Possibilities and limits for capital structure optimalising model design of Czech dairy industry

Konstrukce modelu pro optimalizaci kapitálové struktury podniků českého mlékárenského průmyslu

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Abstract: The aim of the paper is to approximate the conclusions of the Trade-off model for practical usage in Czech dairies. In the contribution, there is carried on a transformation of the basic Trade - off model formula with respect to the practical usage. Then there is proposed a method of the quantification of unique factors of the Trade -off model theory. In order to measure some of these factors, there is partially used the methodology, which was proposed by Prof. Edward Altman. According to this methodology, it is possible to quantify part of the capital structure influences. The measurement is then valid for all firms in the sector. Following the results of empirical study which is carried on in this paper, one of the factors' relationship is not constant in the Czech dairy sector. This limits the recommendation to use the common model for all of the firms in one sector. When making a financial decision, it is necessary, after quantification of the capital structure factors, to analyse individual ability of a firm to utilise foreign capital.

Key words: optimum of capital structure, trade -off model, Czech dairy sector

Abstrakt: Cílem příspěvku je přiblížit závěry Kompromisní teorie k možnosti její konkrétní aplikace při finančním rozhodování v podnicích českého mlékárenského průmyslu. V příspěvku je provedena transformace základní rovnice Kompromisní teorie s ohledem na její praktické využití a jsou naznačeny možnosti kvantifikace jejích jednotlivých faktorů. Pro tuto kvantifikaci je zčásti využita metodologie navržená profesorem Altmanem. Na základě výsledků hrubé empirické studie bylo zjištěno, že nelze doporučit pro konkrétní výpočet model obecně platný pro všechny podniky v odvětví, neboť závislost mezi změnou výše dluhu v kapitálové struktuře a změnou úrovně finančního zdraví každé jednotlivé mlékárny zřejmě není shodná v celém odvětví. Před rozhodnutím o změně hodnoty celkové zadluženosti podniku je proto třeba provést analýzu individuálních schopností podniku nakládat s cizím kapitálem. Poté je možné uplatnit poznatky o chování nákladů indukovaných finanční tísní, jež mohou být zjištěny za využití Altmanova modelu a jsou shodné pro všechny podniky v jednom odvětví.

Klíčová slova: optimum kapitálové struktury, Kompromisní teorie, odvětví českého mlékárenství

INTRODUCTION

The optimal capital structure becames the focus of both academic research and practical financial analysis. The solution to this question brought about the development of economic theory devoted to this topic. The consequence is a number of theoretical models explaining capital structure patterns. One of the best evaluated models is based on the exchange of debt benefits and debt drawbacks, which is usually called the Trade- off model. This model provides an understandable and intuitively attractive explanation for the actual setting of capital structures by real corporations. The biggest disadvantage of this theory is seen in the difficulties connected with the empirical estimate of individual components of this model. The aim of this paper is to contribute to the extension of the possibilities of the Trade- off model practical usage within the dairy sector of the Czech Republic. First, there should be assessed a way of measurement of the capital structure factors that, according to the Trade- off model, influence the market value of the firm, then there will be accomplished the transformation of the model with respect to practical usage in Czech dairies. If it is possible to utilise the Trade- off models conclusions in practice, the benefits to the dairy sector would be immense. Managers of the dairies could always ensure that their companies were being financed at the most effective way.

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LITERARY REVIEW

The Trade- off model is built on the bases of Modigliani and Miller capital structure irrelevance propositions (see Modigliani, Miller 1958). Modigliani and Miller arrived at both propositions by making a list of assumptions. Under the perfect competition market environment assumptions, they achieved results that capital structure is irrelevant in the relationship to the market value of a firm . After the publishing the Modigliani and Miller theorem, the influence of some capital structure factors, which were included among the unchangeable assumption by Modigliani and Miller, was identified. This enabled to create a model, that tallies with real corporations behaviour and that describes the influence of changing capital structure on the market value of a firm.

First, Modigliani and Miller's propositions assumed a world of no taxes. In the real world, the deductibility of interest expenses produces a *tax shield,* which may lower the weighted average costs of capital for companies, that use credits. Second, the financial structure can affect its sales, operating income and ability to attract and keep productive employees. The costs associated with lost sales and operating income due to financial structure decisions are called *financial distress costs* (see, for example Megginson 1997). Third, the use of debt financing may be a way of aligning the interests of management with those of the shareholders. Creditors use debt covenants to protect their position in the firm and control the discretion management has over the use of corporate resources. These restrictive covenants have costs, they are called *agency costs*[1]. It is differentiated between agency costs of outside equity and agency costs of debt.

By tying together all the corporate capital structure factors, there is reached the modern Trade- off model. This model expresses the value of a levered firm in terms of an un-levered firm, adjusted for the present values of tax shields, financial distress costs and the agency costs of debt and equity as follows (Megginson 1997):

$$V_L = V_U + PV\ Tax\ Shield - PV\ Financial\ Distress\ Costs + PV\ Agency\ Costs\ of\ Outside\ Equity - PV\ Agency\ Costs\ of\ Debt \quad (1)$$

V_L is the market value of the bonds and common stock of the levered company. V_U is the market value of common stock the company were it un-levered. *PV Tax Shield* represents present value of available tax savings due to debt financing.

PV Financial Distress Costs stands for the present value of financial distress costs and explicitly recognises that operating cash flows are not independent on the way how the company is financed. Companies in financial distress lose sales and key employees. Their competitive position deteriorates causing an overall reduction in profitability. Among other things, this reduction in profitability reduces the expected value of the interest expense tax shield because the likelihood of having insufficient income against which to take the tax deductions is increased.

PV Agency Cost of Outside Equity refers to costs risen from the conflicts of interest between stockholders and managers. Including the debt in the capital structure lightens the consequences of this conflicts and that is why these costs influence the market value in the positive direction.

The last term, *PV Agency costs of Deb*t, is the present value of costs arising out of conflicts of interest between stockholders and bondholders. Like the costs of financial distress, these costs become larger in the expected value sense as the firm increases its debt to equity ratio.

Quantifying these elements is another matter. This is therefore the object of criticism from the side of academics and financial managers. In order to make the financial decision process in the businesses of Czech dairy sector more effective, there will be offered in this paper a design how to overcome these drawbacks.

METHODS AND MATERIAL

In the correspondence with the objectives of this paper, we will search for a way, how to apply the results of Trade -off model in the Czech dairy sector financial decision- making process. To approximate the model to the practical usage, the relationship between individual components of the formula 1 has to be modified. For this transformation, there will be used a method of reasoning and deduction.

For ensuring whether is it possible to design a capital structure optimising model, which would be valid for all the businesses in the dairy sector, it is necessary to carry on a test of dependence of the debt load of businesses and financial distress stage. Therefore, we will be looking for a correlation coefficient of these two categories, for which there will be used the methodology of correlation analysis (see for example Seger, Hindls, Hronová 1998). The debt load will be described by the ratio Debt/Total Assets (D/TA). The stage of financial distress of the firms will be described by the Index IN. Index IN is the result of a rating model, which was constructed in the conditions of Czech economy (see Neumaier, Neumaierová 1995). According to Neumaier, Neumaierová (1995), IN higher than 2 represents a financially healthy business, IN in the interval 1–2 represents business with neutral financial situation and IN lower than 1 represents a financially sick business.

Accounting data of chosen Czech dairies act as an experimental material. Selection of the dairies was carried out with respect to the needs of this research. There were chosen as well the enterprises in a good financial condition as the dairies in financial distress in the investigated sample. This allows to explore the relationship between debt and financial health not only in the framework of

[1] An Agency costs theory is put forward by Jensen, Meckling (1976)

sector characteristics, but also in the framework of specific characteristics of individual firms. There were chosen the following companies: Olma,a.s. – Olomouc, Mlékárna Kunín, a.s., Mlékárna Kyjov,a.s., Jihočeské Mlékárny, a.s., Mlékárna Hradec Králové, a.s. – since 1997 in bankruptcy, Břeclavská Mlékárna, a.s. – since 1998 in bankruptcy.

RESULTS AND DISCUSSION

Transformation of the Trade off model with the respect to its practical usage

In 1984, Professor Edward Altman (1984) investigated the empirical evidence with respect to costs of financial distress. One of the conclusions was specifying of a simple format for measuring the present value of the expected financial distress costs. The expected present value of financial distress costs is measured by using two related models, both of which estimate the normal or expected profit (such a profit, which the firm would have, if it were not in the financial distress) of bankrupt firms as the failure date becomes more imminent. These are set against the actual profits or losses and the difference is fingered as costs of financial distress. The two related models represent regression technique and security analyst estimates. Neither the first model nor the second leads to the pregnant estimation of the financial distress costs, however, it is the only one known methodology how to quantify the capital structure factor. Using Altman's format helps to overcome the drawback of difficult quantification of the elements.

When using this methodology for measuring of the negative consequences of the debt, the quantification of financial distress costs is valid for all firms in a sector. It is not possible to carry out an individual firm measurement. The value of the financial distress costs is not specific only for the industry sector, but it is characteristic also for a definite stage of financial distress. These facts call for a transformation of the Trade- off model formula:

$$V_L = V_U + PV\ Tax\ Shield - PV\ Financial\ Distress\ Costs + PV\ Agency\ Costs\ of\ Outside\ Equity - PV\ Agency\ Costs\ of\ Debt$$

Agency costs of the outside equity belong, contrary to other components, to that kind of costs, the origin of which is not conditioned by the existence of financial distress. They are entirely the consequences of the conflicts between managers and owners[2]. Quantification of the Agency costs of outside equity depends on the knowledge of internal motivation system of each individual firm. For this reason, it is abstracted from these type of costs in the optimal capital structure model designing process. It is then possible to transform the formula 1 to the following form:

$$PV\ Tax\ Shield/V_L = (PV\ Financial\ Distress\ Costs + PV\ Agency\ Costs\ of\ Debt)/V_L$$

When the above written formula holds true, the optimal capital structure is reached. The negative implications of debt financing balance its positive consequences. It is not worth to engage more of the debt in the capital structure. When making financial decisions, it is not usually looking for the optimum of capital structure, it means, for the definitive relation between the debt and equity. More frequently, the financial managers pose a question, whether a next debt unit is appropriate. The whole formula is therefore worth transforming into the form of condition for an effective running into debt. The component market value of the levered firm V_L can be factored out as the common denominator.

$$PV\ Tax\ Shield > (PV\ Financial\ Distress\ Costs + PV\ Agency\ Costs\ of\ Debt)$$

It is not possible to use the equation in this form for financial decision making, because it does not work with a change of the components, which are realised in the dependence on the changes in the capital structure. It is necessary to rewrite the formula into the form of marginal analysis.

The debt influence on the tax shield formation is given by the character of tax shield birth. Available tax savings rising due to debt financing can be expressed as follows:

$$Tax\ Shield = tax\ rate\ of\ the\ corporation\ (TR) \times interest\ expenses\ (interest\ rate \times D).$$

It is apparent, that running into debt leads to growing tax saving, which is the positive characteristic of a debt. The influence of an additional debt unit on the tax shield value can be noted as follows:

$$\frac{dPV\ Tax\ Shield}{dD}$$

where:
d = change of the component
D = debt.

The relationship between running into debt and financial distress costs birth seems to be a little bit complicated. According to the Altman's methodology, it is possible to quantify the financial distress costs only for the definitive stage of financial distress. The stage of financial distress can be described by the probability of bankruptcy, which can be obtained as a result of many rating models. The object of debt financing influence is therefore not directly the value of financial distress costs, but the level of financial distress respective the probability of bankruptcy. The influence of additional debt unit on the probability of bankruptcy can be noted as follows:

[2] More about Principal – Agent Problem in Reekie a Crook (1995), or Megginson (1997)

$$\frac{dp_B}{dD} \approx PV\ Financial\ Distress\ Costs + PV\ Agency\ Costs\ of\ Debt$$

where:

p_B =probability of bankruptcy

$\approx$ represents the relationship between the probability of bankruptcy and corresponding value of financial distress costs.

Using this knowledge, the Trade off formula can be rewritten as follows:

$$\frac{dPV\ Tax\ Shield}{dD} > \frac{dp_B}{dD} \approx PV\ Financial\ Distress\ Costs + PV\ Agency\ Costs\ of\ Debt$$

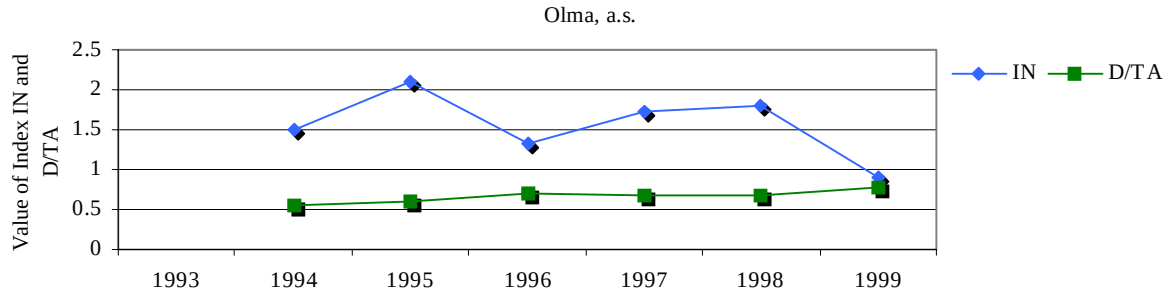
In the second part of the equation, where there is investigated the relationship between the financial distress costs and running into debt, there was carried out converting from the problem of debt influence on the negative debt consequences to the problem of debt influence on the financial stability of a business. According to the Altman's methodology, the relationship between probability of bankruptcy and costs induced by financial distress is constant in the whole sector. This could enable to design the common optimising model for all firms in the sector. It is a question, whether the relationship between additional debt unit and probability of bankruptcy is unified for all business too. In order to find out the possibilities of designing a common optimising model, it is necessary to carry out an investigation of this relationship on a sample of Czech dairies.

Testing of the dependence of bankruptcy probability of Czech dairies on their running into debt

In order to identify the influence of debt financing on the financial stability of dairies, there was probed tightness of statistical dependence of D/TA ratio development and Index IN development, which is described by correlation coefficient. The Figure 1–6 document the quality of the development of these categories.

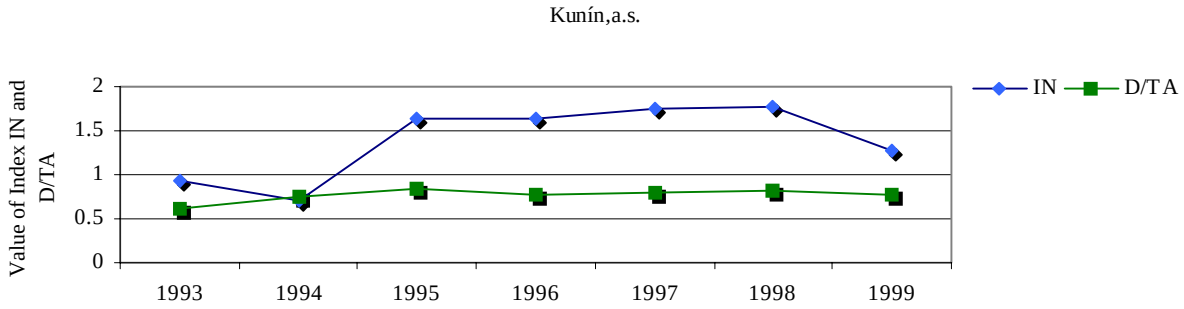
Comparison of debt and financial situation development, which is listed in Figure 1–6, shows, that the dependence of the two categories is probably not unique for all of the businesses in the dairy sector.

In case of Olma, a.s. and Jihočeské Mlékárny, a.s., the increasing debt leads to a slight growth of bankruptcy probability. On the other hand, the statistical tightness of D/TA ratio and Index IN in case of Mlékárna Kyjov, a.s., Mlékárna Břeclav, a.s., Mlékárna Hradec Králové, a.s. is stronger. The fact should be pointed out, that two of these daries (Mlékárna Břeclav, a.s., Mlékárna Hradec



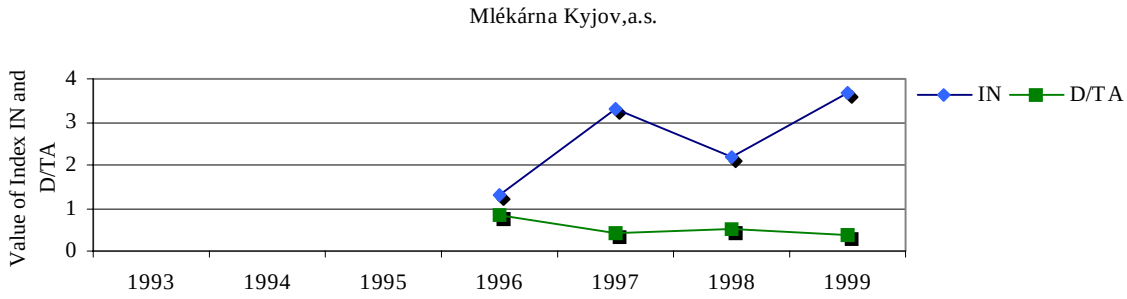
Correlation coefficient: –0.62583

Figure 1. Development and tightness of statistical dependence of D/TA ratio and IN in Olma, joint-stock company



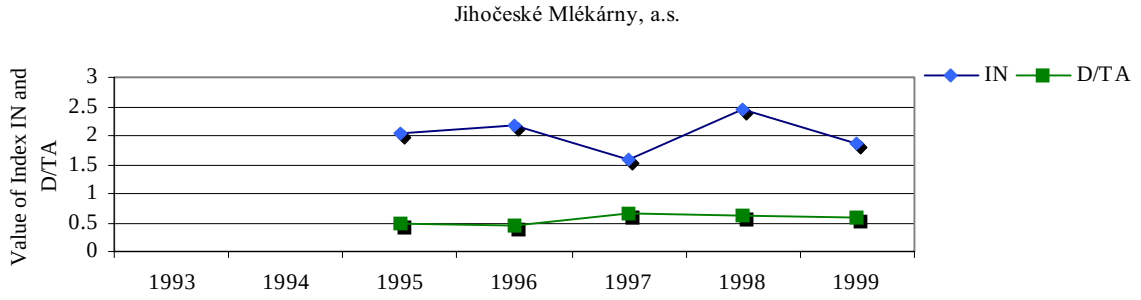
Correlation coefficient: 0.706901

Figure 2. Development and tightness of statistical dependence of D/TA ratio and IN in Kunín, joint-stock company



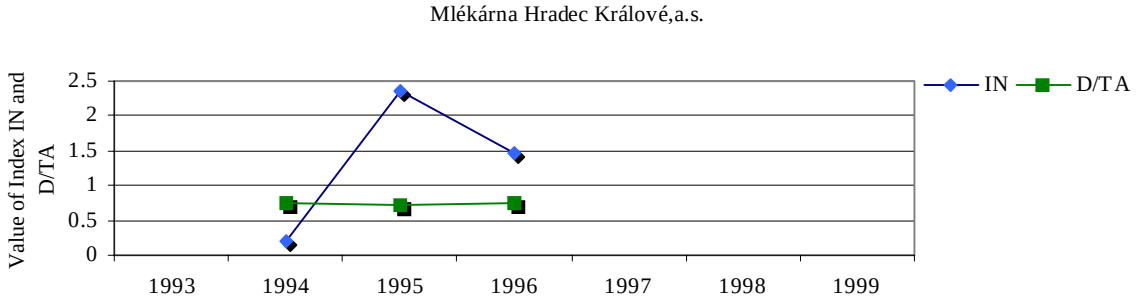
Correlation coefficient: –0.94688

Figure 3. Development and tightness of statistical dependence of D/TA ratio and IN in Mlékárna Kyjov, a.s.



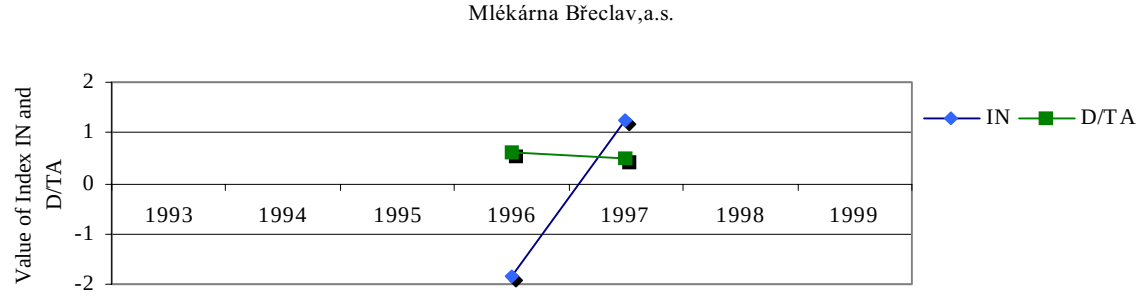
Correlation coefficient: –0.26494

Figure 4. Development and tightness of statistical dependence of D/TA ratio and IN in Jihočeské Mlékárny, joint-stock company



Correlation coefficient: –0.80568

Figure 5. Development and tightness of statistical dependence of D/TA ratio and IN in Mlékárna Hradec Králové, joint-stock company .



Correlation coefficient: –1

Figure 6. Development and tightness of statistical dependence of D/TA ratio and IN Mlékárna Břeclav, joint-stock companys

Králové, a.s.) are in the bankruptcy process. This leads to suspicion of the influence of the financial distress level alone on the financial situation sensibility to the debt financing. In order to verify this hypothesis, it is necessary to enlarge the sample of businesses.

Mlékárna Kyjov, a.s. is very debt sensitive too. Its internal factors manage the debt worse then in other dairies. In 1996, the management of this enterprise probably identified this dependence and decreased the D/TA ratio, which enabled to maintain the firm in a good financial situation.

Especial example is the Mlékárna Kunín, a.s. which shows a reversed dependence. The explanation lays again in its internal factors. The firm is able to operate with debt better than other firms and that is the reason why it can afford a higher debt quotient.

The aforesaid results support the hypothesis, that the debt sensibility to the financial situation of a dairy is probably not unique in the whole sector. The intensity of dependence depends on the quality of internal factors of dairies. The conclusion of this gross empirical research is, that it is not possible to design a common capital structure optimising model for all of the businesses in the dairy sector. The consequence of this study is that in case the quantification of Trade- off model factors is successful, it is necessary, before taking financial decision, to analyse individual ability of a business to get on with debt. It should be accented, that the investigated sample of firms was not large enough to obtain more exact results.

REFERENCES

Altman I.E. (1984): A Further Empirical Investigation of the Bankruptcy Cost Question. The Journal of Finance, *32*, (4): 1 067–1 089.

Jensen M.C., Meckling W. H. (1976): Theory of the Firm: Managerial Behaviour, Agency Costs and Ownership Structure, Journal of Financial Economics *3*: 305–360.

Megginson W.L. (1997): Corporate Finance Theory. Reading.

Modigliani F., Miller M. (1958): The Cost of Capital, Corporation Finance, and the Theory of Investment. American Economic Review, *48*: 261–297.

Numaierová I., Neumaier I. (1995): Zkuste spočítat svůj index IN. Terno, č. 5, s. 7–10.

Reekie W.D., Crook J.N. (1995): Managerial Economics. University Press Cambridge.

Seger J., Hindls R., Hronová S. (1998): Statistika v hospodářství. 1. vyd. Praha: ETC Publishing, edice Manager/Podnikatel.

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