SHORT NOTES

STATISTICAL MODELLING AS AN TOOL TO OPTIMIZING THE CAPITAL STRUCTURE

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We present the results of research on the capital structure of agricultural enterprises in the Chelyabinsk municipal district. On the basis of methods for calculating the cost of capital invested by the enterprise, we develop a matrix for selecting the capital structure by the criteria for maximizing the level of financial profitability of capital and minimizing the cost of the capital in the forecast period.

Keywords: capital; cost of capital; optimization of capital structure; own and borrowed financial resources.

Introduction

In order to achieve the planned results in the financial management, enterprises are in need of solving the problems of optimizing the capital structure. These problems are the most important and difficult in financial and economic activity.

According to I.A. Blank [1, p. 351], "the optimal capital structure is a ratio of the use of own and borrowed resources, which provides the most effective proportionality between the coefficient of financial profitability and the coefficient of financial stability of the enterprise, i.e. the ratio maximizes market value of the enterprise".

At the same time, the management of capital structure of the enterprise is reduced to the following two main directions, see [1, p. 355].

1. Establish the optimal proportions to use own and borrowed capital of the enterprise.

2. In order to achieve the calculated indicators of capital structure, provide the enterprise with the necessary types and amounts of borrowed capital.

1. Statistical Data

Based on the data from the website of the Ministry of Agriculture of the Chelyabinsk region, we group the agricultural enterprises of the Chelyabinsk municipal district according to the share of borrowed capital in the total amount of the used resources. The obtained data are summarized in Table 1, where

A_e are enterprise assets;
A_{cc} is an average weighted cost of the capital;
A_r is an average estimated lending rate;
C_b is a volume of borrowed capital;
C_{fl} is a coefficient of financial leverage;

Table 1

An influence of capital structure on the financial profitability of an enterprise

№	Indicator	Formula	Groups of enterprises by the share of borrowed capital, %				
			I up to 20	II 20, 1−40	III 40, 1−60	IV over 60	Ave-rage
1	Number of enterprises	−	4	4	3	3	14
2	Share of borrowed capital	$S_{bc} = \frac{C_b \cdot 100}{C_t}$	14,5	29,0	48,7	79,0	30,0
3	Coefficient of financial leverage	$C_{fl} = \frac{C_b \cdot 100}{C_o}$	0,75	0,82	0,91	1,17	0,78
4	Average estimated lending rate	$A_r = \frac{F_c \cdot 100}{C_b}$	11,3	5,1	2,9	5,6	8,3
5	Economic profitability	$P_e = \frac{P_b \cdot 100}{A_e}$	13,7	12,5	11,6	10,4	12,7
6	Financial profitability	$P_f = \frac{P_n \cdot 100}{C_o}$	15,5	18,6	19,5	17,0	15,4
7	Increase in financial profitability obtained as a result of the use of credit	$\Delta P_f = P_f - P_e$	1,8	6,1	7,9	5,6	6,8
8	Differential of financial leverage	$D_{fl} = P_e - A_r$	2,4	7,4	8,7	4,8	5,3
9	Coefficient of financial stability	$C_{fs} = \frac{C_b}{C_o}$	1,33	1,22	1,10	0,85	1,05

C_{fs} is a coefficient of financial stability;
C_o is a volume of own capital;
C_t is a volume of total capital;
D_{fl} is a differential of financial leverage;
D_{fp} is a differential of financial profitability;
E_{fl} is an effect of financial profitability;
F_c are financial costs;
P_b is a balance sheet profit;
P_{bc} is a profitability of borrowed capital;
P_e is an economic profitability;
P_f is a financial profitability;

ΔP_f is an increase in financial profitability obtained as a result of the use of credit;

P_n is a net profit;

R_{mr} is a marginal rate of the interest on borrowed capital;

S_{bc} is a share of borrowed capital.

Based on the obtained data, we can trace the change in financial profitability depending on the change in the capital structure. Therefore, we can determine the optimal capital structure for the considered agricultural enterprises by the criterion of maximizing the level of financial profitability.

Denote by E_{fl} an effect of using a credit (an effect of financial leverage), i.e. an increase in profit per ruble of own resources that are parts of the total capital of the enterprise, obtained by the use of borrowed resources.

The grouping of the enterprises by the share of borrowed capital in the total amount of used resources shows that an increase in the share of borrowed resources is the cause of an increase in financial profitability (profitability of own capital).

Denote by D_{fl} a differential of financial leverage, which is one of the most important indicators characterizing the use of capital by an enterprise.

The positive effect of financial leverage takes place when the profit received by the enterprise exceeds the costs of borrowing. According to V.V. Kovalev [2, p. 151], "the higher a positive value of the differential of financial leverage, the higher the effect of financial leverage". An enterprise having the negative D_{fl} is an obvious candidate for the "black card file"of a creditor. This is because an increase in C_{fl} (i.e.,the share of used borrowed capital) is the cause of decrease in the financial stability of the enterprise and increase in the risk of bankruptcy. Therefore, the creditor has a tendency to compensate the growing risk of debt default by raising the price of his "commodity i.e. the loan. An increase in the interest rate leads to a decrease in D_{fl}, and even to a negative value of D_{fl}. In this case, an influence of the capital structure on the financial profitability of enterprises is sharply reduced, since a part of the net profit generated by own capital is used to service the borrowed capital at high interest rates. According to O.V. Efimova [5, p. 134], "the negative value of D_{fl} leads to a decrease in the coefficient of financial profitability (profitability of own capital). In this case, the use of the borrowed capital gives a negative effect."

The data given in Table 2 characterize an influence of the capital structure on the average weighted cost of the capital.

Table 2

An influence of the capital structure on the weighted average cost of the capital

№	Indicator	Groups of enterprises by the share of borrowed capital, %				
		I up to 20	II 20,1−40	III 40,1−60	IV over 60	Average
1	Number of enterprises	4	4	3	3	14
2	Share of borrowed capital	14,5	29,0	48,7	79,0	30,0
3	Average weighted cost:					
	a) share of own capital, %	13,4	11,2	10,0	10,04	10,08
	b) share of borrowed capital,%	1,6	1,4	1,4	4,4	2,0
	c) total capital, %	15,0	12,6	11,4	14,8	12,8

The data of Table 2 confirm that an increase in the share of borrowed capital is the cause of a decrease in the weighted average cost of total capital. This is due to the fact that the use of borrowed capital brings an additional income to the enterprise in the form of a gain in profits (the borrowed resources becomes cheaper than own resources), and the profitability of own capital increases, see Table 1.

An enterprise can perform tasks more efficiently by using borrowed resources. Nevertheless, the use of credit is a financial risk. The role of the financial manager is to make reasonable decisions taking into account all risks.

However, this growth, and consequently, the cheapening of the capital used by the enterprise ceases, when the share of borrowed capital approaches to 60%. The effect of financial leverage decreases. Therefore, we claim that the optimal capital structure takes place in enterprises, where the average share of borrowed capital is 48.7%.

In order to make a decision to use borrowed resources having certain volume, the enterprise managers must perform a number of calculations related to the forecast of the effect of financial leverage. These calculations are connected with the forecast of the economic development of the enterprise. Note that one of the most important points in the forecast is calculation of an average interest rate denoted by A_r:

$$A_r = \frac{F_c \cdot 100}{C_b}.$$

Also, it is necessary to know the forecast of profitability of the enterprise's assets, i.e. P_e (economic profitability), during the period of use of the planned credit. To this end, we take into account the forecasted volume of profit, assets, as well as the required total amount of capital, and the possibility that own resources are enough.

$$P_e = \frac{P_b \cdot 100}{A_e}, \quad P_f = \frac{P_n \cdot 100}{C_o}.$$

It is necessary to determine the required amount of borrowed resources and the corresponding financial costs, as well as planned financial profitability of own capital and future growth of the profitability due to the use of credit, i.e. the effect of financial leverage.

$$\Delta P_f = P_f - P_e,$$

because $D_{fp} = E_{fl}$. Then we determine a differential of financial leverage D_{fl}, i.e. the difference between an economic profitability and a volume of borrowed capital.

Let us substitute the values in the formula $D_{fl} = P_e - A_r$. We obtain $13,7\% - 11,3\% = 2,4\%$.

It is important to determine the amount of profit that an enterprise receives from each ruble of borrowed capital, i.e. P_{bc} (the profitability of borrowed capital). Note that P_{bc} can be determined by multiplying D_{fp} (the differential of financial profitability) by C_{fs} (the coefficient of financial stability).

If we substitute the data in the formula $C_{fs} = \frac{C_b}{C_o}$, then we obtain the same 2,4%, i.e., $P_{bc} = D_{fl}$.

The difference between the economic profitability and the profitability of borrowed capital, i.e. $P_e - P_{bc}$, is the profitability of own resources. Therefore, we can obtain the amount of profit received from each ruble of own capital. If the effect of financial leverage is preserved, an enterprise can reimburse financial costs connected with borrowed capital

only by the profitability of own resources. There are no other sources. Therefore, in order to forecast borrowed capital as a financial resource, it is important to determine R_{mr} , i.e. a marginal rate of the interest on borrowed capital that an enterprise can afford to pay to a creditor without risk to deteriorate own financial position.

2. Statistical Model

According to V.I. Terekhina [4, p. 211], "exceeding the marginal rate of interest on borrowed capital reduces the effect of financial leverage, and the additional profit received due to use of the borrowed capital is used on financial costs for attraction of the borrowed capital".

Therefore, it is reasonable to use borrowed capital by an enterprise, if the interest rate corresponds to the marginal rate, and the financial leverage effect indicator is positive. In this case, an additional profit from the use of borrowed capital takes place.

Therefore, to make and implement decisions is a difficult and complex task, which is connected with numerous conclusions based on calculations. Hence, the employees of the administrative apparatus do not always want to do this routine work. As a result, the management decisions are made without sufficient justification.

In order to simplify and speed up the making decisions on the effective capital structure of the agricultural enterprise, we propose the following. Based on research materials, we develop a matrix to select the capital structure according to the criteria for maximizing the level of financial profitability of capital and minimizing cost of the capital in the forecast period.

Our method is based on multivariate calculations of the level of financial profitability of own capital with different capital structures and involves the use of a financial leverage mechanism. The results are summarized in Table 3.

Table 3

A matrix to select the variant of the capital structure by the criterion of maximizing the level of financial profitability and minimizing cost of the capital in the forecast period (The optimal variants are indicated in bold)

Criterion	Share of borrowed capital in the total capital of enterprise, %									
	25	30	35	**40**	**45**	**50**	**55**	60	65	70
Financial profitability P_f	*18,0*	*18,6*	*18,9*	***19,3***	***19,4***	***19,5***	***19,4***	*18,9*	*18,5*	*18,0*
Coefficient of financial stability C_{fs}	1,22	1,18	1,16	1,12	1,08	1,06	1,03	0,90	0,86	0,82
Effect of financial profitability E_{fl}	5,1	6,2	6,8	7,2	7,8	8,1	7,9	7,6	6,9	5,6
Profitability of borrowed capital P_{bc}	6,2	7,3	7,9	8,1	8,4	8,6	8,1	6,8	5,9	4,6
Marginal rate of the interest on borrowed capital R_{mr}	6,3	4,9	4,1	3,7	3,2	2,8	3,2	4,2	4,9	5,8
Average weighted cost of the capital A_{cc}	*13,0*	*12,4*	*12,0*	***11,7***	***11,5***	***11,4***	***11,5***	*11,8*	*12,3*	*12,7*

In order to forecast the capital structure for the coming year or more distant

perspective, first of all we determine the amount of financial resources required in the planned period to ensure the economic activity of the enterprise. Then, we determine the possible amount of own resources. However, in most cases, own resources are not enough (in addition, use only own resources is not always profitable). Therefore, enterprises use borrowed resources. Hence, there are the shares of the own and borrowed capital in the total amount. But the enterprise always has variants on volumes of borrowed resources. Here there is the moment to choose the optimal variant of the planned capital structure for the enterprise.

Based on the proposed matrix, we can rather easy to choose the optimal variant of the capital structure for a particular agricultural enterprise. Let us consider a level of financial profitability as the criterion. In the matrix header, we find the value of the planned share of borrowed capital of the enterprise in the forecast period and the corresponding indicator of the financial profitability. If the most relevant for the enterprise is the optimization of the capital cost, then we find the value of this indicator in the lower line of the matrix. The economic indicators that can be provided in the case of the selected capital structure are given between the upper and lower rows of the matrix. The optimal variants of the capital structure, which ensure the highest indicators of the economic efficiency, are indicated in bold.

If the financial manager is not satisfied with the obtained estimates of this variant, then he can choose and estimate another variant. However, he should remember that all optimal variants correspond to the share of borrowed capital 40-55%. Therefore, multiversion calculations using mechanism of financial leverage allow to determine the optimal capital structure that provides maximum level of financial profitability and minimal average weighted cost of the total capital.

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СТАТИСТИЧЕСКОЕ МОДЕЛИРОВАНИЕ КАК ИНСТРУМЕНТ В ПРОЦЕССЕ ОПТИМИЗАЦИИ СТРУКТУРЫ КАПИТАЛА

Н. С. Колотова, О. С. Старкова

В статье представлены результаты исследований структуры капитала сельскохозяйственных предприятий Челябинского муниципального района на основании примененных методик расчета стоимости привлекаемого предприятием капитала, разработана матрица выбора структуры капитала по критериям максимизации уровня финансовой рентабельности капитала и минимизации его стоимости в прогнозируемом периоде.

Ключевые слова: капитал; стоимость капитала; оптимизация структуры капитала; собственные и заемные финансовые ресурсы.

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