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## Analysis of the income before tax influencing factors of state-owned and state holding industrial enterprises based on the ordinary least squares regression method

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### ABSTRACT

Profit is really important to the survival and development of enterprises so that the research on the influencing factors is of great significance. The paper takes the sales from main business, the cost of main business, the tax and surcharge of main business as Explanatory Variables, and take the income before tax (IBT) as explained Variable. Based on the calculation path of IBT, we establishes the nonlinear model between main sales and IBT after series regression analysis by EViews and OLS on the data samples of IBT and its relevant aspects during 1998 to 2011. Using Empirical Analysis Methods, we can infer that IBT and sales form main business have positive relation which is coherent to practice, however, the square of IBT and Tax of main business have reversed changing which is against economy theory. At last, with above points, the paper makes proposals to increasing the IBT.

### KEYWORDS

Financial index; Ibt; Regression analysis; State-owned industrial enterprise; Income.



## INTRODUCTION

Since China joined WTO, its market economy has been developing with high speed, and the industrial enterprises get dramatical promotion as well, meanwhile, IBT gets more attention because of its importance to the enterprises.

The research about profit management is since 1960s, more than 20 years earlier than that of China. The famous results are as following: Ball and Brown issued the paper to confirm the importance of accounting profit for the first time, that is the change between accounting income and stock price was positive<sup>[1]</sup>, and in the same year, Beaver illustrated that accounting income means realtime and more information, and drew the conclusion that the share price is related with Accounting Income<sup>[2]</sup>.

In 1982, Baumol, Panzar&Willig pointed out in the theory of passengers competitions that monopoly enterprise can't make excessive profit if there are no barriers<sup>[3]</sup>. In 1993, Lev and Thiaganajan reached the conclusion that there's positive relation between profit quality and durability, and then many people studied it.<sup>[4]</sup> Green researched the prudent accounting policy, reward of share and profit quality combining with practice and data in 1999<sup>[5]</sup>.

In 2000, Graham and Knight made empirical analysis and reached the conclusion that cash flow can influence the profit quality to some extent based on the empirical analysis. In 2001, Richardson extended the studies of Soloan in 1996, and found the mathematic relation among relevant aspect of profit quality; meanwhile, they released some advantaged proposals. Sturda and Typpo analyzed the relationship between profit and cash flow form business in 2004. In the following year, Richardson did the further study to enterprise profit quality.

At the beginning of 1990s, Chinese researchers entered the fields. Wu Shangmin mentioned the target profit management in public communication industry. With many researcher's work, our research is gradually mature. The paper introduces some work in enterprise profit and pick out some points as below:

In 2001, the research group of Naning SAFE branch studied the profit and dividend of foreign enterprises located in Guangxi province and point out that foreign investors had changed their investment plan, scale and structure, so new characters appeared on the measure methods to their income and dividends. The next year, Zhu Tao and Song Weilin compared the rational and actual actions, and analyzed the factors which influence the balance of foreign exchange payment and large scale income remittance, and also gave some matching devices based on total supervising and stock resolving.

In 2003, Zhang Xin'an, Tian Peng and Zhu Guofeng pointed out that researchers have been realizing the relationship between profit and customer satisfaction, which pushed the studying in customer satisfaction. In their research, the intermediate variable included reputation, repeat consumption intention and recommendation intention. From the causal study, they found that customer satisfaction doesn't mean customer loyalty, so enterprises should improve the customer loyalty from several points during market share strategy making.

In 2004, Zhou Xiaosu' study found that different motivation in profit management caused different methods of accounting, moreover, regularity lies in abnormal accounting change. With focusing on the financial report of small meager profit units, the paper tried to find index related to profit after analyzing the relationship among financial index, and analyzed the ratio and methods of profit management in samples.

In 2005, Yang Xiongsheng indicated in his paper that current accounting policies only reflect short term report and the demand of strategy management wasn't satisfied, so the accounting income measurement would be extended in target and room according to the theory of enterprises value increasing. It also says five factors, rate on return of sales, expected increasing rate of profit, asset turnover, strategic control index and EPS, would be mixed to the calculation of strategy transfer profit. Lastly, the author gave proposals on how to increase the enterprise value through refer to the

authoritative research. In the following year, the paper distributed by Wang Guoqing, Cai Shuqin and Tang Yunfei reviewed the research about accounting quality asymmetric information firstly, and then established the profit model among asymmetric information rate, products quality and products price, which firstly discussed the index of asymmetric information rate. Lastly, the paper says enterprises can reach the target of maximum profit by changing the index via information public. In 2007, Ji Ting discussed the importance, theory and advices of profit management.

In 2008, Wang Xiaohong studied the accounting method of income and mentioned some advice on profit management improvement in Foreign Investment enterprise. In 2009, Wang Chuanmei, Tong Hengqing and Lu Yaobin presented that the customer satisfaction's function would be extended so that the model between profit and customer satisfaction could be built. Based on above, the management could get more support from it. In 2010, Li Bozhou and Su Yi analyzed the relationship between profit and invention in large enterprises, and found the positive relationship and format the mathematic relation in them by Granger Test. The paper also explained in economy and pointed out the factors which lead to under-investment of basic research in our large companies<sup>[6]</sup>.

In 2011, Wang Xiaoyan introduced the situation of excessive profit in Monopoly industrial. Based on this, she made an empirical analysis about the influencing factors in state monopoly enterprises, and then she made some proposals on how to rationalize the profit in these companies according to the regression analysis result<sup>[7]</sup>. In 2012, Qi Yanli and Zhang Yangyang, with taking the listed pharmaceutical companies as examples, came to a conclusion as below after regression analysis: the invention can impact the profit, but it's lagged<sup>[8]</sup>.

Above all, many researchers studied the enterprise profit from both theory and practice. Many pieces of advices and basis are distributed. Most part of former study is focused on monopoly enterprises, but the conclusion can't be launched in different units because of different characters. This paper focuses on the state enterprises and tries to find the influencing level of factors to IBT.

Far as the current situation is concerned, according to relevant theory of accounting, the paper tries to find the key factors to profit, and get the nonlinear relationship among IBT, main sales and main tax with the regressive analysis to most relevant index sample.

### **The selection of sample and variable**

The paper takes the data of 1998-2011 issued by Chinese statistic yearbook. (Data is shown in TABLE 1)

Due to our topic, the influencing factors of IBT, according to the formula, IBT equals to operating profit plus nonoperating income minus nonoperating expenses, the factors includes operating sales, operating cost, operating tax ans surcharge, operating expense, General and administrative expenses, financial expense, loss on impairment of assets, net earning on the changes of fair value, earning of investment. We select sales from main business, cost of main business and tax and surcharge of maim business as variables. Next, we would like to explain the three variables.

(1) Sales from main business (X1). It means the income from regular and basis business, such as the sales of products, non-finished products and producing service in manufacturing; sales of retailing; sales of tickets, customer service and catering service in service industry. Since the most part of profit would be from main business, we select it as the first index.

(2) Cost of main business (X2). It means the direct cost and expenses of maim products and service, including material, labor cost, accumulated depreciation, etc. For most enterprises, cost of main business is the first deduction of profit, so we would pay more attention to the impact. Hereunder, it's the second index.

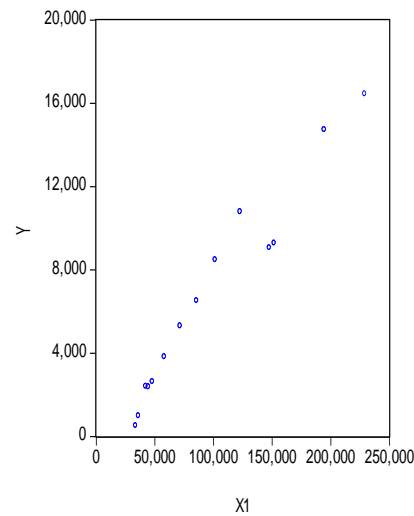
(3) Tax and surcharge of main business (X3). It includes business tax, consumption tax, resource tax, and surcharge on education fund, etc. It's selected as third index.

### **Model establishment**

First observe the relationship between the explained variables and explanatory variables in the model, respectively, set up a scatter diagram between IBT (Y) and the sales from main business(X1), the cost of main business(X2), the tax and surcharge of main business (X3)(as is shown in Figure 1, Figure 2, Figure 3).

**TABLE 1 : Main indexes of state-owned and state holding industrial enterprises; Unit : Ten thousand yuan**

Year	X1	X2	X3	IBT (Y)
1998	33566.11	27092.45	993.53	525.14
1999	35951	28919	1062	998
2000	42203.12	33473.62	1150.28	2408.3323
2001	44443.52	35522.47	1250.18	2388.56
2002	47844.21	38048	1401.82	2632.94
2003	58027	45988	1590	3836
2004	71451.93	57131	1888.51	5311.88
2005	85574.18	69302.41	2121.74	6519.75
2006	101404.62	81957.8	2612.74	8485.46
2007	122617.13	98515.08	3242.18	10795.19
2008	147507.9	122504.18	3882.05	9063.59
2009	151700.55	124590.48	6199.11	9287.03
2010	194339.68	158727.43	8016.31	14737.65
2011	228900.13	187783.79	9053.12	16457.57



**Figure 1 : Scatter diagram between IBT (Y) and the sales from main business(X1)**

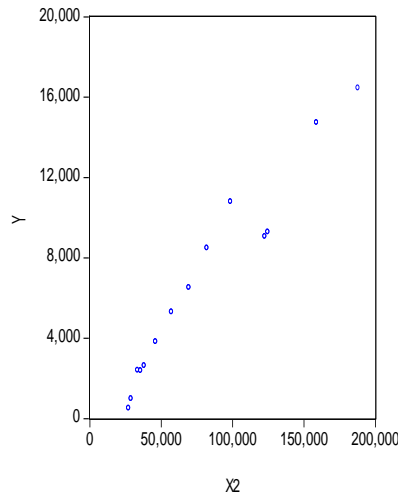


Figure 2 : Scatter diagram between IBT (Y) and the sales from main business(X2)

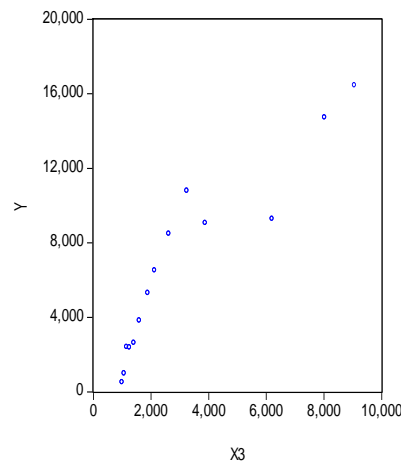


Figure 3 : Scatter diagram between IBT (Y) and the sales from main business(X3)

It can be seen through the scatter diagram that the explanatory variables and explained variables are similar to the linear relationship, so first it establish a multiple linear regression model. EViews output as is shown in Figure 4.

Dependent Variable: Y				
Method: Least Squares				
Date: 04/17/13 Time: 14:46				
Sample: 1998 2011				
Included observations: 14				
	Coefficient	Std. Error	t-Statistic	Prob.
C	-3121.022	257.0681	-12.14084	0.0000
X1	1.100189	0.094462	11.64693	0.0000
X2	-1.202995	0.113895	-10.56228	0.0000
X3	-0.683952	0.136716	-5.002717	0.0005
R-squared	0.996676	Mean dependent var	6674.797	
Adjusted R-squared	0.995678	S.D. dependent var	5010.717	
S.E. of regression	329.4038	Akaike info criterion	14.66740	
Sum squared resid	1085068.	Schwarz criterion	14.84999	
Log likelihood	-98.67181	Hannan-Quinn criter.	14.65050	
F-statistic	999.3523	Durbin-Watson stat	2.109984	
Prob(F-statistic)	0.000000			

Figure 4 : Output of the model

So the estimation results of the relationship between IBT and the sales from main business, the cost of main business, the tax and surcharge of main business was shown in Figure 4, then the model between them are obtained:

$$Y = -3121.02180782 + 1.10018901269 * X1 - 1.20299497781 * X2 - 0.683952042474 * X3 \quad (1)$$

$$(-12.14) \quad (11.65) \quad (-10.56) \quad (-5.00) \quad R^2 = 0.99 \quad \text{s.e.} = 329 \quad F = 999$$

The numbers in brackets are the corresponding value of t statistic. s.e. is standard error of regression function. R<sup>2</sup> is determination coefficient. R<sup>2</sup> = 0.99, it states the fitting degree is good, 99% of y is explained by variable X. Prob. < 0.05, F statistic is 999, that is to say the equation is quite significant. Because the value of t statistic >  $t_{0.05/2} (10) = 2.23$ , so the null hypothesis is rejected, it means there is a linear regression relationship between IBT and the sales from main business, the cost of main business, the tax and surcharge of main business, and variables passed the 5% level of significance test.

Because obvious collinearity between explained variable and explanatory variables exist in the real economic significance, and through the preliminary observation we find that fitting degree of the model is good, the value of F statistic is high, and each variance of regression parameter estimates is big, so explaining variables multicollinearity may exist. Through Klein criterion of evIEWS6.0, by click on the array document window View/Covariance Analysis, partial correlation coefficient matrix of variables can be generated. As shown in TABLE 2.

It can be found by the correlation coefficient matrix that the correlation coefficient of X1 and X2 is 0.999, and it is higher than the goodness of fit 0.996, so multicollinearity exists between X1 and X2.

To overcome multicollinearity there are some methods : (1) Consolidated explanatory variables directly; (2) Use of known information consolidated explanatory variables; (3) Increase the sample size or extract sample again; (5) Transform model form; (6) Centralize the data; (7) Stepwise regression.

In this paper, we use stepwise regression method to eliminate multicollinearity. First, do each explanatory variable a simple regression, Figure 5, 6, 7 show the results of regression analysis.

**TABLE 2 : The correlation between variables**

	Y	X3	X2	X1
Y	1.000000	0.923616	0.972776	0.975829
X3	0.923616	1.000000	0.968173	0.968399
X2	0.972776	0.968173	1.000000	0.999881
X1	0.975829	0.968399	0.999881	1.000000

Dependent Variable: Y				
Method: Least Squares				
Date: 06/08/13 Time: 14:25				
Sample: 1998 2011				
Included observations: 14				
	Coefficient	Std. Error	t-Statistic	Prob.
C	-915.6720	577.5665	-1.585397	0.1389
X1	0.077821	0.005031	15.46828	0.0000
R-squared	0.952242	Mean dependent var	6674.797	
Adjusted R-squared	0.948262	S.D. dependent var	5010.717	
S.E. of regression	1139.733	Akaike info criterion	17.04654	
Sum squared resid	15587898	Schwarz criterion	17.13783	
Log likelihood	-117.3258	Hannan-Quinn criter.	17.03809	
F-statistic	239.2678	Durbin-Watson stat	1.364506	
Prob(F-statistic)	0.000000			

Figure 5 : The linear relationship between Y and X1

Dependent Variable: Y				
Method: Least Squares				
Date: 06/08/13 Time: 14:26				
Sample: 1998 2011				
Included observations: 14				
	Coefficient	Std. Error	t-Statistic	Prob.
C	-764.4967	605.0591	-1.263508	0.2304
X2	0.093867	0.006455	14.54074	0.0000
R-squared	0.946293	Mean dependent var	6674.797	
Adjusted R-squared	0.941817	S.D. dependent var	5010.717	
S.E. of regression	1208.643	Akaike info criterion	17.16395	
Sum squared resid	17529807	Schwarz criterion	17.25524	
Log likelihood	-118.1476	Hannan-Quinn criter.	17.15550	
F-statistic	211.4330	Durbin-Watson stat	1.403635	
Prob(F-statistic)	0.000000			

Figure 6 : The linear relationship between Y and X2

Dependent variable: Y				
Method: Least Squares				
Date: 06/08/13 Time: 14:26				
Sample: 1998 2011				
Included observations: 14				
	Coefficient	Std. Error	t-Statistic	Prob.
C	1191.321	846.7877	1.406871	0.1848
X3	1.726549	0.206850	8.346856	0.0000
R-squared	0.853067	Mean dependent var	6674.797	
Adjusted R-squared	0.840823	S.D. dependent var	5010.717	
S.E. of regression	1999.127	Akaike info criterion	18.17037	
Sum squared resid	47958085	Schwarz criterion	18.26167	
Log likelihood	-125.1926	Hannan-Quinn criter.	18.16192	
F-statistic	69.67000	Durbin-Watson stat	0.719390	
Prob(F-statistic)	0.000002			

Figure 7 : The linear relationship between Y and X3

Dependent Variable: Y^2				
Method: Least Squares				
Date: 06/08/13 Time: 20:07				
Sample: 1998 2011				
Included observations: 14				
	Coefficient	Std. Error	t-Statistic	Prob.
C	-12287438	14623357	-0.840261	0.4204
X1	1736.123	417.1571	4.161796	0.0019
X3	-51087.75	19566.02	-2.611045	0.0260
X3^2	4.360147	1.245864	3.499697	0.0057
R-squared	0.966199	Mean dependent var	67866820	
Adjusted R-squared	0.956059	S.D. dependent var	84097157	
S.E. of regression	17628620	Akaike info criterion	36.44290	
Sum squared resid	3.11E+15	Schwarz criterion	36.62549	
Log likelihood	-251.1003	Hannan-Quinn criter.	36.42600	
F-statistic	95.28283	Durbin-Watson stat	2.433515	
Prob(F-statistic)	0.000000			

Figure 8 : The output of the model

Next, on the basis of the regression equation that has the largest affirmative coefficient, it introduces the rest of the explanatory variables in the order of importance of them, and get the following regression results shown as Figure 8 finally.

The last, by eliminating the X2 that influence its significance, the estimation result of the relationship between IBT and the sales from main business, the tax and surcharge of main business was shown in Figure 8, and then the models between them are obtained.

$$Y^2 = -12287438.1234 + 1736.12270137 * X1 - 51087.751991 * X3 + 4.36014669765 * X3^2 \tag{2}$$

$$(-0.84) \quad (4.16) \quad (-2.61) \quad (3.50) \quad R^2 = 0.97 \quad F = 95.28$$

R<sup>2</sup> = 0.97, it states the fitting degree is good, 97% of y is explained by variable X. Prob. < 0.05, F statistic is 95.28, that is to say the equation is quite significant. Because the value of t statistic >  $t_{0.05/2} (10) = 2.23$ , so the null hypothesis is rejected. It means there is a nonlinear regression relationship between IBT and the sales from main business, the tax and surcharge of main business, and variables passed the 5% level of significance test.

Utilizing software Eviews 6.0 we can obtain the true value, fitted value and residual figure of IBT and the sales from main business, the tax and surcharge of main business. As shown in Figure 9.

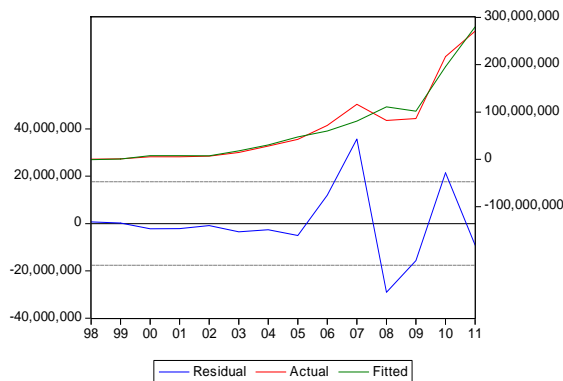


Figure 9 : Figure of true value, fitting value and residual of each variable

Model test



### 1. Heteroscedasticity test

There are many kinds of heteroscedasticity test methods. This article uses the White test. The characteristic of this method is neither need to sort the observation nor need random error term conform to normal distribution. White test has four steps: First, make the formulas of the ordinary least squares regression to strive for the residuals; next make each explanatory variables squared and cross-product term of ordinary least squares regression to construct the auxiliary regression type; the third, construct assumptions that the original hypothesis is that there is no heteroscedasticity residual and the alternative hypothesis is that the residual heteroscedasticity exists; the fourth, construct  $TR2 \sim \chi^2(k)$  statistics under the condition of the same variance, T means total sample, k means the number of explanatory variables in the auxiliary regression type, R2 means determination coefficient in the auxiliary regression type ; finally, it indicates residual item has no heteroscedasticity if  $TR2 \leq \chi^2_{\alpha}(k)$ , on the other hand it has heteroscedasticity.

We can see Prob. < 0.05 and pass t-test. The overall regression equation is significant nonlinear relationship. Utilizing the residual in figure 2 to do the White test, we can find: T=14 R2 =0.91  $TR2=12.80 \leq \chi^2_{0.05}(9)=16.919$ , it shows that there is no residual item heteroscedasticity. It also can be seen from the view of probability, because  $P>0.05$ , so there is no heteroscedasticity in model. As is shown in Figure 10:

Heteroskedasticity Test: White			
F-statistic	6.643453	Prob. F(8,5)	0.0259
Obs*R-squared	12.79617	Prob. Chi-Square(8)	0.1191
Scaled explained SS	9.247912	Prob. Chi-Square(8)	0.3218

Figure 10 : White test

### 2. Autocorrelation test

Autocorrelation test also has a lot of methods. It selects the LM test method to do the autocorrelation. Because of LM test has better applicability that it can test the first-order autocorrelation and higher order autocorrelation. LM test is accomplished by constructing an auxiliary regression type, and the steps are the same with heteroscedasticity test. That is,  $LM=TR2 \leq \chi^2_{\alpha}(n)$ , n is the autoregressive order number, indicates residual item has no heteroscedasticity, on the other hand it has heteroscedasticity.

From T=14 R2 =0.23  $TR2=3.22 \leq \chi^2_{0.05}(1)=3.841$ , we can see there is no autocorrelation in the model. It can also draw the conclusion from the view of the probability, T=14 and three explanatory variables at significance level  $\alpha=0.05$ ,  $P>0.05$ , so model does not exist autocorrelation. In addition, R2=0.99 means fitting degree is good, as is shown in Figure 11.

Breusch-Godfrey Serial Correlation LM Test			
F-statistic	2.707527	Prob. F(1,9)	0.1343
Obs*R-squared	3.237693	Prob. Chi-Square(1)	0.0720

Figure 11 : Lm test

## RESULT AND DISSCUSS

The regression results of model show that there is nonlinear relationship between IBT and the sales from main business, the tax and surcharge of main business at significance level of  $\alpha=0.05$ .

In particular, square of the IBT changes with the sales from main business in the same direction, and the tax and surcharge of main business in the opposite direction. This result is consistent with the practical economic meaning.

From the practical economic meaning of the model, the sales from main business increase one unit, the square of IBT increases 173.6 million Yuan, and the tax and surcharge of main business increase one unit, the square of IBT decreases 65.1 million Yuan, and the square of the tax and surcharge of main business increase one unit, the square of IBT increase 43.6 thousand Yuan.

In addition, the cost of main business has a great influence on IBT in empirical analysis, but because the cost of main business change with the sales from main business in time, so the two introduced models will bring multicollinearity, and by econometric analysis we omit the cost of main business to eliminate collinearity of the model. From the estimated results of the model, there is curvilinear relationship between the square of IBT and the square of the tax and surcharge of main business, the coefficient between them reflects the positive change relationship of each other. It is not accord with practical significance that the two should change in the opposite direction. The cause of the results and the actual deviating may be due to the imperfect of the market economy of our country and relevant tax law is not perfect, also may be loopholes exist in the enterprise management, etc.

Profit is the comprehensive reflection of enterprise production and operation results, so it should be brought to the attention of managers. To improve the profits of enterprises, we should do as the following: First, improve the income of enterprises as far as possible. Whether enterprise profit depends largely on the amount of income, to increase income, we should manage each operation segment. In production, to produce high quality and competitive products we should improve the efficiency of production; in sales, to sell the products to customers, we should choose suitable marketing strategy; in human resources, we should cultivate competent personnel and make the interests of the employees agree with the company's; in finance, we should do budget control, and make the most gain for investment, etc. Second, reduce the cost of enterprises. We should control the cost in each operation segment. In production, we should make full use of enterprise's equipment to achieve maximum capacity and do a good job of throttling from the source so that we can save the purchase cost; in sales, we should use combination of reasonable marketing strategy to lower marketing costs as much as possible; in finance, We should minimize the cost by doing cost budget well to obtain greater benefits<sup>[9]</sup>.

## CONCLUSIONS

On the basis of the research home and abroad, the paper analyzed the total profit influenced by the change of prime operating revenue, operating cost and tax and associate charge, established the related nonlinear regression model, and concluded that the model has high credibility. But it still has the following shortcomings: (1) the data between 1998 and 2011 are used only, so the data sample is not big enough to reflect the research content more accurately; (2) the selected indicators have limitations. In order to analyze the influence factors of the total profits concretely, it should increase the explanatory variables to do a more comprehensive analysis from three aspects of assets, liabilities and owners' equity, and add some earnings ratio at the same time, then combining enterprise's characteristics of the scale, nature, industry, etc to do a more accurate and detailed studies; (3) in actual, total profit is influenced by different factors in different industries. This article analyzes the influencing factors of the total profits on the whole, and the model itself has certain defects that may not apply to all specific individual industries.

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