Profit Analysis of Listed Enterprises of Traditional Chinese Medicine — Based on Threshold Regression Model

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Abstract. As the important part of China's pharmaceutical market, the gross profit fluctuation of the Chinese medicine market will adjust the structure of the pharmaceutical market from different degrees. In order to study the effect of return on total assets on gross profit ratio in listed Enterprises of Traditional Chinese Medicine. This paper selects the relevant data of 52 Listed Enterprises of Traditional Chinese Medicine, using the threshold regression model of panel date to estimate the threshold effect of the corresponding variables. The results testify that there is the double threshold benefit for the gross margin of sales in the asset turnover and flow speed of Listed Enterprises of Traditional Chinese Medicine. The profitability of Listed Enterprises of Traditional Chinese Medicine is affected by the flow of assets and the ability of liquidate.

Keywords-Enterprises of Traditional Chinese Medicine, Panel Model, Threshold

1. INTRODUCTION

Global economic integration and international trade liberalization have created a good macro environment for global enterprises [1]. Since the 1990s the acquisition of international pharmaceutical enterprises had deepened the degree of global integration, increased international competition and accelerated technological progress, which lead to the reorganization and restructuring of the transnational pharmaceutical industry. In turn, the process also promoted the global integration, international competition and technological progress. China is undergoing the transition to market economy, the reform of the pharmaceutical industry accelerated and its market competition is more intense. As an important component of the pharmaceutical industry, Listed Enterprises on Traditional Chinese Medicine (TCM) are different from biopharmaceutical enterprises, chemical pharmaceutical enterprises and medical technology enterprises, the characteristics of Listed Enterprises of TCM are small production scale, production efficiency and low technical level [2]. Scholars have analyzed the profitability of enterprises with panel model and threshold mode [3-9], but there are few

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achievements in using Listed Enterprises of TCM as samples to study the profitability factors. This paper uses the relevant data of 52 Listed Enterprises of TCM from 2008 to 2017 in China to discuss the relationship between the investment of assets and the profitability of in Listed Enterprises on TCM by the panel data model and the threshold regression model. We hypothesize: First, the speed ratio of Listed Enterprises on TCM has a double threshold effect on the gross margin of sales, and when the speed ratio is greater than the threshold value, it is conducive to the improvement of profitability. Second, the asset turnover of Listed Enterprises of TCM has a double threshold effect on the gross margin of sales of enterprises, and when the turnover rate of assets is greater than the threshold, it is conducive to the improvement of profitability.

2. MODEL AND DATE

2.1 Date and Variables

All the data in this paper are collected from the Oriental wealth financial data platform. After screening and selecting the relevant data of 52 Listed Enterprises of TCM, we build the balance panel data and establish the threshold regression model. The names and identifications of specific variables are as TABLE I:

TABLE I. VARIABLE DESCRIPTION

Variable Categories	Variables	Variable Definition
Explained Variables	Gross Profit Ratio (GP Ratio)	GP Ratio =(Net Sales-COGS)/Net Sales
Explanatory variables	R&D Ratio	R&D Ratio = R&D Cost/Rev.
	Quick Ratio	Quick Ratio = Quick Assent/ Current Liability
	Total Assets Turnover (ATO)	Asset Turnover Rate =Total Turnover/Total Assents
	Current Ratio	Current Ratio=Current Assets/Current Liability
	Return On Total Assets(ROA)	ROA =(Net Profit + Interest Cost +Income Tax)/ Total Average Assets

2.2 Model

2.2.1 Panel Model

The Panel model, also known as TS/CS (Time Series/Cross Series), is an important development of econometric theory methods in recent years. Unlike a single time series model or a one-dimensional data model, the model is a data set of two-dimensional structures that extend the time series along the spatial direction or extend the section data along the time direction, which can not only reflect the law of individual data in a certain period, but also describe the law of each individual changing with time. It combines the common advantages of time series and section data, so it has the advantage that traditional time series or section data is difficult to replace.

The model data represents the basic formula as in (1):

$$y_{it} = \alpha_{it} + x_{it}\beta_{it} + \mu_{it},\ i = 1,2,3 \ldots, T \tag{1}$$

The y_{it} is the due variable, x_{it} is the k*1 dimension interpretation variable vector, n is the number of interface member, T is the total number of observation periods for each section member. α_{it} represents the constant entry of the model, β_{it} as the coefficient vector corresponding to the regression vector x_{it}. When the degree of Freedom nT is much smaller than the number of parameters$nT(K+1)$escribes the number of parameters of the μ_{it},in order to achieve model estimation, it can be assumed that the parameters meet the time consistency and the simplified model as in (2):

$$y_{it} = \alpha_i + x_{it}\beta_i + \mu_{it}, i = 1,2,3 \ldots, n;\ t = 1,2, \ldots, T \tag{2}$$

2.2.2 Threshold Regression Model

In this paper, Hansen's threshold panel regression model will be introduced to verify whether there is a nonlinear relationship between GP Ratio caused by the change of ATO and Quick Ratio, and the threshold effect and threshold value exist, and whether the parameter estimation of the model is significant enough by checking the threshold value bounded by gate abuse[10]. the basic form of the setting and testing method of single threshold model (The multi-threshold model is similar to the single-threshold model and is an extension in the case of the first threshold is determined) as in (3):

$$Y_i = \begin{cases} \alpha_1 + X * \theta + \lambda_1 * q_{i,t} + \varepsilon_{i,t}(q_{i,t} \le r) \\ \alpha_2 + X * \theta + \lambda_2 * q_{i,t} + \varepsilon_{i,t}(q_{i,t} > r) \end{cases} \tag{3}$$

Y_i is the interpreted variable, X represents the explanatory variable, $q_{i,t}$ represents the threshold variable, θ and λ are the parametric vectors of the parameter vector of the corresponding variable, ε is the residual term, and Hansen (2000) thinks that the sample can be divided into two regions according

3. RESULTS

3.1 Descriptive Statistical Results of Research Variables

TABLE II shows the results of descriptive statistics on the relevant variables of Listed Enterprises of TCM in China. The average GP ratio is 0.524, the median is 0.603, and the standard deviation is 0.183, which indicates that the GP ratio of Listed Enterprises of TCM is in a steady growth statement from 2007 to 2017. 2007-2017 R&D Ratio accounted for an average of 0.066, which means Listed Enterprises on TCM R&D attention is insufficient. The average of the flow ratio and the speed ratio are 3.232 and 2.68 respectively, the median are 1.370 and

0.505 respectively, the standard deviation are 3.94 and 3.631 respectively, which indicate that the solvency of Listed Enterprises of TCM is generally not high, at a low level, and majority enterprises are below the average. The average ATO is 11.325, the median is 9.005, and the standard deviation is 7.23, which indicate that the ATO of enterprises is reasonable, it is lower than the average, but the fluctuation is greater. The ROA mean is 0.71, the median is 0.330, and the standard deviation is 0.42, which indicate that the business quality of the enterprise is poor and major enterprises are below average.

TABLE II. DESCRIPTIVE STATISTICAL RESULTS OF RESEARCH VARIABLES

Variable	Max	Min	Average	Median	Std.
GP Ratio	0.874	0.096	0.524	0.603	0.183
R&D Ratio	0.450	0.010	0.066	0.170	0.064
Current Ratio	49.850	0.300	3.232	1.370	3.940
Quick Ratio	46.180	0.190	2.680	0.505	3.631
ATO	60.460	0.260	11.325	9.005	7.230
ROA	4.110	0.130	0.715	0.330	0.420

3.2 Panel Model Results

The paper has obtained relevant data indicators of 52 Listed Enterprises of TCM. The GP ratio as the interpreted variable, the R&D ratio, flow ratio, speed ratio, ROA and ATO as explanatory variables, each variable is composed of a 52*11 matrix of panel data, into the Panel-Date model for empirical analysis.

3.2.1 Stability Test of Variables

In order to avoid pseudo-regression, it is necessary to test the smoothness of the interpreted variables and explanatory variables in the model. If the variables are smooth, there is no pseudo-regression, and the model can be built directly. The unit root test of the interpreted variable and the explanatory variable is made by using the LLC test, IPS test and Fisher-ADF inspection method, and the results are shown in TABLE III.

TABLE III. UNIT-ROOT TEST RESULTS OF VARIABLES

Variable	LLC		IPS		Fisher-ADF	
	Coef.	P	Coef	P	Coef.	P
GP Ratio	-17.569	0	-2.9567	0.0016	262.2717	0
R&D Ratio	-15.6528	0	-5.654	0	326.7297	0
Current Ratio	-24.3272	0	-3.9857	0	336.9241	0
Quick Ratio	-26.6014	0	-4.0482	0	332.1924	0
ATO	-28.7531	0	-3.3061	0.0005	368.5466	0
ROA	-25.6407	0	-2.5295	0.0057	326.9081	0

At 1% of the significant level, there is no unit root because the original hypothesis is rejected by all three unit root test results of interpreted variables and explanatory variables, indicating that these variables are stable, and that no pseudo-regression occurs when the model is established.

3.3 Threshold model results

3.3.1 Threshold regression effect test

As seen from the TABLE IV in Hypothesis 1, the P-Value of single threshold is 0.005, while the P-values of the threshold of double threshold and triple threshold are 0 and 0.23 respectively, and if 1% is the criterion of identification, we assumes that Hypothesis 1 accepts the double threshold regression model.

In Hypothesis 2, the P-Value of single threshold is 0.035, while the P-values of double threshold and triple threshold are 0 and 0.685 respectively, and if 1% is the identification criterion, we assumes that Hypothesis 2 accepts the double threshold regression model.

TABLE IV. THRESHOLD REGRESSION EFFECT TEST RESULT

Model		F	P-Value	Critical values		
				10%	5%	1%
Single threshold	H1	38.62	0.005	15.4844	18.6302	30.8958
	H2	22.83	0.035	17.182	21.471	23.456
Double threshold	H1	25.46	0	12.6964	15.2539	23.1155
	H2	38.63	0	17.086	19.036	23.842
Triple threshold	H1	10.57	15.3639	19.61	28.9592	30.8958
	H2	0.23	0.685	36.027	41.057	48.075

As a result, there are two thresholds for both Hypothesis 1 and Hypothesis 2, which are in line with the preliminary assumptions.

3.3.2 Estimation and Authenticity Test of Threshold

After the threshold effect test, it is necessary to estimate the threshold value of the threshold model, Hansen (1999) uses the sequential estimation method proposed by Chong (1994) and Bai (1997) to solve the threshold value of the gate limit model, and constructs the confidence interval of the threshold value. According to the above, this paper selects the double threshold model for subsequent analysis.

The TABLE IVTABLE V shows the 95% confidence interval under the double threshold model and the corresponding estimates.

TABLE V. THRESHOLD ESTIMATES AND CONFIDENCE INTERVALS

	H1		H2	
	Estimator	Level = 95	Estimator	Level = 95
Th-1	0.075	[0.0735 ,0.0760]	0.25	[0.23,0.26]
Th-2	0.224	[0.2095,0.2260]	0.38	[0.365,0.39]

Figure 1 and Figure 2 are likelihood ratio function diagrams, which can be compared intuitively to understand the estimation of the threshold value and the construction process of the confidence interval.

The likelihood ratio test statistics (LR) of H1 is 0, which shows that the threshold value is 0.075 and 0.224 in the double threshold model. According to the threshold value, it will affect the threshold effect of RD Ratio in Listed Enterprises of TCM, which is divided into three stages according to the flow ratio: Speed ratio≤0.075, 0.075<speed ratio< 0.224, speed ratio≥0.224.

The likelihood ratio test statistics (LR) of H2 is 0, which shows that the threshold value is 0.25 and 0.38 in the double threshold model. According to the threshold value, the threshold effect of RD ratio of Listed Enterprises on TCM is divided into three stages, such as ATO ≤0.25, 0.25< ATO <0.38 and ATO ≥0.38.

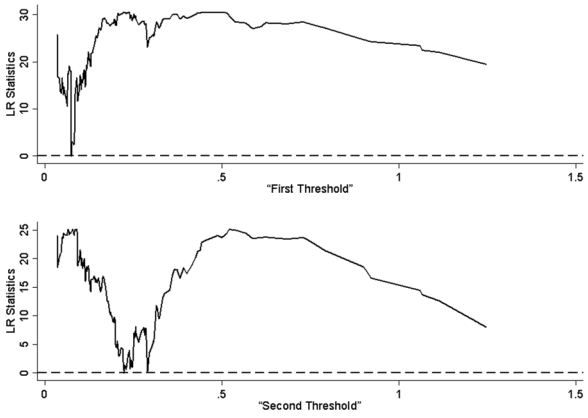

Figure 1. H1 Threshold Estimates and Confidence Intervals

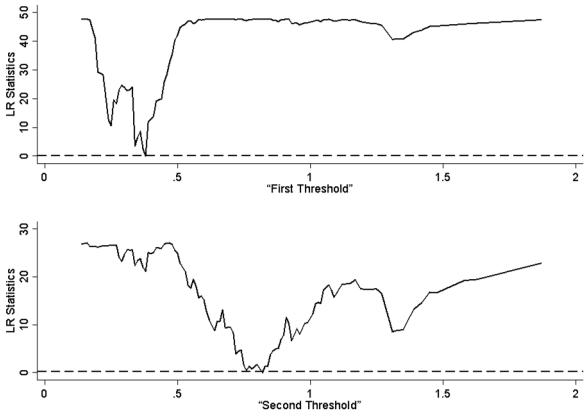

Figure 2. H2 Threshold Estimates and Confidence Intervals

3.3.3 Threshold regression effect results

According to threshold parameter estimation of H1, we can find that there is a double threshold effect on the effect of the ROA on the GP ratio, according to the speed ratio, the whole sample is divided into three intervals, and the effect of the ROA on the GP ratio is significantly different in different intervals. Specifically, when the speed ratio is below the first threshold (speed ratio ≤0.075), the speed ratio is between the first threshold value and the second threshold value (0.075<speed ratio≤0.224) and speed ratio over the second threshold value (speed ratio>0.224), the coefficient of asset turnover effect on the GP Ratio is-0.00037, 0.00398 and 0.00709. When other conditions remain the same, the Speed ratio is less than 0.074, each increasing in the ROA by 1%, the GP ratio will be reduced by 0.0003718%. When the Speed ratio is between 0.075 and 0.224, the GP ratio will increase by 1% for every 0.003982% increase in the ROA; when the speed ratio is higher than 0.224, for every 1% increasing in the ROA, the return on assets will increase by 0.0070896%. This TABLE VITABLE IVshows that the ROA is restricted by the speed ratio of the GP ratio, and with the increase of the liquidity of the enterprise inventory, the impact of the ROA on the profitability of the enterprise is further enhanced.

TABLE VI. ESTIMATION RESULTS OF MODEL PARAMETERS

H1		**H2**	
Predictor	**GP Ratio**	**Predictor**	**GP Ratio**
Current Ratio	-0.0088978	Quick Ratio	-0.199905*
	(-0.91)		(-1.9)
ATO	-0.0474224***	Current Ratio	0.2156411*
	(-3.84)		-1.91
R&D Ratio	-0.0311176	R&D Ratio	-0.103816
	(-0.41)		(-1.36)
ROA 1	-0.00037	ROA 1	-0.00021
(Quick Ratio ≤0.075)	(-0.48)	(ATO≤0.25)	(-0.26)
ROA 2	0.00398***	ROA 2	0.00581*
(0.075<Quick Ratio <0.024)	-5.88	(0.25<ATO<0.38)	-7.42
ROA 3	0.00709***	ROA 3	0.00170***
(Quick Ratio≥0.024)	-8.18	(ATO≥0.38)	-2.74
cons	0.50957***	cons	0.497155***
	-43.72		-45.2
R-sq	0.1447	R-sq	0.1308
F	48.08	F	44.43

Note. (..)represent “t”; *, **, *** represent the 10%, 5%, the 1% significant level.

According to the threshold parameter estimation results of H2, it can be found that there are two thresholds between the GP ratio and the ROA and there is a significant asymmetric nonlinear relationship between the two thresholds. When the ATO is less than 0.25, the GP ratio and the

ROA show a negatively correlated relationship. The coefficient value of the ROA is -0.00021, that is, the ATO increases by 1%, and the ROA is reduced by 0.00021%. When the ATO is between 0.25 and 0.38, the ROA has a significant positive correlation with the GP ratio, and the impact increases dramatically. The coefficient value of the ROA is 0.0058111, that is, the ATO increases by 1%, the ROA increases by 0.00581%. When the ATO is greater than 0.38, the ROA has a weaker positive correlation with the GP ratio. The coefficient value of the ROA is 0.00170, that is, the ATO increases by 1%, and the ROA increases by 0.00170. The results show that the ATO should be controlled within the appropriate range, the promotion of the ROA to the GP ratio can be optimally promoted. ATO is too small or too large, the impact of ROA on the GP ratio will be reduced or even show a negative correlation trend.

It is concluded that when the threshold value is greater than the critical value, the relationship between the ROA and the GP ratio is positively correlated by negative correlation. Both H1 and H2 are established.

4. DISCUSSION

Through 52 Listed Enterprises of TCM data from 2007-2017, the paper uses panel model and threshold model regression method synthetically, and finds that the influence of the return rate of assets on the gross margin of sales of Listed Enterprises of TCM has a double threshold effect on the speed ratio and the level of asset turnover.

4.1 The relationship between the realization ability of e Listed Enterprises on TCM and the profitability of enterprises

The speed ratio can be used to measure the solvency and liquidity of enterprises, and the empirical research shows that the impact of the return on assets of Listed Enterprises on TCM on the profitability of enterprises is restricted by the speed ratio, with the increase of the enterprises speed ratio, the effect of asset return rate on enterprise profitability can be enhanced.

When the speed ratio is lower than the threshold value, that is, the enterprise realization ability is weakened, the asset return rate has the negative correlation to the enterprise's business ability. Which means under the condition of certain flow debt, the large enterprise inventory leads to the decline of the enterprise's fast moving assets, which affects the realization ability of the Listed Enterprises of TCM belong to the traditional enterprises, such enterprises usually consider that investing a lot of inventory is necessary in order to maintain the stability and continuity of production and operation work. while inventory also occupies a lot of liquidity, it will lead to inefficient, masking the hidden dangers of enterprises. In order to maintain a high profitability, such enterprises should pay attention to inventory management and make a trade-off between inventory cost and inventory benefit, reach achieve the best combination.

The speed ratio exceeds its threshold value, means the enterprise realization ability is enhanced, thus strengthen the impact of the asset return rate on the profitability of the enterprise. Under the condition of certain current liabilities, the inventory volume is much smaller than the current assets, and the speed ratio of enterprises rises, realization ability will strong. For reducing inventory quantity will improve the circulation speed of inventory materials and the turnover rate of total assets, and improve the economic benefits of enterprises. In addition, the

Enterprises'ability to repay the debt is improved, the credit will be enhanced and create more profit opportunities.

4.2 The relationship between asset flow and enterprise profitability in Listed Enterprises on TCM

Asset turnover reflects the speed of at which assets flow. Fast flow rate, will save liquid assets relatively and expand asset investment, while delay the speed of flow, will waste funds and reduce the profitability of enterprises. The paper suggests that the degree of asset flow of an enterprise should be controlled within the appropriate range, and the promotion of the return rate of assets to the profitability of an enterprise can be played optimally.

If enterprise assets flow slowly, the impact of asset return rate will affect the profitability of enterprises negatively. The traditional marketing model is basically "heavy asset operation" mode, in order to improve profits, enterprises tend to the main investment capital in the market integration. Larger investment in fixed assets requires long-term liabilities to be supported, which can lead to greater debt servicing pressure on enterprises. If debt matures and cannot be repaid, companies will be in financial trouble, or even financial crises, affecting profitability.

If the enterprise asset flow is within the controllable range, the return of assets will have greatest influence on the profitability of the enterprise. For the majority enterprises, free cash flow has an important role in the daily business process. Proper asset flows facilitate more cash flow, To maintain them quality profitability. Accelerating the turnover of assets for enterprises can shorten the consumption cycle of low value-added areas in the middle of enterprises, and if speed up product updates to meet the continuous needs of the market, thus improving the profitability of enterprises.

When the enterprise assets flow too fast, the asset return rate shows the weak correlation to The influence of enterprise's business ability. It means that listed TCM enterprises adopt "cash spot" operation model and less invest in fixed assets, which leads to low ability to avoid market risk.

5. CONCLUSIONS

Using the relevant data of 52 Listed Enterprises of TCM from 2007 to 2017, the paper analyzes the relationship between profitability and asset flow of Listed Enterprises of TCM. The conclusions are follows: The realization ability of Listed Enterprises on TCM has double threshold effect on profitability. When the realization ability is lower than the threshold value, the realization ability is negatively correlated with the profitability, and when the realization ability is beyond the threshold value, the realization ability is positively correlated with the profitability; there is also a double threshold effect on the profitability of the asset flow of Chinese Traditional Medicine Listed Enterprises, and when the asset flow is lower than the threshold value , The flow of assets is positively correlated with profitability.

If Listed Enterprises of TCM tend to improve profitability, the best way may reduce capital investment to speed up asset turnover and lighten the occupation of inventory materials, to realize cash turnover.

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