(Y_1), debt asset ratio(Y_2), ownership concentration(Y_3), intangible assets ratio(Y_4), increase rate of main business revenue(Y_5), total assets growth rate(Y_6), total asset size(Y_7), current ratio(Y_8), proportion of circulating shares(Y_9), capital appreciation rate(Y_{10}).

Table 1 Description of Index

Index name	Symbol	Formula
operating profit ratio	X_1	X_1=operating profit/total revenue
sales margins	X_2	X_2=net profit/proceeds of sale
return on total assets ratio	X_3	X_3=(total profit+ interest expense)/average total assets
REO	X_4	X_4=net profit/total equity
ratio of profits to cost	X_5	X_5=total profit/total cost
EPS	X_6	X_6=net profit/equity
per share cash flow from operations	X_7	X_7=net cash flow from operations/ordinary shares
asset turnover ratio	Y_1	Y_1=sales income/total assets
debt asset ratio	Y_2	Y_2=total debt/total assets
ownership concentration	Y_3	Y_3=the largest shareholder's stake/total shares
intangible assets ratio	Y_4	Y_4=intangible assets/total assets
increase rate of main business revenue	Y_5	Y_5=operating revenue increase in current/operating revenue at first
total assets growth rate	Y_6	Y_6=assets increase in current/total assets at first
total asset size	Y_7	Y_7=LN(total assets)
current ratio	Y_8	Y_8=current assets/current liabilities
proportion of circulating shares	Y_9	Y_9=circulating shares/total equity
capital appreciation rate	Y_{10}	Y_{10}=owner's equities in current/owner's equities at first

RESULTS AND DISCUSSION

1 Factor analysis
1.1 Correlation matrix
Use SPSS19.0 to calculatethe comprehensive profitability of bio-pharmaceutical listed companies (F). Firstly determine the correlation between the original data, the correlation matrix shows that most correlation coefficients are more than 0.3. Each variable has a strong correlation, it is necessary for factor analysis.

Table 2Correlation Matrix

	X_1	X_2	X_3	X_4	X_5	X_6	X_7
X_1	1.000	0.975	0.493	0.336	0.971	0.536	0.087
X_2	0.975	1.000	0.485	0.332	0.971	0.519	0.064
X_3	0.493	0.485	1.000	0.905	0.511	0.593	0.392
X_4	0.336	0.332	0.905	1.000	0.343	0.529	0.342
X_5	0.971	0.971	0.511	0.343	1.000	0.556	0.115
X_6	0.536	0.519	0.593	0.529	0.556	1.000	0.529
X_7	0.087	0.064	0.392	0.342	0.115	0.529	1.000

1.2 KMO and Bartlett's test
In the KMO and Bartlett's test, the KMO is 0.779, which illustrate the correlation between indicators. Bartlett's test value is 2148.652(Sig. =0.000), it get through the significant inspection.

Table 3KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		0.779
	Approx. Chi-Square	2148.652
	df	21
Bartlett's Test of Sphericity	Sig.	0.000

1.3 Total variance explained
From the factor analysis, two factors explained 82.174% of the variance among the 7 variables. The first characteristic factor is 3.218, the variance of contribution value is 45.967%. The second characteristic factor is 2.534, the variance of contribution value is 36.207%. The contribution of public factor showed that the two factors reflect original indexes.

Table 4 Total Variance Explained

	Initial Eigenvalues			Extraction Sums of SquaredLoadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.166	59.517	59.517						
2	1.586	22.657	82.174						
3	0.796	11.376	93.550	4.166	59.517	59.517	3.218	45.967	45.967
4	0.323	4.616	98.166	1.586	22.657	82.174	2.534	36.207	82.174
5	0.076	1.093	99.259						
6	0.028	0.396	99.655						
7	0.024	0.345	100.000						

Extraction Method: Principal Component Analysis.

1.4 Component matrix

Use orthogonal solution to get the two common factors: commodity management ability(F_1), operating ability(F_2).

$F_1=0.339X_1+0.344X_2-0.011X_3-0.075X_4+0.332X_5+0.038X_6-0.180X_7$

$F_2=-0.097X_1-0.106X_2+0.331X_3+0.368X_4-0.083X_5+0.257X_6+0.385X_7$

Table 5Component Score Coefficient Matrix

	Component	
	1	2
X_1	0.339	-0.097
X_2	0.344	-0.106
X_3	-0.011	0.331
X_4	-0.075	0.368
X_5	0.332	-0.083
X_6	0.038	0.257
X_7	-0.180	0.385

According to the component score coefficient matrix, the comprehensive score model can be established:

$F= (45.967\%F_1+36.207\%F_2)/82.174\%$

2 Regression analysis

2.1 Correlation matrix

Use Eviews6.0 to analysis the factors that may affect the profitability of the bio-pharmaceutical companies. According to the correlation matrix, the correlation coefficient between Y_6 and Y_{10} is 0.943, while most correlation coefficients are less than 0.4. Special treatment is needed in the regression analysis.

Table 6 Correlation Matrix

	Y_1	Y_2	Y_3	Y_4	Y_5	Y_6	Y_7	Y_8	Y_9	Y_{10}
Y_1	1.000	0.373	0.026	0.045	-0.093	-0.122	0.285	-0.300	0.380	-0.130
Y_2	0.373	1.000	-0.254	0.252	-0.067	-0.161	0.294	-0.406	0.468	-0.208
Y_3	0.026	-0.254	1.000	-0.110	0.029	0.135	0.218	0.227	-0.360	0.108
Y_4	0.045	0.252	-0.110	1.000	0.107	-0.127	-0.104	-0.242	0.203	-0.140
Y_5	-0.093	-0.067	0.029	0.107	1.000	0.125	-0.056	-0.008	-0.140	0.103
Y_6	-0.122	-0.161	0.135	-0.127	0.125	1.000	0.012	0.335	-0.328	0.943
Y_7	0.285	0.294	0.218	-0.104	-0.056	0.012	1.000	-0.186	0.150	-0.015
Y_8	-0.300	-0.406	0.227	-0.242	-0.008	0.335	-0.186	1.000	-0.453	0.378
Y_9	0.380	0.468	-0.360	0.203	-0.140	-0.328	0.150	-0.453	1.000	-0.343
Y_{10}	-0.130	-0.208	0.108	-0.140	0.103	0.943	-0.015	0.378	-0.343	1.000

2.2 Index regression result

In the regression analysis, the dependent variable is the comprehensive profitability of bio-pharmaceutical listed companies, the explanatory variables are the indicators that affect the company's profitability. To avoid the multicollinearity between the explanatory variables, the multivariable linear regression model is constructed based on the correlation matrix above.

$P_1=a_0+a_1Y_1+a_2Y_2+a_3Y_3+a_4Y_4+a_5Y_5+a_6Y_7+a_7Y_8+a_8Y_9+a_9Y_{10}$

$P_2=a_0+a_1Y_1+a_2Y_2+a_3Y_3+a_4Y_4+a_5Y_5+a_6Y_6+a_7Y_7+a_8Y_8+a_9Y_9$

Use Eviews6.0 for least squares estimation, the results are shown in table 7and table 8.

Table 7 Index regression result (1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y1	0.005922	0.031763	0.186432	0.8523
Y2	-0.507685	0.069004	-7.357270	0.0000
Y3	-0.128062	0.070878	-1.806799	0.0721
Y4	-0.034171	0.210755	-0.162134	0.8713
Y5	0.007341	0.022273	0.329574	0.7420
Y7	0.085800	0.011060	7.757309	0.0000
Y8	-0.000689	0.001838	-0.374661	0.7083
Y9	-0.002112	0.039939	-0.052871	0.9579
Y10	0.014919	0.010953	1.362065	0.1745
C	-1.441178	0.227650	-6.330678	0.0000
R-squared	0.350962	Mean dependent var		0.221398
Adjusted R-squared	0.324885	S.D. dependent var		0.162583
S.E. of regression	0.133587	Akaike info criterion		-1.146335
Sum squared resid	3.997378	Schwarz criterion		-0.998672
Log likelihood	144.1212	Hannan-Quinn criter.		-1.086797
F-statistic	13.45847	Durbin-Watson stat		1.121215
Prob(F-statistic)	0.000000			

Table 8 Index regression result (2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
Y1	0.006715	0.031632	0.212277	0.8321
Y2	-0.514841	0.068959	-7.465947	0.0000
Y3	-0.131933	0.070499	-1.871412	0.0626
Y4	-0.028490	0.209984	-0.135676	0.8922
Y5	0.005189	0.022248	0.233228	0.8158
Y6	0.030641	0.016203	1.890992	0.0599
Y7	0.085352	0.011021	7.744308	0.0000
Y8	-0.000868	0.001818	-0.477669	0.6334
Y9	0.001510	0.039697	0.038050	0.9697
C	-1.418706	0.226984	-6.250239	0.0000
R-squared	0.355869	Mean dependent var		0.221398
Adjusted R-squared	0.329989	S.D. dependent var		0.162583
S.E. of regression	0.133081	Akaike info criterion		-1.153925
Sum squared resid	3.967156	Schwarz criterion		-1.006261
Log likelihood	145.0092	Hannan-Quinn criter.		-1.094387
F-statistic	13.75061	Durbin-Watson stat		1.097318
Prob(F-statistic)	0.000000			

It is shown in table 7 and table 8 that R-squared is 0.35, adjusted R-squared is 0.32. The F- statistic is about 13, Prob(F-statistic) is 0.0000. Although the goodness of fitting of the regression equation is low, the F-test is passed, indicating that the model is acceptable.

CONCLUSION

1. conclusions
(1)From the regression results of the two models, the regression coefficients of debt asset ratio(Y_2) and ownership concentration(Y_3) are negative, indicating that a higher debt asset ratio will inhibit the company's profitability, the ownership concentration has a negative impact on the profitability of the bio-pharmaceutical companies.[4]

(2)The regression coefficient of total asset size(Y_7) is positive, the T-test is passed, indicating that the total asset size and the profitability are positively correlated.

(3)According to the regression results in table 7, the total assets growth rate(Y_6) gets through the T-test, the regression coefficient is positive, which means that the higher the total assets growth rate, the higher the company's profitability. In table 8, the regression coefficient of capital appreciation rate(Y_{10}) is positive, suggesting that the capital appreciation rate and the profitability are positively correlated.[5]

(4)In the two models, the asset turnoverratio(Y_1), intangible assets ratio(Y_4), increase rate of main business revenue(Y_5), current ratio(Y_8) and proportion of circulating shares(Y_9) are not pass the T-test. These indicators have little impact on the profitability of the bio-pharmaceutical companies.

2. suggestions
(1)Optimize the capital structure of bio-pharmaceutical listed companies

When making decisions about capital structure, bio-pharmaceutical listed companies should pay attention to its impact on the company's profitability. [6]In order to achieve optimal capital structure,the operating profit and financial risk brought by the financial leverage should be taken into account. For the bio-pharmaceutical listed companies with high debt asset ratio, the company should preclude taking debt, so that the financial risk is in a reasonable range. For the companies with low debt asset ratio, when the return on assets ratio is higher than bank lending rates, they can expand the scale of debt to maximize the tax deductibility.

(2)Expansion the asset of bio-pharmaceutical listed companies
The development of the bio-pharmaceutical industry requires sufficient assets and capital to conduct long-term research and innovation.[7]As for the company's strategy, large companies with good brand have better marketing capabilities to occupy a larger market share. From the perspective of technological innovation, large companies have the ability to gather more technical and R&D professionals to conduct technological innovation. [8]Therefore, Merger and holding shares are encouraged to expand the asset and the scale of production.

(3)Improve product competitiveness of bio-pharmaceutical listed companies
To improve the profitability, bio-pharmaceutical listed companies should focus on the changing market demands, analysis their own strengths and weaknesses, and promote the development of new products.[9]Meanwhile, bio-pharmaceutical companies should enhance their management level, strengthen the management level, increase sales income and make effort to control production costs and related expenses.

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