

The Recognition of Capital Structure Peer Effect of Chinese Listed Companies

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Received 4 June 2016; accepted 12 June 2016; published 15 June 2016

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Abstract

The capital structure of listed companies is significantly affected by that of peer companies in the same industry. This phenomenon is called the peer effect of capital structure. This paper studies the peer effect of capital structures of listed companies in the same industry in the Chinese A-share market. Unlike previous literatures simply using the average industry capital structure as the explanatory variable, by constructing the instrumental variable (equity shock), this paper successfully and accurately identifies the peer effect. Through the empirical analysis, this paper has found the following conclusions: 1. The peer effect's ability to explain the capital structure of the company itself is more important than the common capital structure influence factors in the previous literatures; 2. Peer firms play an important role for the company's own capital structure. Specifically, the company's own capital structure will respond to the capital structures of peer firms, rather than other financial characteristics of peer firms. The conclusion of this paper has certain enlightenment significance on the capital structure theory and capital decision-making behaviors of Chinese listed companies. The capital structure of listed companies in China is not independently decided by the company managers, but in the process of decision-making the capital structures of peer firms is considered as the important reference factor. This will provide a new angle for the research on capital structure. The strong correlation among capital decision-making of peer firms will be considered.

Keywords

Peer Effect, Capital Structure, Equity Shock

1. Introduction

The capital structure theory is the most intensively investigated field with the most research results in the

corporate finance theory, and one of the most important problems. The old enterprise capital structure theory mainly includes MM theorem, MM model considering the enterprise income tax, tax difference school, bankruptcy cost school and balance theory, etc.; while the new capital structure theory mainly includes four schools, which are agency cost theory, signaling theory, control right theory and industrial organization theory of capital structure.

The peer effect can be interpreted as the mutual learning of different individuals in the same group. Restricted by their own information environment, the company managers cannot determine the optimal capital structure for their companies. As a result, when determining the company's own capital structure, managers focus on capital structures or other financial characteristics of peer firms. In fact, the behavior of peer firms action is a important explanatory variable for the capital decision-making of a lot of companies. Evidence shows that the company's own capital structure is affected by that of peer firms. Through the questionnaire survey of CFOs of listed companies, Graham & Harvey (2001) [1] proposed that a number of CFOs thought that when they made capital decision for their own companies, behaviors of peer firms played an important role of reference. In addition, in their literatures, Welch (2004) [2], Mackay & Phillips (2005) [3] and Frank & Goyal (2009) [4] pointed out that in the average industry capital structure was an important and significant explanatory variable affecting the capital structure of the company itself.

The purpose of this paper is to discuss about whether behaviors of peer firms affect the capital structure of the company itself. In this paper, the structure of the remaining parts is as follows. Chapter 2 is the recognition model of peer effect. The traditional model, the construction of equity shock and recognition strategy are introduced. Chapter 3 is the empirical analysis. Chapter 4 is conclusion and enlightenment.

2. The Recognition Model of Peer Effect

Referring to previous empirical literature on the capital structure (Rajan & Zingales, 1995 [5]; Frank & Goyal, 2009), the empirical model adopted in this paper is as follows:

$$y_{ijt} = \alpha + \beta \bar{y}_{-ijt} + \gamma' \bar{X}_{-ijt-1} + \lambda' X_{ijt-1} + \delta' \mu_j + \phi' \nu_t + \varepsilon_{ijt} \quad (1)$$

The subscript i, j and t in the model corresponds to the i^{th} listed company, the j^{th} industry and the t^{th} year, respectively. The dependent variable y_{ijt} measures the capital structure of the listed company. K -dimension vector \bar{X}_{-ijt-1} and X_{ijt-1} represent average of peers and the company's own financial characteristics, respectively. μ_j and ν_t represent the deviation of fixed effect of industry and year, respectively. Finally, ε_{ijt} is the disturbing term of the i^{th} company in the n^{th} year. ($\alpha, \beta, \gamma', \lambda', \delta', \phi'$) is the parametric variable in the model.

The Construction of Equity Shock

Another method for recognition of peer effect used in this paper is construction of instrumental variable. Stock return is a known determinant of capital structure (Marsh, 1982 [6]). And then, we constructed the traditional asset pricing model. In order to remove the general differences among the peers, we also added explanatory variables related to the industry into the model. Thus, we can extract the idiosyncratic return based on the company itself from stock returns, which is the residual term in the model, also called return shock and equity shock. Finally, we delayed the return shock for a year, as the instrumental variable in this paper, so that it is not related to financial characteristic variables of other peer firms.

This paper estimates the return shock by building the following model.

$$r_{ijt} = \alpha_{ijt} + \beta_{ijt}^M (rm_t - rf_t) + \beta_{ijt}^{IND} (\bar{r}_{-ijt} - rf_t) + \eta_{ijt} \quad (2)$$

In which, r_{ijt} represents the stock yield of company i in the industry j in month t . $(rm_t - rf_t)$ represents the abnormal return of the market. $(\bar{r}_{-ijt} - rf_t)$ represents the abnormal return of weighted average stock portfolio in the industry j (excluding company i). η_{ijt} represents the random disturbance term.

Expected return: $\hat{r}_{ijt} = \hat{\alpha}_{ijt} + \hat{\beta}_{ijt}^M (rm_t - rf_t) + \hat{\beta}_{ijt}^{IND} (\bar{r}_{-ijt} - rf_t) + \eta_{ijt}$

Equity shock: $\hat{\eta}_{ijt} = r_{ijt} - \hat{r}_{ijt}$

3. Empirical Analysis

3.1. Definition of Variables and Statistical Description of Data

Data in this paper comes from CSMAR database of GTA. GTA's financial market data feeds and delivery platforms offer access to China's largest collection of historical data covering the most recent working day, including intraday and closing exchange pricing, fundamentals including company financial statements, corporate actions, estimates, ownership, etc. CSMAR is one of the databases under GTA. It covers all A shares and B shares companies listed on the Shanghai Stock Exchange and the Shenzhen Stock Exchange in standardized financial data presentation since the data became available in 1990.

The time span of data is from 2008 to 2015. Due to the wide use of data, we put the structure of the sample data and definition of variables in **Table 1**. **Table 2** shows the statistical description of the final samples in this paper. 1054 listed companies and a total of 8432 observations are included. According to the industry classification code in *Guidance of Industry Classification of Listed Companies* issued by China Securities Regulatory Commission in 2012, we defined different industries in the samples. Thus, 1054 listed companies in our samples are included in 55 industries. The average number of listed companies included in each industry in the samples is 19, and the median value is 12. The overall distribution is skewed to the right.

At the same time, **Table 2** shows the statistical description of variable levels and first-order differential values. Before the empirical analysis, the variable data in this paper were winsorized on the first and the 99th quantile. This processing helps to reduce the effects brought by extreme values and data coding errors in samples. Variables used in this paper are divided into two categories, which are firm-specific values and peer firm averages). The first kind of variables directly consist of observations of the i^{th} company in the t^{th} year; the structure of the second kind of variables is formed by eliminating observations of the i^{th} company in the t^{th} year, and then calculating the average in the industry in the year (the industry of the i^{th} company).

3.2. Results of the Construction of Equity Shock

As stated earlier, according to the industry classification code (three-digit code) in *Guidance of Industry Classification of Listed Companies* issued by China Securities Regulatory Commission in 2012, we define different industries in the samples.

Table 1. Definition of variables.

Category	Variable name	Variable symbol	Variable description
Explained variable	Book leverage (asset-liability ratio)	bkl	Total debt/Total assets
	Market value leverage	mkl	Total debt/Market price of equity
	Company size	size	Natural logarithm of total assets
Explanatory variable	Market-to-book ratio	mtbr_a	Market price of equity/Total assets
	Profitability	prof	EBITDA/Total assets
	Asset tangibility	tang	(Net value of fixed assets + Net value of stock)/Total assets
	Altman Z Scoring Value	zscore	1.2 * current capital/total assets + 1.4 * retained earnings/total assets + 3.3 * EBIT/total assets + 0.6 * market price of equity/total liabilities + sales revenue/total assets
Control variable	Non-debt tax shield	shield	Depreciation of fixed assets/Total assets
	Selling, general and administrative costs	sgax	(Sales cost + management fees)/Total assets
	Capital investment	capin	Capital expenditure/(net value of fixed assets of the previous period+ net value of inventory of the previous period)
	Annual rate of return of individual share	skrt	

Table 2. Descriptive statistics of data.

	Mean	Median	Std	Max	Min
Firm-specific					
bkl	0.638	0.540	2.842	142.7	0
mkl	0.421	0.338	0.447	13.51	0
size	22.12	22.03	1.539	29.02	0
mtbr a	0.728	0.660	0.575	15.47	0
prof	3.081	0.0690	276.5	25387	-51.95
tang	0.436	0.431	0.197	0.975	0
Peer Firm Average					
pfa bkl	0.626	0.552	1.543	64.86	0.0649
pfa mkl	0.399	0.374	0.218	2.033	0.00823
pfa size	22.06	21.96	0.756	28.92	18.11
pfa mtbr a	0.699	0.672	0.282	2.862	0.0755
pfa prof	3.083	0.0728	112.8	4231	-8.576
pfa tang	0.433	0.421	0.111	0.787	0.00293

In this paper Rolling Window Regression was completed for the monthly stock return data of each listed company according to the return shock equation. The length of rolling window is 5 years (*i.e.*, 60 months). The step size of each rolling is one year. At the same time, we can ensure that the observation of each rolling regression is up to 60 and at least 24 (there is at least the data of 24 months in five years). For example, to construct the stock shock of Vanke A (stock code: 000002) in 2008, we used the data of monthly return of Vanke A from January 2003 to December 2007 (five years prior to 2008) for regression according to the rolling regression equation. And then, we calculated the corresponding equity shock with the estimate coefficient obtained from the regression, (abnormal return of Vanke A on the market from January to December 2008) and (average abnormal return of peers) with reference to the calculation formula of expected return and equity shock.

$$\text{Expected return: } \hat{r}_{ijt} = \hat{\alpha}_{ijt} + \hat{\beta}_{ijt}^M (rm_t - rf_t) + \hat{\beta}_{ijt}^{IND} (\bar{r}_{-ijt} - rf_t) + \eta_{ijt}$$

$$\text{Equity shock: } \hat{\eta}_{ijt} = r_{ijt} - \hat{r}_{ijt}$$

Table 3 shows the results of Rolling Window Regression based on Equation (2). Although the observation of samples of most rolling regression is 60 (*i.e.*, the monthly data of 5 years), the average observation of all rolling regression samples is about 56, and the average correction value is about 50.09%.

The equity shock $\hat{\eta}_{ijt}$ calculated through the above steps is the monthly data. In order to be consistent with the accounting data period of the listed company, we used the calculation method of compound interest, and merged the equity shock of monthly data into the annual data. And then, we calculated the Peer Firm Average Equity Shock every year in every industry after company i was eliminated.

In **Table 4**, we discussed about the partial correlation between Peer Firm Average Equity Shock and financial characteristics of company i . We calculated the partial correlation between the two in the same period or two adjacent periods (relative to Peer Firm Average Equity Shock), so as to prove whether Peer Firm Average Equity Shock includes current or future financial characteristic information of company i . In fact, the correlation between the two will not cause too many troubles for us, because the company's own financial characteristics have been added to Equation (1) as control variables.

From results in **Table 4**, we can see that in the model of the same period (the first column) only one estimated coefficient is significant, in which the size measuring profitability is only significant at 10% of confidence level; while in the model of two adjacent periods (the second column) all the estimated coefficients are not significant. At the same time, in the two models the numerical values of all estimated coefficient are relatively small, and

Table 3. Results of rolling window regression.

Variable name	Average	Median	Std
$\hat{\alpha}_{ijt}$	0.175	0.1763	0.029
$\hat{\beta}_{ijt}^M$	0.0002	-0.0249	0.7032
$\hat{\beta}_{ijt}^{IND}$	0.7496	0.772	0.7051
Observation per regression	0.5009	0.5129	0.1283
Adjusted R Square	56.4992	58	4.1842
r_{ijt}	0.0075	0.0042	0.1312
Expected return \hat{r}_{ijt}	-0.0094	0.0024	0.1193
Equity shock $\hat{\eta}_{ijt}$	0.0131	0.0015	0.102

Table 4. Character verification of Peer Firm Average Equity Shock.

	Peer Firm Average Equity Shock	
	Contemporaneous	1-Period-Lead
	Independent Vars.	Independent Vars.
<i>Firm-specific Factors</i>		
size	0.00849*	0.0119
	(0.00485)	(0.0160)
mtbr_a	0.0108	-0.00681
	(0.00844)	(0.0222)
prof	-0.0440	-0.156
	(0.0292)	(0.110)
tang	0.0246	0.0773
	(0.0167)	(0.0626)
PFA Characteristics	YES	YES
Firm <i>i</i> Equity Return Shock	YES	YES
Industry Fixed Effects	YES	YES
Year Fixed Effects	YES	YES
Observations	8432	8432
R-squared	0.856	0.933

their economic significance is not significant. The company size is the most significant explanatory variable. Its corresponding estimated coefficient is 0.00849, which means that a unit of growth of company size will be accompanied by less than 0.01 unit of growth of Peer Firm Average Equity Shock in the same period. Therefore, we can think that the information contained by Peer Firm Average Equity Shock does not affect the financial characteristics of listed companies (in the same period or two adjacent periods).

3.3. Results of Two-Stage Linear Regression

We used Peer Firm Average Equity Shock as the instrumental variable of peer firm average capital structure, and used Two-stage Least Squares (2SLS) to estimate Equation (1).

Table 5 shows estimated results of Two-stage Least Squares with Equation (1). The explained variables marked on the top of each column include book leverage, leverage of market price, first-order differential value of book leverage and first-order differential value of leverage of market price. Results of the first-stage regression are shown at the bottom of **Table 5**, including F statistic and χ^2 score obtained based on DWH test of the robust standard deviation and statistics of Regression F.

Table 5. Peer Effect Recognition-Structured Estimation (2SLS Method).

	(1)	(2)	(3)	(4)
VARIABLES	bkl	mkl	d_bkl	d_mkl
<i>Peer Firm Averages</i>				
Dependent Variable	1.901 (3.526)	0.872** (0.389)	1.013 (1.108)	0.473*** (0.168)
l_pfa_size	0.104 (0.165)	-0.0515 (0.0406)	-0.0636 (0.0624)	-0.0193 (0.0231)
l_pfa_mtbr_a	0.0502 (0.0617)	-0.0707* (0.0390)	0.0541 (0.0604)	0.0382 (0.0672)
l_pfa_prof	-0.530 (0.948)	0.158 (0.130)	-0.817 (0.961)	0.0627 (0.0969)
l_pfa_tang	-0.579 (0.934)	-0.141 (0.136)	-0.158* (0.0894)	-0.103 (0.0762)
<i>Firm-specific Factors</i>				
l_size	0.0303*** (0.00398)	0.0641*** (0.00339)	0.00291 (0.00255)	0.0338*** (0.00273)
l_mtbr_a	-0.0409 (0.0300)	0.146*** (0.0207)	0.0284*** (0.0104)	-0.264*** (0.0149)
l_prof	-0.726*** (0.165)	-0.633*** (0.0466)	0.0191 (0.0588)	-0.165*** (0.0378)
l_tang	0.200*** (0.0338)	0.158*** (0.0164)	-0.0294** (0.0127)	0.00561 (0.0138)
equity_shock	-0.00371 (0.0149)	-0.0448*** (0.00758)	-0.0196*** (0.00686)	-0.0644*** (0.00613)
<i>First Stage Statistics</i>				
F statistics	0.0498	61.0902***	0.0029	90.7750***
Robust score chi2	0.7472	9.8141***	1.1266	3.8978**
Robust Reg. F-stat	0.7541	8.5747***	1.1214	3.6095**
Industry Fixed Effects	YES	YES	YES	YES
Year Fixed Effects	YES	YES	YES	YES
Observations	8432	8432	8432	8432
Adj. R-squared	0.450	0.452	0.400	0.403

Notes: F statistic is the weak instrumental variable used to judge the Two-stage Least Squares Regression. The null hypothesis of the test is the existence of weak instrumental variable. Because in this paper there is only an endogenous variable, we can use F statistic. In statistical software stata we can use command estatfirststage to obtain F statistic of the first stage of regression. χ^2 scoring and F statistic of regression obtained based on DWH test (Durbin-Wu-Hausman Test) of robust standard deviation are both used to judge whether the two-stage least squares regression has the endogenous explanatory variable. In this paper, they are used to judge the endogeneity of \bar{y}_{-ij} . The null hypothesis of the test is that endogenous explanatory variable does not exist. That is to say, it is unnecessary to use two-stage least squares regression. In statistical software Stata we can use command estat endogenous to obtain robust χ^2 scoring and F statistic of regression, respectively.

The estimated results reported in the first row of **Table 5** reports are marked as “Dependent Variable”, namely the coefficient of \bar{y}_{-ijt} , peer average capital structure estimated through 2SLS. When the explained variables are the value of book leverage level and first-order differential value (Column (1) and (3)), the peer effect is not significant. At the same time, the first-stage statistical data in Column (2) and columns (4) shows that the instrumental variable used in this paper (Peer Firm Average Equity Shock, *pfa_equity_shock*) is not a weak instrumental variable, and \bar{y}_{-ijt} is indeed an endogenous explanatory variable. It is necessary to use 2SLS estimation method in this paper.

Therefore, we focus on observing Column (2) and (4) in **Table 5**. The results show that the capital structure of its peer firms has significant and positive influence on the capital structure of listed companies (market leverage only). Specifically, 1 unit of increase of peer average market leverage will lead to the 0.872 unit of increase of the company’s own market leverage. Compared with the company’s own traditional financial characteristic variables, including size, prof, tang and mtbr, peer average market leverage has more significant effect with bigger numerical value. For example, in Column (2), in addition to the peer average market leverage, with the significant explanatory variable with secondary influence is profitability of the company (prof), whose estimated coefficient is -0.633 . The later one is almost 36% smaller than the former one. Similarly, mtbr, another explanatory variable with secondary influence, has the estimated coefficient of 0.641. Its influence is also 26% smaller than the peer average market leverage.

In general, the peer effect plays an important influence role in the deciding of capital structure of listed companies. Its influence is bigger than other influencing factors of capital structure. At the same time, the peer effect existing in differences among the capital structures of listed companies is often brought by the capital structures of peer firms (Financial Action), rather than financial characteristics of peer firms.

4. Conclusion and Enlightenment

This paper used 1082 Chinese companies whose A shares were listed between 2008 and 2015 (including Shanghai A and Shenzhen A) as samples. Companies listed after 2003 (including 2003), financial-related industries (industry code: J66-J69), ST and PT companies, companies whose data was lost for two consecutive years, and industries conforming to the above conditions and only having one company were eliminated. The monthly data from 2003 to 2014 was used to build equity shock (including rate of return on individual share, risk-free rate of return, rate of return of comprehensive market). This paper refers to the research of Leary & Roberts (2014) [7], and systematically discusses about the peer effect in the capital structure of listed companies in China. The empirical analysis includes building of earnings based on the company’s own characteristics and equity shock; and recognition of structural formula of peer effect.

Based on the above empirical test, the conclusion of this paper is as follows. The listed company does not make the financing decision independently. On the contrary, the capital structure of listed companies is significantly influenced by their peer firms. That is to say, there is the peer effect. At the same time, the capital structures of peer firms have significant, positive, stable and healthy effect on the company’s own capital structure. Its explanation ability of the capital structure of the company itself is stronger than any observed traditional capital structure influencing factor.

The above conclusion in this paper has certain enlightenment significance on the capital structure theory and capital decision-making behaviors of Chinese listed companies. It can be concluded that the peer effect of capital structure of listed companies may be related to the optimal capital structure theory. Although this paper has no rigorous proof in the theoretical analysis and empirical test, and this problem is still worth discussing about. Especially, the imitation behavior of capital structures of different companies is driven by the optimal capital structure. Solving these problems will help us to have better and deeper understanding of the influencing mechanism of peer effect.

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