Testing the influence of Capital Structure on Corporate profitability of Chinese listed companies

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Abstract

This study investigates the impact of capital structure on the profitability of non-financial listed companies in China for the period between 2010 and 2014. The entire sample data includes 571 companies from 12 different industries. The study builds a panel-data model for the data, use both linear model and quadratic model to test the relationship between capital structure and profitability.

Through correlation and regression analysis, the study finds that the relationship between total debt-asset ratio and profitability is negative, and relationship between long-term debt to total debt ratio and profitability is positive. Moreover, the quadratic model indicates that the evidence of optimal capital structure exist in the Chinese capital market.

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Chapter 1 Introduction

1.1 Research Background

In the corporate finance area, the analysis of capital structure and firm performance is still among the most interesting and important topics. From the fountainhead of the modern capital structure theory, the MM theory (Modigliani and Miller 1958) to now, numerous theoretical and empirical studies have added to the literature in this area. Most of them have agreed that the capital structure of a firm is a very important factor affected profitability and firm value.

The mainstream of these theories of capital structure set maximizing the value of the firm as the goal of capital structure optimization. That means there must exist an optimal capital structure. The core problem consists of identifying this and realizing it. The most successful theories from the literature are the Trade Off Theory, the Pecking Order Theory and the Agency Cost Theory. As they approach the issue from different prospective, they provide explanations with different paths to achieve the optimal. However, these theories only hold under certain conditions. So the "Capital structure puzzle" still remains to be revealed.

A significant prospect for the capital structure research area is a link between capital structure and corporate profitability. It is needed and crucial to improve profitability for the long-term viability of any enterprise. Changing the capital structure has a significant influence on the profitability of a firm via reducing the costs of financing, giving the markets good signals, improving the corporate governance structures and so on. Therefore, testing the relationship between capital structure and corporate profitability and making an optimal capital structure decision is of great importance.

There are lots of empirical research carried out within the area of capital structure decisions. In the 1980's, most of the studies focused on developed countries such as US, Japan, Canada and European countries. However, research which has concentrated on emerging countries has gradually increased. Some of these empirical studies show that the developed markets and the emerging markets reaction of changing in capital structure are widely different. Some of the theories cannot be tested in the emerging countries because of differences of the macroeconomic environment, policy and government surveillance levels and the institutional customs.

The securities market in China was established in 1990, and has experienced a rapid and wild growth. On average, there are around 100 new companies that are listed in both Shanghai and Shenzhen stock exchange every year. Distinct from stock market in more developed markets, the Chinese stock market is far from mature. The entire investment environment is determined mostly by changes of government policy, and some research shows that the market is far away from obtaining the semi-form EMH. However, the listed Chinese companies do provide a forum for research about the corporate finance policy issues, because the company must disclose all accounting information (balance sheets and income statements).

1.2 **Purpose of Study**

Due to differences between the economic systems of countries and the degree of development of their capital markets, the shaping mechanism of companies' capital structure has obvious cross-country differences. Therefore, in the context of China's distinct economic and environmental constraints, the study of capital structure has a very real importance for economists, and for policy makers.

With the continuous development of capital markets, in China listed companies commenced to take an interest in not only their own financing, but to pay more attention to capital structure and the methods of financing. Due to historical and institutional reasons, listed companies in China still retain particular characteristics of capital structure, such as low asset-liability ratio, higher concentration of ownership and the dominance of state-owned shares.

After 2005, with the unceasing trial of the reform of state-owned non-tradable shares, Chinese domestic investors have experienced a magnificent bullish market. The entire regulatory market shows the trend to become increasingly openly and unrestrained. More and more listed companies tend to adopt untraditional financing approaches such as corporate bonds, convertible bonds and other securities to satisfy their own financing demands instead of the traditional way of issuing stocks and borrowing short-term debts from banks and other financial institutions.

In the existing financial research area, many studies have been published on the topic of capital structure. Most researchers have focused on the effect of capital structure on firm value, agency costs and stock prices. On the other hand, there has been less research based on the

relationship between the company's capital structure and the firm’s profitability. Compared with the firm value, the mainstream optimizing objective, the profitability of a company is more elastic and short-time focused, and it is also much easier and accurate to evaluate. The generalized concept of profitability not only includes the measure of a company making extra earnings. It also comprises the growth ability, the ability to make free cash flow. Academia and the real financial investors have developed multitudinous mature indexes and ratios to measure the profitability, such as operating cash flow to assets, gross margin, Net Profit Margin, ROA, ROE, Revenue Growth Rate, and Net Profit Growth Rate.

This paper is dedicated to developing an empirical analysis of the company's capital structure, and to verify whether the changing of a firm’s financial means affected the profitability of the firm, using both static and dynamic approaches. By unifying both theory and empirical research methods, this paper uses listed company's annual report data, and conducts an empirical analysis of the relationship between capital structure and corporate profitability for Chinese listed companies.

1.3 Structure of the Research

There are five chapters in this paper. The current chapter has provided an introduction of the background knowledge. It also established the purpose of the study.

Chapter 2 provides an account of what kind of work has been published on the topic by accredited scholars and researchers. It demonstrates what knowledge and ideas have been proposed, and their relative strengths and weaknesses.

The methodology adopted to this paper, the sample selection, data analysis methods, and the way to pick the suitable model are covered in Chapter 3.Then, the analysis and discusses of the results is the Chapter 4.

Chapter 5 summarizes the results of this paper, and provides recommendations for future work in this area.

Chapter 2 Literature Review

2.1 Theoretical Literature

Systematic research on the theory of capital structure began from Modigliani and Miller’s groundbreaking work in the 1950s with the publication of the paper "The Cost of Capital, Corporation Finance and the Theory of Investment". While this paper has been treated as the birth of modern capital structure theory, after half a century the theories of capital structure are constantly innovating and developing. Scholars have introduced more factors into the capital structure decisions, such as taxes, bankruptcy costs, agency costs, and asymmetric information, right control and product market competition. However, the mechanisms and factors influencing capital structure and corporate profitability are still a mystery for scholars all over the world, as there are still many differences both on theoretical analysis and empirical study.

2.1.1 Modigliani–Miller theorem

In the middle of the 20th century, after undergoing a rigorous mathematical derivation and a large number of empirical studies, the Nobel Laureates and economists of United States, Modigliani and Miller, put forward the famous proposition that the capital structure decision is independent of a firm’s market value. In 1963, by publishing the article “taxes and the cost of capital：a correction”, they made an addition to this theory, by introducing corporate income taxes. These articles and research results constitute the MM theory.

The MM theory is that, in a perfect market, enterprise capital structure has nothing to do with enterprise's market value. This theorem is considered the cornerstone of the theory of modern capital structure. Subsequently, many other theories have been gradually relaxed the MM theoretical assumptions.

The MM theorem consists of two main parts. The first part deals with the five hypotheses of the theorem: (1) no tax; (2) the company's dividend policy has nothing to do with firm value; (3) issuing new debt will have no impact on market value of existing debt ;(4) no bankruptcy costs and (5) the capital market is efficient. Under these five assumptions,

Modigliani and Miller launched two basic structures: First, the efforts of enterprises to realize the market value maximization has been offset by investors' struggle of pursuing maximized investment income, and thus, the market value of any enterprise is independent of its capital structure. Second, after taking into account the debt risk factors, at no-debt and lower levels of debt situation, the enterprise return on equity can be changed by changing the capital structure. This change increases linearly with the increasing of corporate debt ratio.

While these assumptions only exist in theory, Modigliani and Miller then made an amendment which relaxed the tax-free assumption, and proved that in conditions of corporate income tax, by adjusting the capital structure, you can change the market value of enterprises. That is, through increasing the debt-asset ratio, a company's market value can be expected to increase by virtue of the tax shield.

As the MM theory has a series of strict conditions that are hardly in line with the reality, this has been the focus of controversy in the academic community. Nevertheless, the MM theory has inspired numerous debates among financial experts. With the gradual relaxation of the basic assumptions of MM theory, they developed a series of theories that include Trade-off, Pecking-order and agency cost theories. In short,

the emergence of MM theory was a major shift from the traditional view of capital structure theory to modern ideas, and it remains a landmark in capital structure theory.

2.1.2 Trade Off Theory

According to the modified MM theory, the greater the corporate debt, the greater the market value. As a result it is conceivable for a firm to implement a comprehensive 100% debt capital structure. This result does not correspond to reality. In the late 1970s, Trade Off Theory - a new corporate capital structure theory began to gain currency. The theory builds on the MM theory, but further relax the assumption that there are no bankruptcy costs. In the pursuit of more debt and seeking tax shield effect, the increase in debt has increased the risk of the enterprise, this may lead the enterprise into a financial crisis, even leading to bankruptcy. So adding more debt will inevitably increase the risk of reducing the market value of the firm. Therefore, the Trade Off Theory reflects both the tax benefits and the expected costs and liabilities or losses, by holding a balance between the cost of the benefits in the tax shield and long-term debt obtaining the capital structure to optimize firm value. The theory offers the possibility of a corporate capital structure with the optimal solution.

When the extent of the debt amount is very low, bankruptcy cost is very inconsequential and can be ignored. So the firm value increases with rising debt levels due to the presence of the tax shield effect. When debt reaches a certain limit, bankruptcy costs began to offset the debt tax shield effect, when marginal benefit from the debt tax shield equals marginal bankruptcy costs, the firm obtains the largest value and the optimal capital structure. If the company continues to get more debt, the enterprise value due to bankruptcy costs and agency costs is greater than the debt tax shield benefits and the enterprise value declines.

While the Trade Off Theory advances the discussion on capital structure, it has its own flaws. The present value of the cost of business bankruptcy is simply not accurate metric, to accurately calculating the optimal capital structure. Another critique is that in the real world, the company is in continuous operation over multiple periods, but the Trade Off Theory is a single period model without considering about the impact of retained earnings.

Based on the static Trade Off Theory, in recent years, some scholars have used a multi-period model to consider the impact of the financial crisis and the cost of the tax on capital structures to form a dynamic Trade Off Theory. The current discussion about dynamic models is fairly

intense. Frank and Goyal (2006) describes the general idea of a dynamic trade-off model that no matter what the optimal structure in the subsequent periods. Today's best financing options depend on the expectation of the optimal capital structure of subsequent periods. Because a dynamic tradeoff model emphasizes the different kinds costs, its conclusions would be different.

2.1.3 Pecking Order Theory

Far different from the Trade Off Theory, and based on signaling theory, Myers and Majluf proposed the Pecking Order Theory in 1976.This theory followed preconditions of asymmetric information that corporate insiders are more informed about business situation than outside investors. When the company management needs to finance a project with a positive expected return, as the representatives of the interests of the old shareholders, management are reluctant to issue new shares, because the new shareholders will share tin he benefits of the project and the deduct the benefits of the old shareholders. In addition, according to the signaling theory, equity financing is considered to be a

bad signal of company operating performance, and will lead to the company's stock price falling.

The Pecking Order Theory suggests that companies should give priority to the internal financing. That is financing from retained earnings. Because the source of financing not only can solve the problems caused by the equity financing which is mentioned above, and also can avoid the risk of bankruptcy caused by debt financing. If internal financing is insufficient, firm may give priority to debt financing, because interest income from bonds is fixed, shareholders can still get the extra benefits bringing by the project, and debt financing is seen as a positive sign, it may let the company's stock appreciate, and therefore increase the corporate value. The conclusion of the Pecking Order Theory is that corporate finance sequence should be: the internal of financing, debt financing, and finally equity financing.

However, it is considered to have the following disadvantages: It just explains the enterprise system under certain constraints for a firm incremental financing, it cannot reveal the dynamic changes of the capital structure of the business growth process.

2.1.4 Theories based on Agency Costs

Another very influential theory is the Agency Cost Theory. Modern business is essentially run by managers. Ownership and management are separated. So the separation between owners and managers brings agency problems and issues of incentives. Jensen, Michael C.; Meckling, William H. (1976) introduced agency theory to capital structure research, those costs include monitoring costs, constraints, costs and residual loss, as the determinant of capital structure. The financing structure will affect the manager's work effort level and other behaviors. Thus it will affect future corporate earnings and enterprise value. Jensen and Meckling pointed out that the optimal capital structure of enterprises should be at which agency cost is minimal at a given level of internal capital. Myers (1977) found another type of agency cost of debt, namely "any agreed payment to creditors will lead companies to abandon future investment projects which the net present value is greater than zero." (page154) Grossman and Hart (1983) enhanced the agency theory and established a proxy model (GH model), where debt is a security mechanism, which can force managers to increase personal efforts to reduce the ‘pleasure’, thereby reducing agency costs.

The theory of Control Right of Capital structure can be treated as a continuation Agency Cost Theory. In this, corporate capital structure is not only determines the distribution of corporate income cash flow, but also determines the allocation of corporate control. Equity and debt are important instruments of financing, but also a very important structure for control and governance. The theory can be divided into two categories, one is related to and control over the market, and the other related to and control over distribution. While it is very important about the area of corporate governance, it is not very relevant to the profitability of a company.

In total, the theories of capital structure have two main streams: the focus on how to obtain an optimal capital structure to maximize firm value; and the theories that treat capital structure as a tool of corporate governance. In this paper, we will concentrate on the theories which are relevant to the corporate profitability, namely the static and dynamic trade-off and pecking-order theories.

2.2 Empirical Literature

2.2.1 Empirical Studies in developed countries

After the appearance of the MM theory, the empirical work for testing various the hypotheses covers a wide range with only some of them related to corporate profitability.

Friend and Lang (1988), Kester (1986), Wald (1999) found that there is a very important negative correlation between profitability and the debt / asset ratio. Kester, and Wald also found that profitability is a factor with the biggest influence among all the factors influencing capital structure. If profitability increased by one standard deviation it would drive the long-term debt / asset ratio drop by 9.6 percentage points.

The research of Titman and Wessels (1988) shows that the industry of the company, company size, collateral value of assets, non-debt tax shield, growth, and profitability are all capital structure determinants. Rajan and Zingales (1995) through comparative analysis of France, Germany, United Kingdom and the United States and other industrialized countries, found the effect of the intangible assets ratio, growth opportunities, company size and profitability as the four variables affecting the company's capital structure. Frank and Goyal (2009) studied capital

structure factors on listed companies of the United States from 1950 to 2003 and found six core factors, confirming that the tangible assets ratio, company size and the inflation rate all have a positive correlation with the debt ratio, while profitability and growth were negatively correlated with the debt ratio.

Wald (1999) examined the factors associated with France, Germany, Japan and the United Kingdom related to capital structure using a heteroskedastic model other than normal linear regression. His research revealed that, net fixed assets/total assets and leverage were positively correlated and the non-debt tax shield, R&D, profitability and leverage were negatively correlated. The risk, sales revenue growth, company size and inventory in different countries show different effects. These results indicate that the institutional specific factors may be an important determinant of capital structure, and different agency and supervision problems exist across countries.

Booth et al (2001) in performing a comparative study concentrated on the capital structure in 10 developing countries. They used the Static Trade-Off, Pecking Order and the Agency Theories to explain differences in capital structure variables. The study found these were similar both in developing and developed countries, but sometimes, some factors,

particularly business risks and Tobin Q effect are contrary to expectations. The reason may be that companies in developing countries have excessive short-term debt, as well as different commercial credit financing methods.

In the 21st century, many studies have been published using the dynamic model of capital structure theory to measure the relationship between the profitability and capital structure. Fama and French (2002) test for financial leverage of the Trade-off Model and the Pecking Order Model, confirmed that the general predictions of Trade-Off models have a notable exception the factor of profitability. They identified a negative correlation between leverage and profitability and marked as "a scar on the trade-off model". One explanation is that the negative relationship is because of the influence of taxes. However, Kemsley and Nissim (2002) found that the personal income tax impact of capital structure was small or inconspicuous.

Abor (2005) tested the relationship between capital structure and profitability using the data from the Ghana Stock Exchange. He found that the short-term debt to total assets ratio is positively correlated to the ROE, but the long-term debt ratio demonstrates a negative impact.

Gill, et al., (2011) extended Abor's work by testing the effect of capital structure on profitability using US service and manufacturing firm. Their results show the same conclusions as Abor's work (2005).

2.2.2 Empirical Study – the case of China

Due to a short history of securities transactions, the imperfect regulatory and supervisory systems, the market economy in China is far from perfect, it would be expected that the empirical study results would be quite different from other countries.

Lu and Xin s (1998) joint study found that Chinese companies' debt ratio was found that profitability, size of listed companies and asset-backed value, and growth influenced capital structure and long-term debt ratio were not significant statistically. Wang and Yang (1998) believed that with the increase in the debt ratio, the profitability of listed companies have an upward tendency with ROE increasing. The study of Lv and Wang (2001) showed a negative correlation between the profitability of listed companies and asset-liability ratio, with a positive correlation between the size of the company's growth and the asset-liability ratio. Liu (2003) has originally studied the relationship

between the intensity of competition and capital structure, and found a positive correlation between the two. But the financial leverage and corporate performance were negatively correlated.

Chen et al (2005) used Shanghai and Shenzhen listed companies as samples. Their findings indicate that by selecting different measures of corporate value will arrive at different conclusions of the relationship between capital structure and corporate value. They were respectively using book value, ROE and Tobin's Q as measures of corporate value indicators. The results show that if one uses book value as a measure of enterprise value, there is a positive correlation between capital structure and corporate value. However, if using ROE as a measure of corporate value, the enterprise value of the debt ratio first decreases, then after a certain point, it increases. This fact may imply evidence that the optimal capital structure existed.

Xiao (2004) first used the dynamic model to perform their empirical analysis with the understanding of the issue of using the actual value instead of optimal value. From the empirical results, both the Trade Off Theory and Pecking Order Theory received strong support.

Chapter 3 Data and Methodology

3.1 Data Resource

This paper selected all the listed companies in the Shanghai and Shenzhen exchanges for years 2010-2014 as a data source, using Bloomberg and CSMAR databases.

In the sample selection, we follow seven principles as detailed:

(1) Do not consider financial listed companies, because of their own characteristics. International researchers have generally removed financial companies from of their samples;

(2) Pick the listed company with a relatively long life to ensure that the company is more mature;

(3) Exclude ST and PT listed companies. These companies either have abnormal financial status, or have more than two years of consecutive losses. If they are included in the study sample, they will bias the result.

(4) Do not include companies listed on the SME Board and Growth Enterprise Board. Use only data from main board of Shanghai and Shenzhen exchanges.

(5) Exclude the companies without valid data. Only pick the firms which have sufficient data for testing purposes.

(6) In order to avoid the effects of deviant operations of listed companies, firms with the asset-liability ratios is greater than 100% were removed.

(7) Companies which changed their main business or conducted a restructuring were not included in the sample.

According to the China Securities Regulatory Commission's categories, data were divided into total 21 categories.

Then with these principles in mind, we are able to select a sample of 571 firms and divide them into 12 categories as shown in Table 3.1:

Table 3.1

Industry	Frequency
Agriculture	8
Basic material	131
Consumer goods	55
Manufacturing	106
Media	13
Mining	23
Pharmacy	34
Real Estate	27
Retail	49
Technology	39
Transport	31
Utility	55

For the study period, we choose the period from 2010 to 2014. The influence of the financial crisis on the Chinese economy shrunk after 2010, so the factors of microeconomic environment remain similar for the years 2010 to 2014.

This paper uses 18 time period's data from 2010Q1 to 2014Q2 for each variable of every company.

3.2 **Variable Selection**

According to the previous studies, measures pertaining to capital structure and profitability need to follow these principles:

(1) It must be irrelevant to market price. That means we cannot use the P/E ratio, book to market ratio and other ratios, including market price factor. The reason is because the market price is always floating, and affected by the market situation. The research needs to focus on fundamental analysis and exclude any market factors.

(2) In order to avoid multicollinearity, we cannot keep total debt to assets, long-term debt to total debt ratio and short-term debt to total debt ratio simultaneously. For the same reason, we cannot use both ROA and ROE as independent variables.

In line with the previous research of Abor (2005), this present study uses ROE, Total debt to assets, long-term debt to assets, company's size factor, and sales growth as variables.

Profitability:

This study uses return on common equity as the variable to express the profitability of a firm. It is a common method used by previous

studies. Compared with ROA, ROE is the better way to measure a firm's profitability for common shareholders, as it is the most comprehensive and representative indicator to evaluate the company's own capital and accumulated benefits levels. It fully reflects the capability of investor's own capital to obtain a net benefits. ROE has good versatility, as it can be adapted to a wide range and does not have limitations from the industry. Compared with ROA, it highlights the relationship between investment and return. This paper does not use other common indicators of profitability such as EBIT and Free Cash Flow, because Chinese companies are in a very complicated tax situation. Companies need to pay a variety of other types of taxes prior to the payment of income tax, causing measurement difficulties.

Capital Structure:

This study uses total debt to total asset ratio and long-term debt to total asset ratio to represent the capital structure of a firm. These two indicators cover the most useful information of a firm's capital structure. We can obtain other ratios such as the total debt to total equity ratio, short-term debt to total asset ratio and total equity to total asset ratio from these two ratios by simple calculations. In terms of avoiding multicollinearity, only two of these ratios are applied in this paper.

Control variables:

This paper introduce some control variables to exhibit other factors effected the profitability of a firm. These are firm size and growth. The principle of selecting control variables is that control variable must have significant influence on response variables, but have small impact on, and are independent with explanatory variables. To represent the firm size factor, this paper use the natural logarithm of the total asset. SIZE=Ln (Total Assets). For the growth factor, in order to avoid correlation with the profitability, this paper uses the indicator of sales growth ratio.

3.3 **Regression Model**

The model is constructed to test the relationship between dependent variable ROE, the independent variables DA, LTD, and control variables GROWTH and SIZE.

Since the sample has been divided into 12 industry categories, and the feature of capital structure and control variables vary between different categories, this research use a Panel Data Model to test the relationship between capital structure and the profitability of a company. It uses dummy variables into model to test if there are some similarity within industry categories, and some significant differences among categories.

First, we assume that there is a single linear relationship between them. That means, the hypothesis is a higher financial leverage will boost companies' profitability, or suppress it.

The Panel Data Model can be constructed as follows:

$$ROE_{i,t} = \alpha_{i,t} + \beta_{1i,t} DA_{i,t} + \beta_{2i,t} LTD_{i,t} + \beta_{3i,t} SIZE + \beta_{4i,t} GROW + \varepsilon_{i,t}$$ …… Equation 3.1

where

ROE = Return on Equity

DA = Total Debt /Total Asset

LTD = Long-term Debt / Total Debt

SIZE= Ln (Total Assets)

GROW=Sales Growth Ratio

NDTS= Fixed Assets / Total Assets

This model is to test the linear relationship between capital structure and profitability.

After considering the industry effect on profitability, we obtain the model with dummy variables:

$$ROE_{i,t} = \alpha_{i,t} + \beta_{1i,t} DA_{i,t} + \beta_{2i,t} LTD_{i,t} + \beta_{3i,t} SIZE + \beta_{4i,t} GROW + \beta_{5i,t} \sum ki + \beta_{6i,t} \sum ki*DA + \varepsilon_{i,t}$$

…….Equation 3.2

Then, in the case of Trade Off Theory, any company would have an optimal capital structure, so we structure a quadratic model:

$ROE_{i,t} = \alpha_{i,t} + \beta_{1i,t} DA_{i,t} + \beta_{2i,t} DA2_{i,t} + \beta_{3i,t} LTD_{i,t} + \beta_{4i,t} SIZE + \beta_{5i,t} GROW + \varepsilon_{i,t}$ …….Equation 3.3

where

DA2 = the Square of DA

And a dummy variable model:

$ROE_{i,t} = \alpha_{i,t} + \beta_{1i,t} DA_{i,t} + \beta_{2i,t} DA2_{i,t} + \beta_{3i,t} LTD_{i,t} + \beta_{4i,t} SIZE + \beta_{5i,t} GROW + \beta_{6i,t} \sum ki + \beta_{7i,t} \sum ki * DA + \varepsilon_{i,t}$ …….Equation 3.4

In order to check if there is an optimal capital structure which can maximize firm's profitability, this model use a quadratic equation to representative a complicated relationship between DA and ROE. If there is an optimal capital structure, ROE must first increase then decrease as DA increases. So the coefficient of DA2 must be negative.

Chapter 4 Results

4.1 Descriptive Statistics

Table 4.1: Descriptive Statistics

VARIABLE	ROE (%)	DA (%)	LTD (%)	SIZE	GROW
Obs	10278	10269	10120	10275	10278
Mean	9.194703	33.49676	37.95337	22.58448	25.76386
Std. Dev.	10.8617	16.03814	26.59585	1.185077	111.6654
Min	-83.7522	0.030472	.0067982	18.33226	-96.4533
Max	92.34785	82.13603	99.93753	26.99871	4132.079
Skewness	0.498379	0.136087	1.296482	0.487029	19.00462
Kurtosis	10.62822	2.53519	4.845564	3.249085	521.1823

Table 4.1 demonstrates the summary descriptive statistics for all variables: dependent variables, independent variables and control variables. From this table we can obtain on initial impression for all variables of the sample.

In this table, we can know the average of ROE for the sample is approximately 9.19%, which implicates the profitability level expected

return of common stocks of sample companies. The average finance leverage: the total debt to total asset ratio remains at the level 33.5% of sample companies, the average long term debt level: long-term debt to total debt is 37.95%, compared to the data in developed countries. As both ratios are not high, that means Chinese listed companies do not use high leverage as a financing alternative.

For different industries, we calculate only means of variables by different industries, Table 4.2 demonstrates the results below:

Table 4.2: Means of variables by different industries

INDUSTRY	ROE	DA	LTD	SIZE	GROW
Agriculture	4.796	32.455	31.046	21.923	16.967
Basic Material	7.347	41.702	34.349	22.829	27.995
Consumer Goods	7.887	33.093	33.088	22.181	22.674
Manufacturing	9.479	26.641	28.041	22.346	19.968
Media	8.628	20.462	42.192	22.611	11.708
Mining	14.870	29.277	46.284	23.336	31.265
Pharmacy	11.580	25.910	30.929	21.969	18.830
Real Estate	11.504	31.172	46.437	22.884	43.477
Retail	11.003	31.846	31.495	22.532	25.925
Technology	7.220	28.738	30.369	22.389	31.949
Transport	10.168	32.773	64.872	23.045	23.870
Utility	9.388	43.656	62.625	22.800	29.141

As shown in Figure 1 to Figure 3 in Appendix B, the distributions of three variables within different industries are quite different. For ROE, we can see that the mining industry has the highest level of return on equity, followed by pharmacy, real estate and retail companies. The agriculture and high-technology industries have the lowest ROE.

But for the capital-structure variables, things are quite different. Figure 2 shows the overview for the debt-asset ratio among industries. It shows a very different picture with Figure 2. It suggests that Utility and Basic Material Industries have the highest-level debt-asset ratio, and the DA ratio of the Media industry is among the lowest. Figure 3 shows the same thing, which suggests that there are no significant correlations between ROE, DA and LTD ratio of industries average. Each industry has its own capital-structure factors and mechanisms to influence profitability. That is the reason why doing the analysis in every industry is necessary.

4.2 **Correlation analysis**

Table 4.3 Pearson Correlation Coefficients

	ROE	DA	LTD	SIZE	GROW
ROE	1.0000				
DA	0.2238**	1.0000			
LTD	-0.0241**	0.0884**	1.0000		
SIZE	0.1221**	0.2250**	0.0853**	1.0000	
GROW	0.0944**	0.0135	0.0084	-0.0188	1.0000

* Correlation is significant at 0.05 level

** Correlation is significant at 0.01 level

Table 4.3 provides the summary of the Pearson correlation analysis. The results show that most Pearson correlations between variables are statistically significant at the 0.01 level, but all Pearson correlation related to variable GROW are not significant even at the 0.05 level. This fact indicates that ROE DA LTD and SIZE are significantly inversely correlated to each other, but GROW seem to be not correlated with other variables.

The correlations between independent and control variables DA, LTD and SIZE are significant, indicating a possible multicollinearity problem. The Pearson correlations between DA and SIZE are positive and quite large, suggesting that a strong positive relationship between total debt-to-assets ratio and firm size.

4.3 Necessary Tests

4.3.1 Multicollinearity Problem

As shown in Table 4.2, the correlations among the main independent variables are really significant, which may lead to the multicollinearity problem. If the multicollinearity problem exists, it will have adverse effects on the model validity and its explanatory ability.

A normal measure to quantify the severity of multicollinearity is the Variance Inflation Factor (VIF).VIF has been used to assess how much the level of the variance of an estimated regression coefficient is increased because of the multicollinearity problem. A common rule of thumb is that if VIF is smaller than 5, the regression model can be considered with no multicollinearity. If it is bigger than 5, the regression

model may face some degree of multicollinearity. Also 10 has been proposed as a cut off value.

As shown from the results, all VIF factors are less than (5), so there is no multicollinearity problem in the regression models.

4.3.2 Heteroscedasticity problem

Another common problem to effect the validity and efficiency of the regression model is the heteroscedasticity problem. This problem can often happen with large cross-section sample. Since our sample is quite large and cross various industries, the heteroscedasticity is very prone to appear. If so, the OLS estimators will not have the smallest-variances compared with other unbiased estimators. That means the OLS estimators will not be efficient any longer.

There are several types of tests of heteroscedasticity and this paper will use one of the most popular test method: the White Test. The White Test provide the robust regression results along with OLS regression results for both pooled data regressions and for the panel data regression.

4.3.3 Autocorrelation problem

Since the sample is a time-series data, another problem which is likely to happen is the autocorrelation problem. The autocorrelation among regression model residuals has been tested using the Durbin-Watson factors, and using the unit root test. If the Durbin Watson factors are between (1) and (3) there is no autocorrelation problem. Otherwise, it is necessary to change the model to adapt the autocorrelation factors.

In the Panel Data Models, this paper provides the DW factors and analyzes if there is autocorrelation exists in the data.

4.4 **Pooled Regression Results**

In general, there are three methods to estimate a panel data model: pooled data, fixed effect and random effect models. The Pooled data Model is the easiest one, as it only consider no slope and constant difference between all companies. The pooled data model can provide a general overview of the relationship between independent and dependent variables, but it ignores the difference between companies.

Table 4.4. Coefficients of Pooled Regression Model of Equation 3.1

roe	coef.	std. err.	t	p>t
da	-0.20848	0.008107	-25.72	0.000
ltd	0.064753	0.010963	5.91	0.000
size	1.631346	0.089569	18.21	0.000
grow	0.011012	0.00099	11.13	0.000
_cons	-21.7959	1.991958	-10.94	0.000

Table 4.5 Coefficients of Pooled Regression Model of Equation 3.2

roe	coef.	std. err.	t	p>t
da	-0.1996	0.0086	-23.15	0.000
ltd	0.0442	0.0123	3.6	0.000
size	1.5585	0.0915	17.03	0.000
grow	0.0107	0.001	10.93	0.000
k1	-23.55	2.156	-10.92	0.000
k2	-20.8	2.071	-10.04	0.000
k3	-20.71	2.0308	-10.2	0.000
k4	-18.1	2.031	-8.91	0.000
k5	-20.7	2.0382	-10.16	0.000
k6	-23.12	2.1583	-10.71	0.000
k7	-16.54	2.1683	-7.63	0.000
k8	-19.12	2.1201	-9.02	0.000
k9	-18.4	2.0672	-8.9	0.000
k10	-22.64	2.0644	-10.97	0.000
k11	-20.43	2.1204	-9.64	0.000
k12	-18.97	2.0755	-9.14	0.000

(k1, k2, k3…k12 are dummy variables express 12 catalogues of industry)

From the Table 4.4 and Table 4.5, all the coefficients are statistically significant at the 1% level. Both tables show that the coefficients of DA are negative, approximately equal to -0.2, and coefficients of LTD are near positive at 0.05. The values of the coefficients indicate the positive relationship between total debt to total asset ratio and ROE, and the negative relationship between long term debt to total debt ratio and ROE.

Table 4.6 VIF factors for Pooled Regression Model of Equation 3.1

variable	vif	1/vif
ltd	1.59	0.627154
da	1.59	0.627393
size	1.07	0.938183
grow	1	0.999147
mean vif	1.31	

The VIF values shows that in the pooled regression model, there is no multicollinearity problem.

Table 4.7 White Test Result for Pooled Regression Model of Equation 3.1

source	chi2	df	p
heteroskedasticity	1663.49	69	0.000
skewness	492.45	15	0.000
kurtosis	20.64	1	0.000
total	2176.59	85	0.000

The result of the White test shows that in pooled regression model there is no heteroskedasticity problem.

Table 4.8 Coefficients of Pooled Regression Model of Equation 3.3

roe	coef.	STD.ERR	t	p>t
da	-0.1469824	0.02362	-6.22	0.000
da2	-0.0009066	0.000327	-2.77	0.006
ltd	0.0674879	0.011004	6.13	0.000
size	1.645667	0.089689	18.35	0.000
grow	0.011004	0.000989	11.12	0.000
_cons	-22.96563	2.03553	-11.28	0.000

Table 4.9 Coefficients of Pooled Regression of Equation 3.4

roe	coef.	std. err.	t	p>t
da	-0.1260	0.0240	-5.2500	0.0000
da2	-0.0011	0.0003	-3.2900	0.0010
ltd	0.0460	0.0123	3.7300	0.0000
size	1.5819	0.0918	17.2400	0.0000
grow	0.0107	0.0010	10.9400	0.0000
k1	-25.0610	2.2034	-11.3700	0.0000
k2	-22.3585	2.1234	-10.5300	0.0000
k3	-22.2143	2.0807	-10.6800	0.0000
k4	-19.5487	2.0773	-9.4100	0.0000
k5	-22.2360	2.0902	-10.6400	0.0000
k6	-24.5391	2.2002	-11.1500	0.0000
k7	-18.1091	2.2192	-8.1600	0.0000
k8	-20.7569	2.1767	-9.5400	0.0000
k9	-19.9531	2.1196	-9.4100	0.0000
k10	-24.22855	2.11934	-11.43	0.0000
k11	-22.00429	2.17251	-10.13	0.0000
k12	-20.36324	2.11707	-9.62	0.0000

The use of Equation 3.3 and 3.4 is to test the Trade Off Theory and to determine if there exists an optimal capital structure. Both coefficients of DA and DA2 in the two tables are statistically significant at the 99% level. The negative coefficient of DA2 indicates that the optimal capital structure exists.

From Table 4.9, the Equation 3.3 is presented as:

$$ROE=-21.7959-0.1469824da-0.0009066da^2+0.0674879ltd+1.645667size+0.011004grow$$

So we can obtain the optimal structure point is that DA=30.84%, ignore the industry effects. The Table 1 in Appendix B shows the regression results of Equation 3.4 within industries.

Since DA2 is simply the square of DA, there must be multicollinearity between DA and DA2. Moreover, there is no need to test the heteroskedasticity in this model for the same reason.

4.5 **Panel Data Results**

Before the panel data regression, there are some points which is necessary to figure out:

First, it is very necessary to check if the model have an autocorrelation problem. In the pooled data regression, there is no need of testing the autocorrelation problem because we treated the sample as cross-section data, the time-series was ignored.

For the panel data, time-series was set, and the autocorrelation problem may appear in this model. For the autocorrelation problem in panel data, The Wooldridge test is a feasible test. The result is demonstrated in Figure 5.

The result shows that the probability of autocorrelation is 0.0000. Therefore, the autocorrelation problem can be neglected.

Table 4.10 Fixed Effect Model Coefficients for Equation 3.1

roe	coef.	std. err.	t	p>t
da	-0.1976	0.0156	-12.6400	0.0000
ltd	0.0267	0.0180	1.4800	0.1390
size	-4.7864	0.3063	-15.6300	0.0000

grow	0.0083	0.0008	10.8100	0.0000
_cons	123.4248	6.8559	18.0000	0.0000

Table 4.11 Random Effect Model Coefficients for Equation 3.1

roe	Coef.	Std. err.	z	p>z
da	-0.20883	0.013444	-15.53	0.0000
ltd	0.042657	0.016298	2.62	0.0090
size	-0.87489	0.202682	-4.32	0.0000
grow	0.009564	0.000774	12.36	0.0000
_cons	35.15271	4.532906	7.76	0.0000

Table 4.12 Random Effect Model Coefficients for Equation 3.2

roe	coef.	std. err.	z	p>z
da	-0.2072	0.0137	-15.1400	0.0000
ltd	0.0316	0.0167	1.8900	0.0590
size	-1.0156	0.2056	-4.9400	0.0000
grow	0.0095	0.0008	12.2600	0.0000
k1	-7.1230	2.7166	-2.6200	0.0090
k2	-1.9089	1.1676	-1.6300	0.1020
k3	-3.6540	1.3885	-2.6300	0.0080
k4	-1.6056	1.5882	-1.0100	0.3120
k5	-3.1721	1.2234	-2.5900	0.0100
k6	-4.9120	2.2239	-2.2100	0.0270
k7	3.5713	1.7922	1.9900	0.0460
k8	-0.1591	1.6913	-0.0900	0.9250
k9	-0.4011	1.4266	-0.2800	0.7790
k10	-5.1022	1.5198	-3.3600	0.0010

k11	-0.9535	1.6103	-0.5900	0.5540
k12	0.0000	(omitted)		
_cons	40.4079	4.7239	8.5500	0.0000

The Hausman White test result in Appendix B figure 3 shows that there is no significant difference between the FE model and the RE model.

From Table 4.5.1 to 4.5.4, the results are similar to the results of Pooled Data Model. The DA coefficient is negative and the LTD coefficient is positive. The difference is that in Table 4.5.1 and 4.5.3, the coefficients of LTD are not significant at 95% level. That may tell the fact after considering firm peculiarity, long term debt proportion is no longer important for firm's profitability.

Table 4.13 Fixed Effect Model Coefficients for Equation 3.3

roe	**coef.**	**std. err.**	**t**	**p>t**
da	-0.0279	0.0389	-0.7200	0.4740
da2	-0.0024	0.0005	-4.7600	0.0000
ltd	0.0235	0.0180	1.3000	0.1920
size	-4.7617	0.3060	-15.5600	0.0000
grow	0.0082	0.0008	10.7200	0.0000

Table 4.14 Random Effect Model Coefficients for equation 3.3

roe	coef.	std. err.	z	p>z
da	-0.0719	0.0350	-2.0500	0.0400
da2	-0.0020	0.0005	-4.2300	0.0000
ltd	0.0422	0.0163	2.5900	0.0100
size	-0.8507	0.2028	-4.1900	0.0000
grow	0.0095	0.0008	12.3000	0.0000
_cons	32.7538	4.5722	7.1600	0.0000

Table 4.15 Random Effect Model Coefficients for equation 3. 4

roe	coef.	std. err.	z	p>z
da	-0.0669	0.0352	-1.9000	0.0570
da2	-0.0020	0.0005	-4.3300	0.0000
ltd	0.0302	0.0167	1.8100	0.0710
size	-0.9859	0.2057	-4.7900	0.0000
grow	0.0094	0.0008	12.2000	0.0000
k1	-7.4168	2.7189	-2.7300	0.0060
k2	-2.2805	1.1713	-1.9500	0.0520
k3	-3.9330	1.3907	-2.8300	0.0050
k4	-1.7809	1.5895	-1.1200	0.2630
k5	-3.5140	1.2265	-2.8700	0.0040
k6	-5.0074	2.2252	-2.2500	0.0240
k7	3.2063	1.7951	1.7900	0.0740
k8	-0.6515	1.6961	-0.3800	0.7010
k9	-0.7722	1.4299	-0.5400	0.5890
k10	-5.5319	1.5238	-3.6300	0.0000
k11	-1.2944	1.6131	-0.8000	0.4220

k12	0.0000	(omitted)		
_cons	38.1580	4.7550	8.0200	0.0000

For the quadratic model, the results are quite different from the results in 4.4. First, the coefficient of DA is not significant any longer. Only the coefficient of the Random Effect Model without dummy variables is significant at 95% level. The p-value of coefficient of Fixed Effect Model is 0.474, it is far away from significant. Therefore, the evidence of optimal capital structure derived from the Panel Data Model are not very significant.

From the Random Effect Model, the optimal capital structure can be calculated. The optimal point is between 33% and 36%. The results is not far from the conclusion of Pooled Regression Model. But it does not include the difference of DA2 across industries.

Chapter 5 Conclusions and Limitations

This research paper use a sample of 571 Chinese listed companies, to test the relationship between the probability and capital structure, and to verify the efficiency of the Trade Off Theory conclusions in China.

From the analysis in Chapter 4, there is a significant negative relationship between ROE and DA, moreover, ROE and LTD are positively correlated. The result is in line with previous study Wald (1999) on US markets and Lu (1996) on Chinese markets. Moreover, different from Abor (2005)'s work, the regression results indicate that ROE and LTD are positively correlated.

The results are in line with the reality that when a company has strong profitability, it can retain more surplus earnings, so it will prefer internal-financing than raise debt. But if a high-profit company wants to use debt financing, it will prefer long-term debt to diversify risks. Moreover, high-profit companies find it much easier to receive long-term debt.

The test of optimal capital structure is more comprehensive. The Pooled Data Model suggests that there is an optimal capital structure point for Chinese listed companies, but the Panel Data Model does not give strong support for this conclusion. For the pooled data model, the optimal point of debt-asset ratio is near 31%, but fixed effect and random effect models suggests that the optimal point is between 33% and 36%. Therefore, the optimal capital structure exists theoretically among Chinese Listed Companies. The Trade Off Theory can be verified in the sample.

However, we can point out some deficiencies in this paper. First, the regression models are static so they can only demonstrate the static situation of capital structure and profitability, but cannot reveal the dynamic relationship between them. Next, the model only picks ROE to represent the profitability, but in fact, ROE can only reveal part of the profitability of a firm. Additionally, this paper only use the debt-asset ratio and long-term liability ratio as independent variables, so the changes of equity structures cannot be revealed. Lastly, this paper only uses dummy variables to express the difference among industries, but further analysis of specific industries is necessary.

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Appendix A: Companies included in the sample

Agriculture			
000713	HEFEI FENGLE S-A	000735	LUONIUSHAN GRO-A
002069	ZHANGZIDAO GRO-A	600598	HEILONGJIANG-A
600108	GANSU YASHENG-A	000592	ZHONGFU STRAIT-A
600354	GANSU DUNHUANG-A	000663	FUJIAN YONGAN-A
Basic Material			
000698	SHENYANG CHEM-A	601003	BENGANG STEEL-B
600531	HENAN YUGUANG-A	002108	YUNNAN YUNTIAN-A
600500	SINOCHEM INTL-A	200761	JILIN JI EN NI-A
000707	HUBEI SHUANG S-A	600096	JIAOZUO WANFAN-A
000887	ANHUI ZHONGDI-A	600432	WUHAN IRON & S-A
000825	SHANXI TAIGANG-A	000612	SHANDONG HUALU-A
600078	JIANGSU CHENG-A	600005	XINJIANG TIAN-A
600549	XIAMEN TUNGSTEN	600426	TAIYUAN COAL G-A
002162	SHANGHAI CIMIC-A	000877	ZHEJIANG JIANFNG
600318	ANHUI CHAODONG-A	000968	KINGFA SCI.-A
000039	CHINA INTL MAR-A	600668	CHONGQING JIAN-A
000786	BEIJING NEW BUIL	600143	BAOJI TITANIUM-A
200012	CSG HOLDING CO-B	000950	NINGXIA XINRI -A
600449	NINGXIA BUILDI-A	600456	AEOLUS TYRE CO-A
002004	HUAPONT-NUTRIC-A	600165	ANGANG STEEL-A
600091	BAOTOU TOMOR-A	600469	KAILUAN ENERGY-A
600409	TANGSHAN SANYO-A	000898	FUSHUN SPECIAL-A
000599	QINGDAO DOUBLE-A	600997	INNER MONG YUA-A
002136	ANHUI ANNADA -A	600399	TONGLING NONFE-A
600389	NANTONG JIANGS-A	000683	ADVANCED TECH -A
600328	INNER MONGOLIA-A	000630	SHANDONG HUMON-A
600352	ZHEJIANG LONGS-A	000969	ANYANG IRON -A
000422	HUBEI YIHUA CH-A	002237	GUIZHOU JIULIA-A
600210	SHANG ZI JIANG-A	600569	XINING SPEC ST-A
600507	FANGDA SPECIAL-A	002037	JIANGXI WANN-A
600721	XIN JIANG BAI-A	600117	SHANDONG JINJING
002080	SINOMA SCIENCE-A	000789	XIANGTAN ELEC -A
000407	SHANDONG SHENG-A	600586	SHAANXI XINGHU-A
600182	GITI TIRE CORP-A	002125	GUANGDONG ORIE-A
600423	LIUZHOU CHEMICAL	002109	XINYU IRON & S-A
002054	WANHUA CHEMIC-A	002167	DYMATIC CHEMIC-A
000962	HUNAN VALIN ST-A	600782	NINGXIA ORIENT-A
000932	SICHUAN MEIFEN-A	000885	WUHU CONCH PRO-A

600309	XINGJING QINGS-A	000619	HUBEI XINGFA-A
000731	ZHEJIANG HAILI-A	600141	JIANGXI BLACK -A
600425	JILIN YATAI GR-A	002068	XINJIANG ZHONG-A
002203	TANGSHAN JIDON-A	002092	XINJIANG DUSHANZ
600881	HEBEI IRON-A	600339	ANHUI FANGXING-A
000401	SINOPEC SHANG-A	600552	YUNNAN TIN CO-A
000709	SEAGULL KITCH -A	000960	GUANGDONG TAPA-A
600688	LUXI CHEMICAL-A	002233	NBTM NEW MATER-A
002084	NANJING HONGBA-A	600114	CHINA FIBERGLA-A
000830	MAANSHAN IRON-A	600176	GUIZHOU CHITIA-A
002165	SHANXI SANWEI -A	600227	BAOSHAN IRON & S
600808	FUJIAN CEMENT-A	600019	SHANDONG IRON -A
000755	HENAN HENGXING-A	600022	YUNNAN SALT -A
600802	NORTH HUAJIN C-A	002053	HUBEI SANONDA-B
002132	KINGRAY NEW MA-A	200553	LIUZHOU LIANGM-A
000059	QINGHAI SALT-A	600249	INNER MONGOLIA-A
600390	JIANGSU FASTEN-A	600010	SHENZHEN ZHONG-A
000792	SICHUAN LUT-A	000060	YUNNAN COPPER-A
000890	INNER MONGOLIA-A	000878	INNER MONG BAO-A
000912	COFCO BIOCHEM -A	600111	GANSU JIU STEE-A
600277	GANSU QILIAN-A	600307	YUNNAN ALUM-A
000930	HENAN ZHONGFU-A	000807	ANHUI JING-A
600720	CHONGQING SANX-A	002171	SHENZ UNIVERSE-A
600595	HEBEI CANGZHOU-A	000023	BEIJING SHOUG-A
000565	ZHEJIANG XINAN	000959	HENAN TONGLI C-A
600230	SICHUAN SHUANG-A	002205	FUYAO GROUP-A
600596	HENAN HUANGHE-A	600282	SANSTEEL MINGU-A
000935	LINGYUAN IRON-A	600660	SHANXI COKING-A
600172	XINJIANG GUOTO-A	002110	GUANGDONG HEC -A
600231	NANJING IRON-A	600740	HENAN SHENHUO-A
000933	RUITAI MATERIA-A	600673	XINJIANG BA YI
600581	SHUANGLIANG EC-A		
Consumer goods			
600872	JONJEE HIGH-TE-A	600069	HENAN YINGE-A
600251	XINJIANG GUANN-A	600321	SICHUAN GUODONG
002240	GUANGDONG WEIH-A	600978	GUANGDONG YIHU-A
600103	FUJIAN QINGSHA-A	600177	YOUNGOR GROUP-A
000860	BEIJING SHUNX-A	600567	SHANYING PAPER
000752	TIBET GALAXY-A	000876	NEW HOPE LIUHE-A
000850	ANHUI HUAMAO-A	002220	DALIAN TIANBAO-A
600095	HARBIN HIGH-TE-A	600300	V V FOOD BVRG-A
600966	SHANDONG BOHUI-A	000910	DARE TECH CO -A
600356	MUDANJIANG HEN-A	600597	BRIGHT DAIRY-A
002100	XINJIANG TECON-A	600600	TSINGTAO BREW-A
002259	SICHUAN SHENGD-A	000488	SHANDONG CHEN-A
600439	HENAN REBECCA -A	600866	STAR LAKE BIOS-A

200018	SHENZ VICTOR-B	600073	SHANG MALING-A
600107	HUBEI MAILYARD-A	000982	NINGXIA ZHONGY-A
600987	ZHEJIANG HANGM-A	600308	SHANDONG HUATA-A
002144	HONGDA HIGH-TE-A	002070	ZHONGHE CO -A
600298	ANGEL YEAST CO-A	000716	NANFANG BLACK-A
002087	HENAN XINYE -A	600836	SHANG JIELONG-A
600887	INNER MONG YIL-A	002228	XIAMEN HEXING-A
002042	HUAFU TOP DYED-A	200986	FOSHAN HUAXIN-B
000729	BEIJING YAN-A	000158	SHIJIAZHUANG C-A
002083	SUNVIM GROUP-A	600543	GANSU MOGAO IN-A
002067	ZHEJIANG JING -A	000955	XINLONG HOLDIN-A
002193	JINING RUYI-A	600438	TONGWEI CO-A
600429	BEIJING SANYUAN	002078	SHANDONG SUN -A
600127	HUNAN JINJIAN-A	600400	JIANGSU HONGDO-A
Pharmacy			
002020	ZHEJIANG JINGX-A	000915	NORTHEAST PHAR-A
002166	GUILIN LAYN -A	600535	YABAO PHARMACE-A
600518	KANGMEI PHARMA-A	000597	CHINA RESOURCE-A
600285	HENAN LINGRUI-A	600351	HARBIN PHARMA-A
000919	JINLING PHARM-A	000999	HARBIN PHARM.G-A
600079	HUMANWELL HEAL-A	600664	HUBEI GUANGJI-A
600267	ZHEJIANG HISUN-A	600829	NORTH CHINA PHAR
600161	BEIJING TIAN-A	000952	SHANDONG LUK-A
600201	INNER MONG JIN-A	600812	PKU HEALTHCARE-A
600572	ZHEJIANG CONBA-A	600789	CHANGCHUN HIGH-A
000538	YUNNAN BAIYAO-A	000788	SOUTHWEST PHAR-A
000606	QINGHAI GELAT-A	000661	JIANGSU KANION-A
600867	TONGHUA DONGBA-A	600666	JOINCARE PHARM-A
600568	ZHONGZHU HOLD-A	600557	CHONGQING TAIJ-A
000756	SHANDONG XINHU-A	600380	JIUZHITANG CO -A
600594	GUIZHOU YIBAI-A	600129	ZHEJIANG NHU-A
Manufacturing			
600093	SICHUAN HEJIA-A	000806	BEIHAI YINHE I-A
002031	GREATOO INC-A	600336	AUCMA CO LTD -A
000913	ZHEJIANG QIAN MO	000901	AEROSPACE HI-T-A
600761	ANHUI HELI CO-A	600523	GUIZHOU GUIHANG
002105	HL CORP -A	600893	XI'AN AERO-ENG-A
600066	ZHENGZHOU YUT-A	002248	WAIHAI HUADONG-A
600262	INNER MONGOLIA-A	002011	ZHEJIANG DUN'A-A
200521	HEFEI MEILING-B	000821	HUBEI JINGSHAN-A
600312	HENAN PINGGAO	600580	WOLONG ELECTRI-A
600388	FUJIAN LONGKING	000678	XIANGYANG AUTO-A
600031	SANY HEAVY INDUS	600178	HARBIN DONGAN-A
600379	SHAANXI BAOGUA-A	600685	GUANGZHOU SHIP-A
000425	XCMG CONSTRUCT-A	600166	BEIQI FOTON-A

002005	ELEC-TECH INTE-A	002101	HONGTU TECHNOL-A
600268	GUODIAN NANJ-A	600480	LINGYUN INDUSTRI
600582	TIAN DI -A	000738	AVIC AERO-ENGI-A
600587	SHINVA MEDICAL-A	600970	SINOMA INTERNATI
200550	JIANGLING MOTO-B	002050	ZHEJIANG SANHU-A
000680	SHANTUI CONST-A	600690	QINGDAO HAIER-A
600391	SICHUAN CHENGF-A	600202	HARBIN AIR CON-A
600590	TELLHOW SCI-TE-A	600884	NINGBO SHANSHAN
600889	NANJING CHEM-A	000836	TIANJIN XINMAO-A
000404	HUAYI COMPRESS-A	600742	CHANGCHUN FAWA-A
600261	ZHEJIANG YANKO-A	000768	AVIC AIRCRAFT-A
002009	MIRACLE AUTOMA-A	600072	CSSC STEEL STR-A
000957	ZHONGTONG BUS-A	600765	AVIC HEAVY MAC-A
002085	WANFENG AUTO -A	000782	GUANGDONG XINH-A
002111	WAIHAI GUANGTA-A	600303	LIAONING SG AU-A
600760	ZHONGHANG HEIB-A	600218	ANHUI QUANCHAI-A
600487	HENGTONG OPTIC-A	600110	CHINA-KINWA-A
000528	GUANGXI LIUGON-A	600416	XIANGTAN ELEC-A
600495	JINXI AXLE -A	601766	CSR CORP LTD -A
000410	SHENYANG MACH-A	002129	TIANJIN ZHONG-A
000816	JIANGHUAI ENGI-A	600468	TIANJIN BENEFO-A
002046	LUOYANG BEARIN-A	000400	XJ ELECTRIC-A
600055	CHINA RESOURCE-A	600741	HUAYU AUTOM-A
000070	SHENZHEN SDG INF	600346	DALIAN RUBBER-A
002023	SICHUAN HAITE-A	600815	XIAMEN XGMA-A
600112	GUIZHOU CHANZH-A	000633	SHENYANG HEJIN-A
002126	ZHEJIANG YINLU-A	600526	ZHEJIANG FEIDA-A
600150	CHINA CSSC HOL-A	600654	SHANG FEILO CO-A
000651	GREE ELECTRIC-A	600184	NORTH ELECTRO-A
000666	JINGWEI TEXTIL-A	000949	XINXIANG CHEM-A
002169	GUANGZHOU ZHI-A	600192	LANZHOU GREAT-A
000559	WANXIANG QIAN-A	600104	SAIC MOTOR-A
002123	RONGXIN POWER -A	600418	ANHUI JIANGHUA-A
600086	EASTERN GOLD J-A	002097	SUNWARD INTELL-A
000777	SUFA TECH INDS-A	600089	TBEA CO LTD-A
600960	BINZHOU BOHAI -A	600499	KEDA CLEAN ENE-A
600169	TAIYUAN HEAVY-A	000980	HUANGSHAN JINM-A
600875	DONGFANG ELECT-A	600710	CHANGLIN CO -A
600879	CHINA AEROSPAC-A	000923	XUANHUA CONST-A
600063	ANHUI WANWEI U-A	002073	MESNAC CO LTD -A
Media			
000839	CITIC GUOAN-A	000917	HUNAN TV & BRO-A
600831	SHAANXI BROADC-A	600718	NEUSOFT CORP-A
600410	BEIJING TEAMSU-A	600050	CHINA UNITED-A
600588	YONYOU SOFTWAR-A	600570	HUNDSUN TECHN-A
000503	SEARAINBOW HLD-A	600037	BEIJING GEHUA

000793	HUAWEN MEDIA INV	000948	YUNNAN NANTIAN-A
Mining			
600797	INSIGMA TECH -A	600121	ZHENGZHOU COAL-A
000937	JIZHONG ENERGY-A	002155	CHENZHOU MININ-A
600547	SHANDONG GOLD-MI	600157	WINTIME ENERGY-A
601666	PINGDINGSHAN -A	600489	ZHONGJIN GOLD
601168	WESTERN MINING-A	601958	JINDUICHENG -A
000983	SHANXI XISHAN-A	600714	QINGHAI JINRUI-A
600971	ANHUI HENGYUAN-A	000939	WUHAN KAIDI-A
600508	SHANGHAI DATUN	600123	SHANXI LANHUA-A
000758	CHINA NONFERRO-A	600397	ANYUAN COAL IN-A
002128	HUOLINHE COAL-A	600497	YUNNAN CHIHONG-A
000629	PANGANG GROUP -A	601918	SDIC XINJI -A
601699	SHANXI LU'AN -A	600395	GUIZHOU PANJIA-A
Real Estate			
000926	HUBEI FUXING-A	600565	CHONGQING DIMA
600067	CITYCHAMP DART-A	002060	GUANGDONG NO.2-A
600730	CHINA HI-TECH-A	002051	CHINA CAMC -A
600745	JOIN. IN-A	600215	CHANGCHUNJINGA-A
600862	TONTEC TECHNOL-A	600170	SHANG CONSTR-A
600491	LONG YUAN CONS-A	600068	CHINA GEZHOUBA-A
000882	BEIJING HUALIA-A	000090	SHENZHEN TAGEN-A
600545	XINJIANG URBAN-A	600284	SHANGHAI PUDON-A
600528	CHINA RAILWAY-A	002077	JIANGSU DAGANG-A
600463	BEIJING AIRPOR-A	600724	NINGBO FUDA-A
600039	SICHUAN ROAD-A	600502	ANHUI WATER-A
002135	ZHEJIANG SOUTH-A	600238	HAINAN YEDAO CO
600853	LONGJIAN ROAD-A	600820	SHANG TUNNEL-A
600326	TIBET TIANLU-A		
Retail			
600153	XIAMEN C & D-A	600058	MINMETALS DEVE-A
200025	SHENZ TELLUS-B	002221	ORIENTAL ENERG-A
600258	BTG HOTELS GROUP	000785	WUHAN ZHONGNAN-A
600811	ORIENT GROUP-A	000753	FUJIAN ZHANGZH-A
000159	XINJIANG INTL IN	600739	LIAONING CHENG-A
000417	HEFEI DEPT ST0-A	000679	DALIAN FRIENDS-A
600175	MEIDU HOLDINGS-A	600051	NINGBO UNITED-A
600694	DASHANG GROUP -A	002262	JIANGSU NHWA -A
600677	AEROSPACE COMM-A	600361	BEIJING HUALI-A
000501	WUHAN DEPT STORE	601607	SHANG PHARM -A
000632	FUJIAN SANMU G-A	600358	CHINA UNITED T-A
600653	SHANG SHENHUA -A	600774	WUHAN HANSHAN-A
600120	ZHEJIANG ORIEN-A	000062	SHENZ HUAQIANG-A
600858	SILVER PLAZA-A	600546	SHANXI COAL -A
600865	BAIDA GROUP-A	600278	ORIENT INTL -A

200026	FIYTA HOLDING-B	000560	KUNMING SINOBR-A
600755	XIAMEN INTL TR-A	600241	LIAONING SHIDA-A
000061	SHENZ AGRICULT-A	000652	TIANJIN TEDA-A
600759	GEO-JADE PETRO-A	600828	CHENGSHANG GRO-A
200045	SHENZ TEXTILE-B	000759	ZHONGBAI HOLDI-A
600415	COMMODITIES CITY	000516	XIAN KAIYUAN-A
600704	ZHEJIANG MATER-A	600697	CHANGCHUN EURA-A
600138	CHINA CYTS-A	600778	XINJIANG YOUHAO
600655	SHANG YUYUAN-A	000829	TELLING TELECO-A
600280	NANJING CENTRA-A		
Technology			
000988	HUAGONG TECH -A	600667	WUXI TAIJI IND-A
002052	SHENZHEN COSHI-A	002179	CHINA AVIATION-A
600601	FOUNDER TECHNO-A	000733	CHINA ZHENHUA-A
000050	TIANMA-A	002241	GOERTEK INC -A
000063	ZTE CORP-A	002436	SHENZHEN FASTP-A
200020	SHENZ ZHONGHEN-B	000066	CHINA GREATWAL-A
002055	SHENZHEN DEREN-A	200725	BOE TECHNOLOGY-B
600060	HISENSE ELEC-A	002199	ZHEJIANG EAST-A
200016	KONKA GROUP-B	600360	JILIN SINO-MIC-A
002115	SUNWAVE COMMUN-A	600460	HANGZHOU SILAN-A
600330	TDG HOLDING-A	000100	TCL CORP-A
600288	DAHENG NEW EPO-A	000938	TSINGHUA UNISP-A
600525	CHANGYUAN GRO-A	600839	SICHUAN CHANG-A
000748	GREATWALL INFO-A	000823	GUANGDONG GOWORL
002185	TIANSHUI HUATI-A	002151	BEIJING BDSTAR-A
002156	NANTONG FUJITS-A	002045	GUOGUANG ELECT-A
600151	SHANGHAI AEROS-A	600703	SANAN OPTOELEC-A
600183	SHENGYI TECH C-A	002138	SHENZHEN SUNLO-A
600888	XINJIANG JOINW-A	600100	TSINGHUA TONG-A
600584	JIANGSU CHANGJ-A		
Transport			
600717	TIANJIN PORT -A	600017	RIZHAO PORT -A
601008	LIANYUNGANG -A	600269	JIANGXI GANYUE-A
600033	FUJIAN EXPRESS-A	600018	SH INTL PORT -A
600794	ZHANGJIAGANG F-A	600548	SHENZHEN EXPRE-A
000088	SHENZ YANTIAN-A	000099	CITIC OFFSHORE-A
600009	SHANG INTL AIR-A	600708	SHANGHAI HAIBO-A
600279	CHONGQING GANG-A	600798	NINGBO MARINE-A
600428	COSCO SHIPPING-A	600350	SHANDONG HI-SP-A
600317	YINGKOU PORT-A	600020	HENAN ZHONGYUA-A
002040	NANJING PORT-A	601872	CHINA MERCHANT-A
000900	XIANDAI INVEST-A	601111	AIR CHINA LTD-A
200152	SHANDONG AIRLINE	600787	CMST DEVELOPM-A
000507	ZHUHAI PORT CO-A	000905	XIAMEN DEVELOPME

600119	YUD YANGTZE-A	601006	DAQIN RAILWAY -A
600368	GUANGXI WUZHOU-A	200429	GUANGDONG PROV-B
600676	SHANG JIAO YUN-A		
Utility			
000966	GUODIAN CHANGY-A	600995	YUNNAN WENSHAN-A
000531	GUANGZHOU HENG-A	000993	FUJIAN MINDONG-A
600578	EIJING JINGNEN-A	600310	GUANGXI GUIDON-A
600868	GUANGDONG MEIY-A	000692	SHENYANG HUITI-A
600744	DATANG HUAYIN-A	000720	SHANDONG XINNE-A
600116	CHONGQING THRE-A	600979	SICHUAN GUANGA-A
600396	SHENYANG JINSH-A	600008	BEIJING CAP CO-A
600864	HARBIN HATOU -A	600749	TIBET TOURISM -A
000899	JIANGXI GANNEN-A	000826	SOUND ENVIRONM-A
600323	GRANDBLUE ENV-A	600900	CHINA YANGTZE-A
000544	ZHONGYUAN ENVI-A	600187	HEILONGJIANG I-A
001896	HENAN YUNENG-A	600505	SICHUAN XICHAN-A
600874	TIANJIN CAP-A	600509	XINJIANG TIANF-A
600236	GUANGXI GUIGAN-A	000027	SHENZHEN ENERG-A
000069	SHENZEN OVERSE-A	600027	HUADIAN POWER-A
600635	SHANGHAI DAZHO-A	002033	LIJIANG YULONG-A
600863	INNER MONGOL M-A	002159	WUHAN SANTE -A
000685	ZHONGSHAN PUBLIC	000543	AN HUI WENERGY-A
600886	SDIC POWER HOL-A	000690	BAONENGYUAN-A
200539	GUANGDONG ELEC-B	600283	QIANJIANG WATE-A
000601	GUANGDONG SHAO-A	600168	WUHAN SANZHEN-A
600131	SICHUAN MINJ-A	600021	SHANGHAI ELECT-A
600292	CPI YUANDA ENV-A	000301	JIANGSU WUJIAN-A
200037	SHENZ NANSHAN-B	600795	GD POWER DEVEL-A
002039	GUIZHOU QIANYU-A	002267	SHAAN XI NATUR-A
600461	JIANGXI HONGCH-A	600969	HUNAN CHENDIAN-A
600098	GUANGZHOU DEVE-A	600674	SICHUAN CHUAN-A
000978	GUILIN TOURISM-A		

Appendix B: Figures and Tables

Figure 1: ROE within different Industries

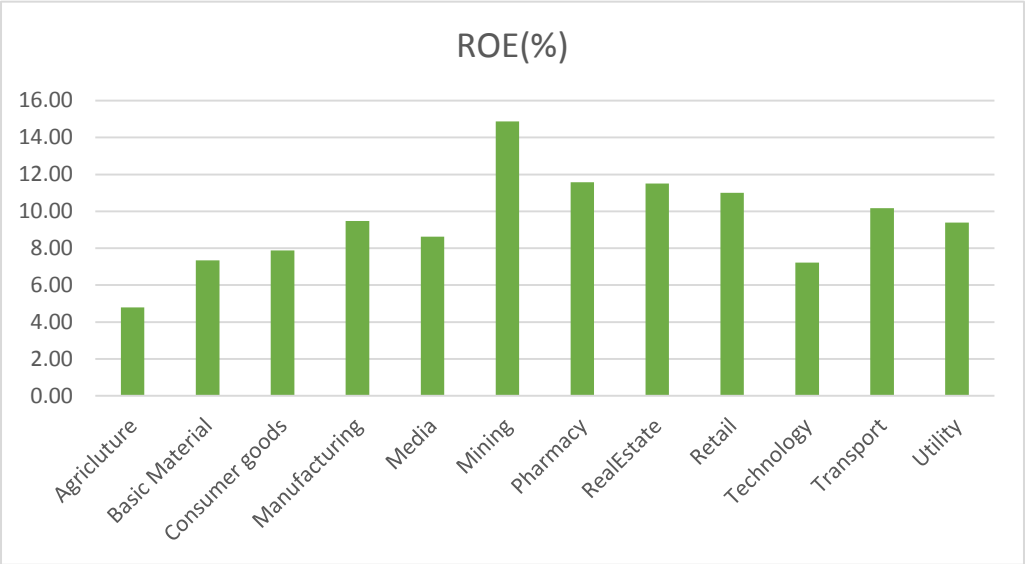

Figure 2: DA within different Industries

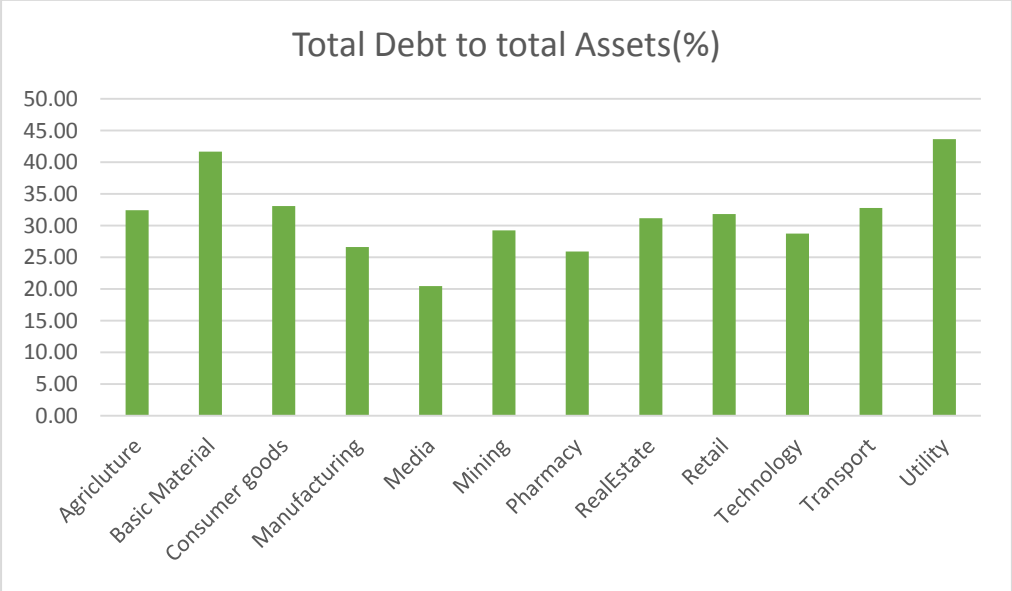

Figure 3: LTD within different Industries

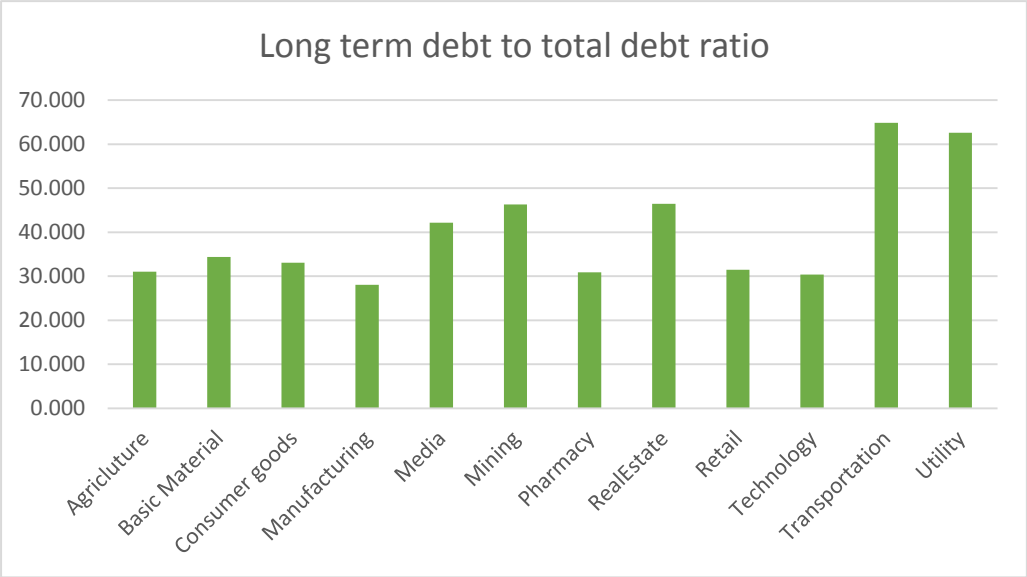

Table 1: Pooled Data Regression results of Equation 3. 4 by group

-> ic = 1

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	.1034158	.1852286	0.56	0.578	.2088976
da2	-.004032	.0025742	-1.57	0.120	-.6182587
ltd	-.0357306	.069189	-0.52	0.606	-.0548965
size	-1.103072	.924266	-1.19	0.235	-.1023317
grow	.0172067	.0134366	1.28	0.202	.1001463
_cons	30.98112	19.79196	1.57	0.120	.

-> ic = 2

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	.0683802	.096751	0.71	0.480	.0740728
da2	-.0038196	.0011384	-3.36	0.001	-.34717
ltd	.0933831	.0262087	3.56	0.000	.0796075
size	-.0112122	.2219995	-0.05	0.960	-.0010702
grow	.0080224	.0019725	4.07	0.000	.0813707
_cons	10.56929	5.256035	2.01	0.044	.

-> ic = 3

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	-.2242755	.068605	-3.27	0.001	-.3458465
da2	.001912	.0010062	1.90	0.058	.1914598
ltd	-.236521	.0451705	-5.24	0.000	-.1809037
size	3.137491	.3009143	10.43	0.000	.3078125
grow	.0201723	.0028196	7.15	0.000	.2051148
_cons	-54.91362	6.561817	-8.37	0.000	.

-> ic = 4

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	-.1646689	.0858453	-1.92	0.056	-.2303282
da2	-.0040565	.001348	-3.01	0.003	-.3437961
ltd	.1672486	.0686862	2.43	0.015	.1237542
size	1.794764	.4844904	3.70	0.000	.1321304
grow	.0591042	.0096883	6.10	0.000	.213172
_cons	-22.43825	10.78804	-2.08	0.038	.

-> ic = 5

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	-.1780916	.0657762	-2.71	0.007	-.2170396
da2	.0001351	.001116	0.12	0.904	.0094637
ltd	-.1403346	.0368929	-3.80	0.000	-.0887272
size	3.627566	.1820627	19.92	0.000	.3972705
grow	.0460635	.0044318	10.39	0.000	.2071447
_cons	-66.96439	4.187154	-15.99	0.000	.

-> ic = 6

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	-.2753444	.1232856	-2.23	0.027	-.5021363
da2	.0005328	.0025119	0.21	0.832	.0511374
ltd	.3953566	.0687009	5.75	0.000	.5829623
size	-.8229884	.3360104	-2.45	0.015	-.1609212
grow	-.0071172	.014996	-0.47	0.636	-.0288703
_cons	28.92318	7.216902	4.01	0.000	.

-> ic = 7

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	.1806897	.1227188	1.47	0.142	.2411978
da2	-.0058375	.0019015	-3.07	0.002	-.4893929
ltd	.0834329	.0835825	1.00	0.319	.0672996
size	-1.743265	.6000911	-2.91	0.004	-.1383258
grow	.018328	.0044319	4.14	0.000	.1984378
_cons	54.90431	13.99024	3.92	0.000	.

-> ic = 8

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	-.4502706	.131609	-3.42	0.001	-.5642007
da2	.0042111	.0019413	2.17	0.031	.3439496
ltd	.0310377	.0489152	0.63	0.526	.0315161
size	2.677066	.4103135	6.52	0.000	.2798665
grow	.0186643	.0028626	6.52	0.000	.273371
_cons	-41.8435	9.421018	-4.44	0.000	.

-> ic = 9

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	-.0594555	.0823259	-0.72	0.470	-.095141
da2	-.0009475	.0011636	-0.81	0.416	-.1045177
ltd	.1528387	.0412078	3.71	0.000	.1341829
size	1.87241	.2978876	6.29	0.000	.2057285
grow	.0263959	.0034679	7.61	0.000	.2430086
_cons	-30.24139	6.888273	-4.39	0.000	.

-> ic = 10

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	.1127868	.0898686	1.26	0.210	.1846479
da2	-.0047879	.001462	-3.27	0.001	-.4790404
ltd	-.030973	.0402483	-0.77	0.442	-.0341942
size	-.1339284	.2340875	-0.57	0.567	-.020564
grow	.0184155	.0030131	6.11	0.000	.2182055
_cons	11.53859	5.267307	2.19	0.029	.

-> ic = 11

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	-.2740919	.0915108	-3.00	0.003	-.506389
da2	.0036345	.0013336	2.73	0.007	.4666953
ltd	-.0875939	.0431795	-2.03	0.043	-.1527601
size	1.218079	.2992991	4.07	0.000	.1727979
grow	.0122394	.0046302	2.64	0.008	.1100105
_cons	-12.063	6.873949	-1.75	0.080	.

-> ic = 12

roe	Coef.	Std. Err.	t	P>|t|	Beta
da	.1138718	.0840642	1.35	0.176	.1839159
da2	-.0041718	.0009075	-4.60	0.000	-.6121214
ltd	.163818	.035724	4.59	0.000	.2305369
size	1.749887	.2845425	6.15	0.000	.2023576
grow	-.0098032	.0021409	-4.58	0.000	-.1378949
_cons	-30.49613	6.449904	-4.73	0.000	.

Table 2: Woodrige autocorrelation Results

```
Wooldridge test for autocorrelation in panel data
H0: no first-order autocorrelation
    F(  1,     570) =    604.364
           Prob > F =      0.0000
```

Table 3: Hausman Test Results

	Coefficients (b) fe	(B) .	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
da	-.1976441	-.2088283	.0111843	.007977
ltd	.0267038	.042657	-.0159532	.0077115
size	-4.786377	-.8748859	-3.911491	.2296279
grow	.0083104	.0095637	-.0012533	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

```
    Test:  Ho:  difference in coefficients not systematic

                  chi2(4) = (b-B)'[(V_b-V_B)^(-1)](b-B)
                          =      298.68
                Prob>chi2 =      0.0000
                (V_b-V_B is not positive definite)
```