The Impact of Capital Structure on Financial Performance of Agricultural Listed Companies in China Based on Multiple Linear Regression Model and Data Mining

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Abstract: Background: With the transformation and upgrading of the economy, the market capitalization scale of agricultural listed companies has become larger and larger, but the problems caused by the unreasonableness of their capital structure have become increasingly prominent. This study aims at examining the relationship between capital structure and financial performance of agricultural listed companies in China.

Methods: Secondary data are obtained from annual financial statements of the sampled firms over the period 2018-2022, and analyzed statistically using multiple regression models. The capital structure indicators refer to total debt ratio (TDR), short-term debt ratio (STDR), and long-term debt ratio (LTDTR), and return on assets (ROA) and return on equity (ROE) are the performance proxies.

Results: The results reveal that TDR and STDR have strong negative relationships with ROA and ROE, while LTDTR has insignificant correlations with financial performance.

Conclusion: The outcomes imply that agricultural companies should pay regular attention to the gearing ratio and strive to maintain good capital mix. They should depend less on short-term debt and could properly employ more of long-term debts in financing to improve profitability and promote sustainable development.

Keywords: capital structure; financial performance; agricultural listed companies

1. Introduction

Capital structure is an important factor that affects a firm’s financial performance and has received significant attention in academic fields and business media during the last two decades [1]. Under the condition that the total scale of enterprise assets is fixed, the more reasonable the enterprise capital structure is, the less idle productive factors are and the greater comprehensive production capacity of the enterprise is. According to Modigliani Miller Models in the capital structure theory, when income tax is not considered, the market value of a company is irrelevant to its capital structure and is therefore not affected by whether there is debt or not. When tax factors are considered in reality, improving the debt financing level of the capital structure will form a “tax shield”. When the rate of earnings before interest and tax to total assets is greater than the debt capital cost rate, it will bring financial leverage income or tax-saving income and increase enterprise value. However, with the growth of debt financing, enterprises may fall into financial crisis or bankruptcy due to the increased financial risks. Kraus and Litzenberger [2] put forward the trade-off theory, which holds that an effective portfolio depends on the benefits of a specific source of funds as well as the related costs. For example, debt financing has the advantage of tax relief, but the bankruptcy cost involved should also be considered along the way. Given the cost-benefit analysis, decisions on a capital combination will have a great influence on the financial performance of companies. Thus, it becomes necessary to explore an appropriate capital structure that is conducive to the performance of modern enterprises. Although there are a large number of studies that have examined the relationship between capital structure and firm performance, these empirical researches have not led to consistent conclusions. Some studies such as Nguyen and Nguyen [3], Vu Thi and Phung [4], and Shahzad et al. [5] demonstrated a negative relation between capital structure and financial performance, while studies such as Musah and Kong [6], Abdullah
and Tursoy [7], Rabab’ah [8] argued that there is a positive correlation between them. Therefore, a targeted and in-depth study of a specific industry or company’s capital structure will be extremely helpful to improve firms’ financial performance and maximize the wealth of shareholders.

China is the world’s largest consumer of agricultural products, and agriculture has contributed greatly to the country’s development. Agricultural companies are mainly engaged in the production and operation activities of agriculture, forestry, animal husbandry, and fishery [9]. As an important organizational form of modern agriculture, agricultural listed companies have the functions of promoting the progress of agricultural science and technology, optimizing the structure of the agricultural industry, and promoting the industrialized operation of agriculture [10]. With institutional advantages, agricultural listed companies can realize multi-level value-added of agricultural products, actively develop domestic and international markets, and ultimately drive the overall development of China’s agriculture and rural areas. However, agriculture belongs to the inefficient industry and has relatively weak anti-risk ability, long payback period, and low performance [11]. Especially with the transformation and upgrading of the economy, the market capitalization scale of agricultural listed companies has become larger and larger, and the problems caused by the unreasonableness of their capital structure have become increasingly prominent. Similar to most enterprises, the financial performance of agricultural listed companies is also inseparable from the influence of financing and capital structure [1]. According to relevant market data in recent years, China’s agricultural listed companies mainly adopt equity financing [12]. The share of debt financing funds is very small, and shareholders’ equity will be partially diluted. Many agricultural companies have inefficient resource allocation and fail to take advantage of financial leverage [13]. Their average current debt ratio is high, while the average asset-liability ratio is low, reducing their ability to cope with emergencies and impacting corporate profitability. These facts confirm the importance of a good capital combination for agricultural listed companies to maximize operational efficiency and financial performance. Thus, this paper aims to study the relationship between capital structure and financial performance of agricultural listed companies in China to provide better investment references and promote the sustainable development of the agricultural industry.

The remainder of this paper is as follows. Section 2 presents the literature review, and Section 3 presents the methodology. Section 4 shows the results. Finally, Section 5 concludes the paper and gives suggestions.

2. literature review

Although there appear numerous studies that have investigated the impact of capital structure on financial performance, the relationship between them is still a subject of ongoing debate. Relatively few studies have been conducted on Chinese agribusinesses regarding this relationship, and the available empirical evidence is mixed and contradictory.

Most studies found a negative correlation between capital structure and financial performance of enterprises. Obuobi et al. [14] sampled 7 banks out of 11 banks listed on the Ghana stock exchange over a seven-year period from 2008 to 2014 and extracted data from their annual financial statements. It showed that capital structure has a negative effect on bank performance. Shahzad et al. [5] suggested that both proxies of capital structure, i.e., total debt ratio and debt-equity ratio negatively influence company performance. Moreover, a study conducted by Vu Thi and Phung [4] also confirmed that a firm’s capital structure, represented by the debt ratio, has a significant and negative impact on the firm’s financial measures by examining more than 2,000 small- and medium-sized enterprises in Taiwan during the 24-year period of 1995–2018. Another study by Nguyen and Nguyen [3] investigated the effect of capital structure on firm performance in state-owned and non-state enterprises listed on the Vietnam stock market. The panel data of the research sample includes 488 non-financial listed companies from 2013 to 2018. Their empirical results once again indicated the significant negative effect of capital structure on firm performance.
and found this effect is stronger in state-owned enterprises than non-state enterprises. For industries in China, similar results are also obtained. According to Qiao and Li [15], the comprehensive financial performance of air transportation companies listed on the Shanghai and Shenzhen stock exchanges are negatively correlated with capital structure, which is consistent with the conclusions of previous research on the real estate listed company in China by Feng and Guo [16]. In short, these studies all highlight the negative impact of capital structure on enterprise financial performance.

In contrast, other studies showed the opposite findings when observing the impact of capital structure on financial performance. Demsetz and Villalonga [17] showed no statistically significant relation between capital structure and firm performance. David and Olorunfemi [18] argued that there exists a positive relationship between earnings or dividends per share and leverage ratio after employing panel data analysis of Nigerian petroleum industries. Abdullah and Tursoy [7] explored the non-financial firms listed in Germany during 1993-2016 and discovered a positive association between firm performance and capital structure. Besides, Abdullah and Tursoy [7] also found that the European stock market transition to IFRS in 2005 is considered a shifting point that might have influenced the extent of the relationship. The findings of Saeed et al. [19] also validated the positive relationship between the determinants of capital structure and financial performance of Pakistani banks, although the significance is not very large. In addition, studies conducted by Nawaz et al. [20] within the textile sector during the period of 2000-2009 pointed out that the debt-to-equity ratio has a positive significant relationship with return on assets (ROA) and return on equity (ROE).

3. Methods

3.1 Sample selection

The purpose of this research is to identify the impact of capital structure on financial performance. The sample includes 20 Chinese agricultural companies listed on the Shanghai and Shenzhen stock exchanges. Companies with missing data, delisted companies, and special treatment (ST) companies are excluded from the sample. The data covers the period of 5 years from 2018 to 2022. Finally, 68 firm-year observations are left. All variables are winsorized at the extreme 1% and 99%.

3.2 Variables

(1) Dependent variables. Guided by Xu et al. [1], Kamatra and Kartikaningdyah [21], Bayaraa [22], and Grofčíková [23], ROA and ROE are used to measure financial performance as the most widely used accounting-based ratio.

(2) Independent variables. There are different ways of measuring capital structure. Xu et al. [1], Salim and Yadav [24], and Ajibola et al. [25] selected three variables as proxies of capital structure, including total debt ratio, short-term debt ratio, as well as long-term debt ratio. After reference to previous studies, this study considers total debt ratio (TDR), short-term debt ratio (STDR), and long-term debt ratio (LTDR) as measures of capital structure.

(3) Control variables. Size has a positive relationship with the profitability of technology firms according to Diaz and Pandey [26]. There is also a positive relationship between the growth and performance for all the sectors [24]. Moreover, İltas and Demirgüneş [27] found that the impact of asset tangibility on financial performance depends on the break date. The above three factors can all affect a firm’s performance and are used as control variables in this research.

<table>
<thead>
<tr>
<th>Variables</th>
<th>Symbol</th>
<th>Measurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Return on assets</td>
<td>ROA</td>
<td>Net income/total assets</td>
</tr>
<tr>
<td>Return on equity</td>
<td>ROE</td>
<td>Net income/owners’ equity</td>
</tr>
<tr>
<td>Total debt ratio</td>
<td>TDR</td>
<td>Total liabilities/total assets</td>
</tr>
</tbody>
</table>
### 3.3 Models

Models (1)-(6) are used to examine the impact of capital structure on financial performance.

$$
\text{ROA}_{it} = \beta_0 + \beta_1 \text{LTDR}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{SALES}_{it} + \beta_4 \text{TAG}_{it} + \epsilon_{it}
$$

$$
\text{ROA}_{it} = \beta_0 + \beta_1 \text{STDR}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{SALES}_{it} + \beta_4 \text{TAG}_{it} + \epsilon_{it}
$$

$$
\text{ROA}_{it} = \beta_0 + \beta_1 \text{LTDR}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{SALES}_{it} + \beta_4 \text{TAG}_{it} + \epsilon_{it}
$$

$$
\text{ROE}_{it} = \beta_0 + \beta_1 \text{LTDR}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{SALES}_{it} + \beta_4 \text{TAG}_{it} + \epsilon_{it}
$$

$$
\text{ROE}_{it} = \beta_0 + \beta_1 \text{STDR}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{SALES}_{it} + \beta_4 \text{TAG}_{it} + \epsilon_{it}
$$

$$
\text{ROE}_{it} = \beta_0 + \beta_1 \text{LTDR}_{it} + \beta_2 \text{SIZE}_{it} + \beta_3 \text{SALES}_{it} + \beta_4 \text{TAG}_{it} + \epsilon_{it}
$$

where $i$ is the firm; $t$ is the year; $\epsilon$ is the term error.

### 4. Results

#### 4.1 Descriptive statistics

Table 2 presents the descriptive statistics of agricultural listed companies. The mean values of ROA and ROE are 1.9% and 2.4% respectively, suggesting that they have relatively low profitability. In addition, it is clear that the total debt ratio stands at 43.1% on average, while the mean of STDR is 12.2%, and the long-term debt ratio is 4.5%, indicating that agricultural companies generally rely more on short-term debt than long-term debt. Meanwhile, the mean value of SIZE is 21.844, and the sales growth rate (SALES) is 0.188 on average. The share of fixed assets in the asset structure (TAG) has an average of 22.8%.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Obs</th>
<th>Mean</th>
<th>Std. Dev.</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA</td>
<td>68</td>
<td>0.019</td>
<td>0.056</td>
<td>-0.125</td>
<td>0.115</td>
</tr>
<tr>
<td>ROE</td>
<td>68</td>
<td>0.024</td>
<td>0.12</td>
<td>-0.406</td>
<td>0.166</td>
</tr>
<tr>
<td>TDR</td>
<td>68</td>
<td>0.431</td>
<td>0.188</td>
<td>0.073</td>
<td>0.755</td>
</tr>
<tr>
<td>STDR</td>
<td>68</td>
<td>0.122</td>
<td>0.13</td>
<td>0</td>
<td>0.462</td>
</tr>
<tr>
<td>LTDR</td>
<td>68</td>
<td>0.045</td>
<td>0.065</td>
<td>0</td>
<td>0.247</td>
</tr>
<tr>
<td>SIZE</td>
<td>68</td>
<td>21.844</td>
<td>1.045</td>
<td>19.52</td>
<td>23.693</td>
</tr>
<tr>
<td>SALES</td>
<td>68</td>
<td>0.188</td>
<td>0.563</td>
<td>-0.376</td>
<td>4.383</td>
</tr>
<tr>
<td>TAG</td>
<td>68</td>
<td>0.228</td>
<td>0.14</td>
<td>0.083</td>
<td>0.639</td>
</tr>
</tbody>
</table>

#### 4.2 Correlation analysis

The results of correlation analysis are shown in Table 3. There exists a significant positive relationship of 0.929 between ROE and ROA. TDR has strong negative correlations with ROA and ROE. STDA is negatively associated with both ROA and ROE, whereas LTDR is not significantly related to ROA and ROE. All three control variables show an insignificant negative effect on ROA and ROE. SIZE and TAG exhibit a strong positive correlation with LTDR. In addition, the values of variance inflation factor (VIF) are found to be less than 10, suggesting that there is no multi-collinearity.
Table 3: Correlation matrix

<table>
<thead>
<tr>
<th>Variable</th>
<th>ROA</th>
<th>ROE</th>
<th>TDR</th>
<th>STDTR</th>
<th>LTDR</th>
<th>SIZE</th>
<th>SALES</th>
<th>TAG</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROA</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ROE</td>
<td>0.929***</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDR</td>
<td>-0.29**</td>
<td>-0.238*</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>STDTR</td>
<td>-0.468***</td>
<td>-0.449**</td>
<td>0.817****</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTDR</td>
<td>-0.068</td>
<td>-0.008</td>
<td>0.333***</td>
<td>0.083</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SIZE</td>
<td>-0.124</td>
<td>-0.123</td>
<td>0.134</td>
<td>0.087</td>
<td>0.411***</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SALES</td>
<td>-0.059</td>
<td>-0.067</td>
<td>-0.194</td>
<td>-0.104</td>
<td>-0.008</td>
<td>-0.213*</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>TAG</td>
<td>-0.056</td>
<td>-0.091</td>
<td>0.089</td>
<td>0.005</td>
<td>0.35***</td>
<td>-0.005</td>
<td>-0.033</td>
<td>1</td>
</tr>
</tbody>
</table>

Notes: * p < 0.1, ** p < 0.05, *** p < 0.01.

4.3 Regression results

Table 4 presents the statistics of regression analysis. Models (1) and (4) reflect that there is a strong negative relationship between TDR and ROA ($\beta = -0.089$, t = -2.449) and ROE ($\beta = -0.155$, t = -1.967). If the leverage level of a firm increases beyond a reasonable level, profitability may be eroded due to the high risk associated with debt financing, according to the theory of traditional capital structure. These results are consistent with Xu et al. [1], Salim and Yadav [23], Omollo [27], Appiah et al. [28], and Okudo et al. [29]. Therefore, companies are advised to carefully manage the proportion of debt in their financing.

In Models (2) and (5), the coefficients of STDTR are both negative and significant ($\beta = -0.202$, t = -4.283; $\beta = -0.415$, t = -4.082), establishing the relationship between STDTR and ROA and ROE. Excessive short-term liabilities may expose agricultural companies to liquidity risk and repayment difficulties. Firms may sell investments or assets to pay off matured debts, thereby reducing profitability to some extent. This negative correlation is in agreement with the findings of Murugesu [31], Yazdanfar and Öhman [32], and Mboi et al. [33]. The results, however, disagree with Berzkalne and Zelgalve [34] and Pradhan and Khadka [35], who found a positive correlation between short-term debt ratio and financial performance.

LTDR is found to have no significant impact on the financial performance of firms measured by ROA and ROE, as is shown in Models (3) and (6). These results align with the outcome of studies by Bayaraa [22], Appiah et al. [28], Murugesu [31], Pradhan and Khadka [35], Taani [36], and Kibunja and Fatoki [37]. Firms and equity holders will benefit from an appropriate long-term financing structure.

Table 4: Regression results

<table>
<thead>
<tr>
<th>Variable</th>
<th>Model(1)</th>
<th>Model(2)</th>
<th>Model(3)</th>
<th>Model(4)</th>
<th>Model(5)</th>
<th>Model(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.197 (1.375)</td>
<td>0.182 (1.378)</td>
<td>0.202 (1.209)</td>
<td>0.413 (1.331)</td>
<td>0.383 (1.347)</td>
<td>0.537 (1.512)</td>
</tr>
<tr>
<td>TDR</td>
<td>-0.089** (-2.449)</td>
<td>-0.202*** (-4.283)</td>
<td>-0.155* (-1.967)</td>
<td>-0.415*** (-4.082)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>STDTR</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTDR</td>
<td>-0.006 (-0.936)</td>
<td>-0.006 (-0.994)</td>
<td>-0.008 (-1.058)</td>
<td>-0.014 (-0.976)</td>
<td>-0.013 (-1.006)</td>
<td>-0.022 (-1.391)</td>
</tr>
<tr>
<td>SIZE</td>
<td>-0.014 (-1.157)</td>
<td>-0.013 (-1.191)</td>
<td>-0.009 (-1.072)</td>
<td>-0.03 (-1.139)</td>
<td>-0.03 (-1.248)</td>
<td>-0.024 (-0.885)</td>
</tr>
<tr>
<td>SALES</td>
<td>-0.014 (-0.294)</td>
<td>-0.024 (-0.539)</td>
<td>-0.026 (-0.488)</td>
<td>-0.064 (-0.618)</td>
<td>-0.08 (-0.851)</td>
<td>-0.117 (-1.027)</td>
</tr>
<tr>
<td>TAG</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>1.972*</td>
<td>5.142***</td>
<td>0.434*</td>
<td>1.54*</td>
<td>4.848***</td>
<td>0.711*</td>
</tr>
<tr>
<td>R2</td>
<td>0.111</td>
<td>0.246</td>
<td>0.027</td>
<td>0.089</td>
<td>0.235</td>
<td>0.043</td>
</tr>
</tbody>
</table>
5. Conclusion

We examine the financial performance of selected 20 agricultural listed companies over the 2018-2022 period based on their capital structure. Financial performance is measured by ROA and ROE, and capital structure is measured by three indicators, namely TDR, STDR, and LTDR. Correlation and regression analysis are used in this study. According to the empirical findings, total debt and short-term debt have strong negative relationships with ROA and ROE. However, financial performance is not significantly affected by long-term liabilities. An appropriate capital mix can help reduce financial risk and guide stakeholders in undertaking profitable investments, thus enhancing their optimal performance. The relationship between capital structure and financial performance revealed in this study can help agricultural listed companies make better financing decisions and improve their economic interests.

Based on the research, the following recommendations are provided. Firstly, it is important for agricultural companies to pay regular attention to the gearing ratio. They should strive to maintain a good capital mix to safeguard the interests of shareholders and the financial requirements of the firm. Secondly, agricultural companies should depend less on short-term debt, reduce its proportion in financing, and pay off some of the existing debt of this type. In addition, firms could properly increase their long-term debt ratio as it gives them more time before payoff and mitigates cash flow pressures or business risks. They could also actively develop more internal financing programs. Thirdly, as the fundamental industry of the country, agriculture is in great need of government support and constant monitoring of corporate financial activities to promote its sustainable development. Policymakers should develop a balance between the bond market and the stock market to provide firms with more channels of capital mobilization. Agricultural companies should be encouraged to find a threshold for debt to take advantage of financial leverage and tax shield benefits to improve profitability.

The limitations of this paper are as follows. First, the sample is limited to 20 agricultural companies. Therefore, in future studies, the sample size can be increased to make the conclusions more representative. Second, this study is limited to the agricultural sector. In the investigation of the relationship between capital structure and financial performance, other industries can also be considered as the objects of future study. Finally, cross-country comparisons could be carried out in other developed or developing countries in the future.

References


