

Can Properly Raised Debts Help Increase the Profits of Industrial Enterprises?

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Abstract

To figure out the impact of debt financing on the profits of industrial enterprises, it starts with calculating the first differences against the logarithms of the cost profit ratios and the debt asset ratios of Chinese industrial enterprises during 179 months from 2002 to 2016; next, it runs the cointegration test and afterwards the regression test to analyze the obtained first differences, and still next uses the Simulink software to get the regularity of those changes. It finds out that there is not only a long-term stable relationship between the enterprises' profits and debts, but also a steady time series trend within a short term. The profit rate positively correlates to the debt asset ratio, and profit for the current term positively correlates to the profit for the previous term. It indicates that properly raised debts can help increase the profit rate of the industrial enterprises, and a higher previous profit level can help improve the current profit level.

Keywords

Co-integration, Debt, Profit, Regression, Simulation

1. Introduction

With the global financial crisis triggered by the 2008 US subprime disaster, and after the series of pain events, the public's trust towards enterprise debt financing has dropped to the lowest point. Under this situation, commercial banks and other financial institutions in some countries start to manage their asset sides with much more prudential attitude, and some even start to feel worried about their normal debt activities. With all of these, economic recovery becomes a top issue all over the world: the US Federal Reserve Committee launches the "QE (Quantity Easy) plan", buying in the government supported enterprise bonds in the open market to reduce the default risks caused by the debts. Meanwhile, Europe and Japan also put forward the "European version of QE program" and "the Japanese version of the QE program" to reduce the default risks caused by the debts.

In 2015, Chinese Premier Li Keqiang in the executive meeting of the State Council proposed that enterprises should de-leverage and reduce their financing costs; and Li Yang, the famous economist and research fellow in Chinese Academy of Social Sciences, also believes that enterprises in China should control their debt levels. However, the fact is that China has actually taken a moderately easy monetary

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Manuscript received November 24, 2017; first revision March 23, 2018; second revision May 21, 2018; accepted July 14, 2018.

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policy in recent years. The central bank has also lowered the benchmark interest rate of deposit and loan for several times. In January, 2017, China's total social financing scale achieved 3,737.703 billion yuan. Its loaning scale in commercial banks was 2,313.285 billion yuan, reaching an unprecedented high point. Are there any reasons for these two simultaneously adopted but seemingly contradictory approaches, namely, de-leveraging on the one hand and increase of the enterprise debt financing scale on the other hand?

In fact, some local governments, financial institutions, entrepreneurs and scholars are also very confused about the pros and cons of the debt operation: Can raised debt asset ratio help increase the profits of enterprises? Why should financial institutions inject more liquidity into enterprises? To explain the above phenomenon and answer these questions, we need to find out the reasons and rules behind the financial phenomenon through both the macro and micro analysis of the enterprises' data.

2. Literature Review

2.1 Previous Studies outside China

The first theory of enterprise financing in the true sense is MM theory put forward by Modigliani and Miler [1]. Under highly strong assumption restrictions, MM theory holds that the profit level has nothing to do with the scale and structure of enterprises' debt financing. Later, Modigliani and Miler [1] add the tax assumption to the original in the practice, and demonstrate that increased debt financing can reduce the tax in practice and thereby improve the enterprise profit level. On this basis, Stieglitz [2] and Smith and Warner [3] release the bankruptcy assumption of MM theory and bring about the trade-off theory of debt financing. They believe that enterprises' debt financing can either result in improvement of the profit level or the bankruptcy. Timan and Wessels [4] makes the financing channel assumption of MM theory, proving the existence of debt financing pecking order in real economic life. Still later, Jensen and Meckling [5] raises the manager assumptions in MM theory, considering that by debt financing enterprises can achieve consistency in goals of the managers and the enterprises. Several studies [6-10] loose the information assumption of MM theory, proving the impact of information transfer in debt financing on enterprise performance. The authors of [11-13] show the impact of debt financing on enterprises' operations through empirical studies.

2.2 Previous Studies in China

In China, several researchers [14-31] studied the relationship among the debt financing, the equity and the operational behaviors of enterprises, and so on; [32-43] explained the interrelationship between the debt financing and the investment of enterprises; and [44-60] discussed the financial leverage, financial risks and risk control methods in enterprise debt financing.

To sum up, scholars have made many achievements in terms of enterprise debt financing, but their conclusions are often inconsistent and contradictory. Some scholars point out that now it is the critical time to decrease the debt rate; on the contrary, some scholars think that we should raise the debt rate. Some researches are based on the game theory while some others only make use of data from stock markets. What's more, most of them lack support of long-span data.

3. Model Design

3.1 Data Sources and Model Design

Data selected in this research are from the monthly statistical reports of enterprise profit rates and enterprise debt asset ratios of large-capacity industrial enterprises (the annual main business income ≥ 20 million yuan) during 2002 to 2016 in China. The data are all from the Database of China Economic Information Network, including 179 samples of 15 years. Since these data take on an irregular wavy distribution (as shown in Figs. 1 and 2), the data of the nearest previous month will be used to replace a few missing values in the report.

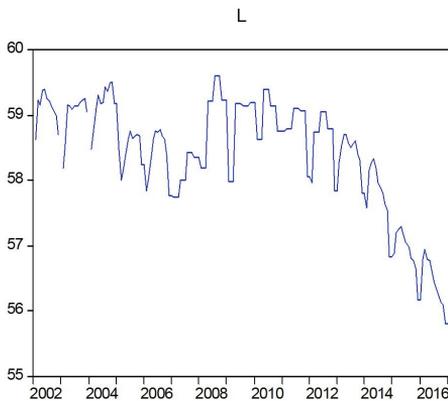


Fig. 1. Linear trend chart of L.

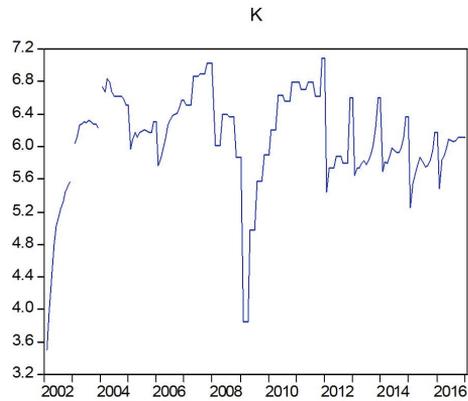


Fig. 2. Linear trend chart of K.

According to the common sense of enterprise financial management, enterprise profit rate for the term is not only influenced by the debt rate for the term, but also relevant to the profit rate for the previous term. Therefore, the model can be established as:

$$K_t = c + aL_t + bK_{t-1} + u_t \quad t = 1, 2, \dots, n \tag{1}$$

Among them, L (loan rate) stands for the debt rate, K (capital rate) the profit rate, a the debt rate coefficient, b the coefficient after the first difference of the profit rate, c the constant, and t time.

3.2 Estimation and Test of the Regression Model

From the time-series data in Figs. 1 and 2, it can be seen that the variables are not stationary and they correlate to each other to some extent, thus it is feasible for us to carry on our study. Firstly, the logarithms of the variables are used to eliminate the heteroscedasticity of data. It can be shown as the following Figs. 3 and 4.

By using Eviews 6.0, a unit root ADF test is carried out to test the non-stationary time series: first, check the results of the three level tests: intercept test, trend and intercept test and none test. Results show that both $\ln K$ and $\ln L$ are non-stationary time series: it can be seen from the ADF test result of $\ln L$ (Table 1) that the value is -0.478543 , bigger than the critical value of -3.145341 at the significant level of 10%; the value of P is 0.9836 , far bigger than 0.05 . Thus, the time series is non-stationary.

As both $\ln K$ and $\ln L$ are non-stationary time series, we need to test unit root through first difference. Choose the lagged variable when the values of AIC and SC are the smallest. Conduct the following three tests: intercept, trend and intercept and none. The results show that $\ln K$ and $\ln L$ after first difference are both stationary time series. As shown in Table 2, the t-statistic value of $\ln L$, -13.27276, is much smaller than the critical value of -3.145341 at the confidence level of 1%. The value P is 0.0000. Thus, $\ln L$ is an integrated series (I (1) series).

As can be seen from Table 3, the t-statistic value of $\ln K$ is -12.03050, much smaller than the critical value of -4.012296 at the confidence level of 1%. The value of P is 0.0000. The $\ln K$ can also be determined as an integrated series.

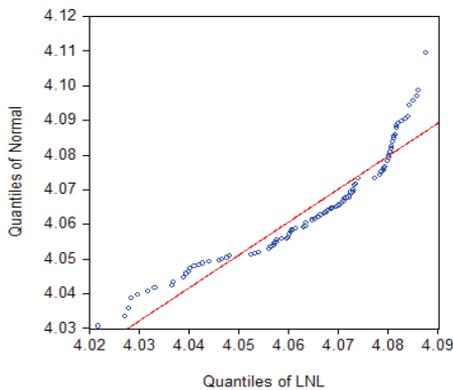


Fig. 3. $\ln L$ and normal distribution.

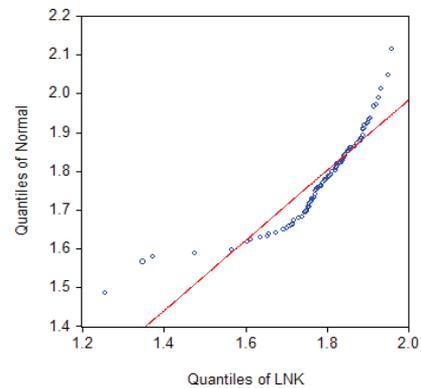


Fig. 4. $\ln K$ and normal distribution.

Table 1. ADF test statistic of $\ln L$

	t-statistic	P
ADF test statistic	-0.478543	0.9836
Confidence level		
1%	-4.023506	
5%	-3.441552	
10%	-3.145341	

Table 2. ADF test statistic of $\ln L$ after first difference

	t-statistic	P
ADF test statistic	-13.27276	0.0000
Confidence level		
1%	-3.468521	
5%	-2.878212	
10%	-2.575737	

Table 3. ADF test statistic of $\ln K$ after first difference

	t-statistic	P
ADF test statistic	-12.03050	0.0000
Confidence level		
1%	-4.012296	
5%	-3.436163	
10%	-3.142175	

From the ADF test statistic in Tables 1–3, we can see that both $\ln L$, the logarithm of the enterprise debt asset ratio in large-capacity Chinese industrial enterprises, and $\ln K$, the logarithm of the enterprise profit rate in large-capacity Chinese industrial enterprises, are I (1) series. They are of the same order (first order), enabling us to further carry out the cointegration test. Press the [quick] button in Eviews 6.0, choose the item [estimate equation], input the equations with constants and then without constants, and compare the estimation results of the two regression models, from which one can get the long-term stationary cointegration equations of $\ln K$ and $\ln L$ (Table 4).

$$\ln K_t = 0.087399 \ln L_t + 0.803892 \ln K_{t-1} \tag{2}$$

$$\text{ecm} = \ln K_t - 0.087399 \ln L_t - 0.803892 \ln K_{t-1} \tag{3}$$

Table 4. Cointegration test statistic of $\ln K$ and $\ln L$

	Coefficient	t-test
INL	0.087399	5.59948 (0.0000)
INK(-1)	0.803892	22.8508 (0.0000)
R ²	0.751825	
Adjusted R ²	0.750390	
AIC	-3.022502	
DW	1.939894	

3.3 Estimation and Test of Residuals

To ensure the accuracy of the model, we need to further test the residuals and the error correction model (ecm). Following are results of the Histogram-normality test, unit root ADF test, and correlogram-q-statistics of the ecm.

From Fig. 5, it can be seen that the residuals take on a normal distribution, and Jarque-Bera value in its Histogram-normality test is 5741.226, with the value of P equaling to 0.0000, which is significantly bigger than the critical value at the confidence level. It means that the ecm passes the Histogram-normality test.

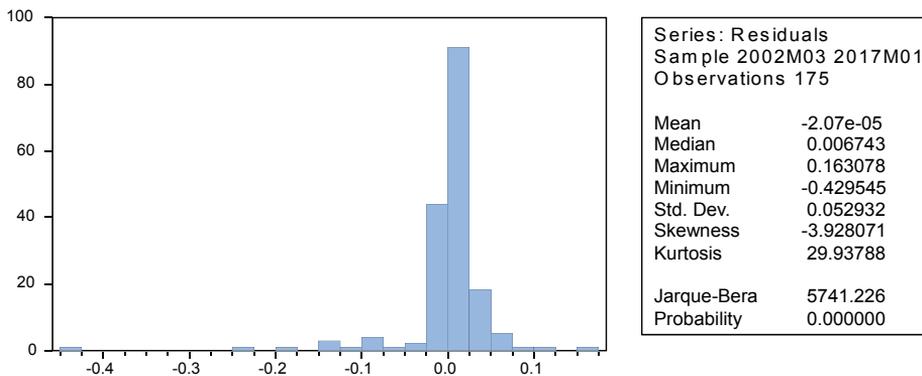


Fig. 5. Histogram-normality test of residuals.

Table 5. ADF test statistic of residuals

	t-statistic
ADF test statistic	-2.243612
Confidence level	
1%	-2.581349
5%	-1.943090
10%	-1.615220

Table 6. Autocorrelation and partial correlation test of residuals

	AC	PAC	Q-Stat	Prob
1	0.041	0.041	0.2946	0.587
2	-0.031	-0.032	0.4625	0.794
3	-0.032	-0.030	0.6512	0.885
4	0.013	0.015	0.6817	0.954
5	0.068	0.065	1.5246	0.910
6	-0.013	-0.019	1.5556	0.956
7	0.035	0.041	1.7795	0.971
8	-0.016	-0.016	1.8273	0.986
9	-0.058	-0.058	2.4533	0.982
10	-0.096	-0.095	4.1941	0.938

Tables 5, 6, and Fig. 5 show that the t-statistic in ADF test of the residuals is -2.243612, smaller than the critical value -1.943090 at the confidence level of 5%. Thus, the time series is of integrated distribution.

At the same time, the results of 10th correlogram-q-statistics show that the maximum critical value of autocorrelation coefficient is -0.096, while the maximum critical value of partial correlation coefficient is -0.095. The two values are both within the scope of dotted line part; the maximum value of Q is 4.1941, and the minimum value of Q is 0.3946; the minimum value of Prob is 0.587, far bigger than the critical value of 0.05. Therefore, ecm also passes the ADF test and correlogram-q test.

3.4 Interpretation of the Model

Through the estimation and tests of the regression model and its residuals, it can be seen that there is a stable cointegration relationship in both the long-run and short-run regression models.

$$\ln K_t = 0.087399 \ln L_t + 0.803892 \ln K_{t-1} \quad (4)$$

$$\text{ecm} = \ln K_t - 0.087399 \ln L_t - 0.803892 \ln K_{t-1} \quad (5)$$

From the above regression models, we can see that the logarithm of profit rate $\ln K_t$ positively correlates to the logarithm of the debt ratio $\ln L_t$, with a correlation coefficient of 0.087339. This indicates that from both a short-term and a long-term perspective, it is feasible for industrial enterprises to raise their debt asset ratios to a certain degree. That is, within the scope of controllable risks, enterprises can adopt debt financing to increase their cash flow and operation vigor, so as to improve their operating performance and profit rates. At the same time, the correlation coefficient between $\ln K_t$ and $\ln K_{t-1}$ is 0.8038932. That means the enterprise profit level for the term highly correlates to its profit for the previous term, say, its performance for the previous term directly influences its current profit level.

3.5 Numerical Simulation

According to the regression equations of the debt ratios and profit rates of industrial enterprises, the Simulink function modules are grouped and designed. And then, with the numerical simulation of the system, the relationship between debt ratios and profit rates can be more directly understood.

- (1) Assuming that the debt ratio of the industrial enterprise is a ramp function, and the slope is 0.5, the initial value of the debt ratio 0.3, $T = 10$. The following simulation results can be obtained (Fig. 6). Comparing the simulation results of Figs. 7 and 8, one can see that when the debt ratio of the industrial enterprise shows a ramp continuous dynamic function with a slope of 0.5, the output curve of its profit rate is very similar to the shape of the input slope function, which shows the positive relative influence between them. What is more, the marginal growth rate of the profit rate curve decreases gradually with time T , finally tending to a horizontal line.

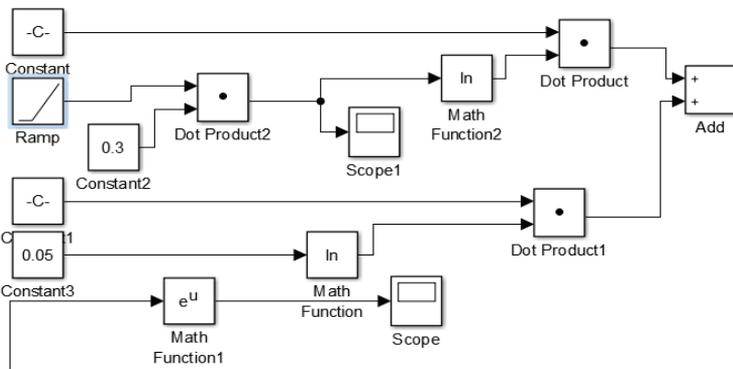


Fig. 6. Simulation system of the industrial debt ratio as a slope function.

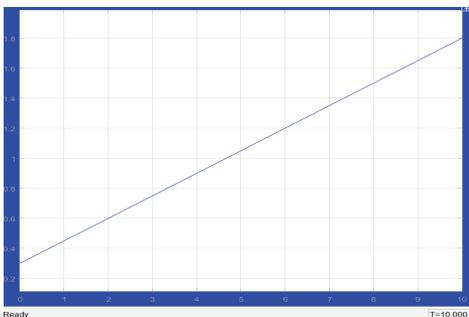


Fig. 7. Input: ramp function of the debt rate.

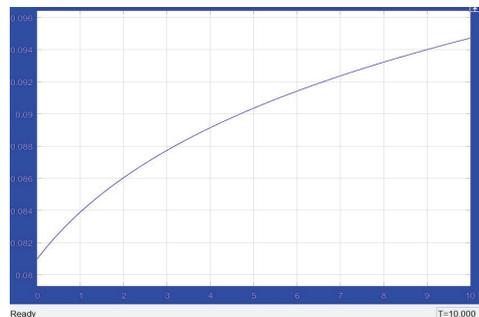


Fig. 8. Output: profit rate.

- (2) Assuming that the debt rate of the industrial enterprise is a sine function, Amplitude 1, Bias 1, and Frequency still 1. The minimum value of debt ratio tends to 0, its maximum value tends to 2, time $T = 10$. Then we can get the following simulation results (Fig. 9). It can be seen from Figs. 10 and 11 that the simulation curve of the profit rate is very similar to the sine function curve of the debt rate in shape, only slightly different in their kurtosis and skewness. That means, the profit rate of an enterprise usually goes up or lows down along with the increase or decrease of its debt. In other words, there is a positively relative relationship between the two factors.

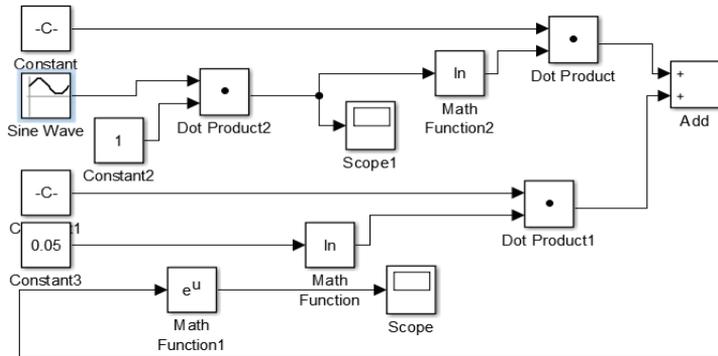


Fig. 9. Simulation system of industrial debt rate as a sine wave function.

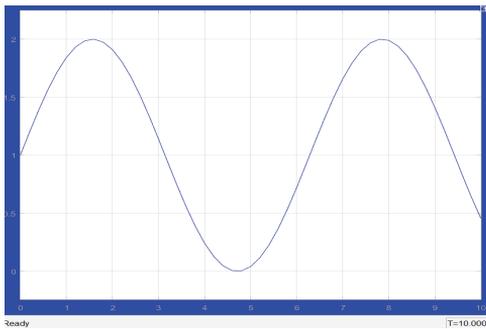


Fig. 10. The sine function of the debt rate.

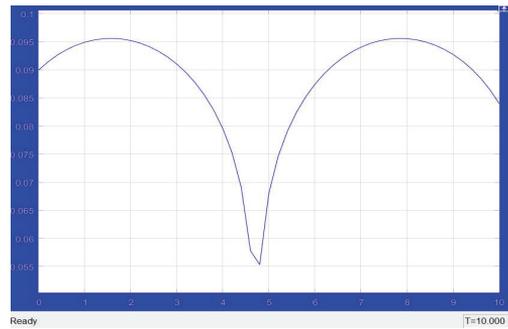


Fig. 11. Simulation results of the profit rate.

3.6 The Contributions of the Research

This study, quite different from others, carries out a cointegration test and a regression analysis of the economic data spanning as long as 15 years in China. On this basis, it also digs up the inner economic rules. It can help those enterprises to properly control their own debt rates. It is hoped that the research can improve and supplement the previous researches.

4. Conclusion

It can be seen from the results of the above analysis that at the micro level of enterprises, properly raised debt rate can help increase the profits of the enterprises; at the macro level of a country, the increased profit and the brighter enterprise prosperity can result in the improvement of the national macro economy, which explains why governments and central banks of many countries compete to launch the QE policies.

To conclude, on the one hand, industrial enterprises, especially those SMEs (small and medium enterprises), can certainly take advantage of debts to increase their profits (of course, the debts must be controlled into a reasonable scope). Properly raised debts will not harm but will benefit enterprises. On the other hand, enterprises should also invest more (both money and energy) to their business operations so as to speed up their development and improve their profitability power.

Acknowledgement

This research is supported by grant of the Chongqing Social Science Fund (No. 2017YBGL156) and the Yangtze Normal University Research Funds (No. 20170037).

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