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A General Model Based on the DuPont System of Financial Analysis for Identification, Analysis and Solution of a Potential Crisis in a Business

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ABSTRACT

The purpose of this article is to create a general model using the data commonly available in the managerial accounting system for the signalization of a possible potential crisis. The critical level of the input variables influencing the return of equity (ROE) and return on sales (ROS) was theoretically determined based on the DuPont system of financial analysis. To determine actual amount of the input variables for the test of their critical amount in a real company, we considered their average amount based on a simple arithmetic mean. For the real analysis in a potentially threatened company, we considered one month as a time unit for the time interval in a range of 14 months. We determined the average actual amounts of the input variables using confidence intervals. Because of the relatively small sample, we used Student's t-distribution for the construction of confidence intervals of the input variables. An analytical model-based system approach based on analysis of the complex value chain was used. By the means of logical derivations and testing this analytical model-based system approach in a real company, we proved, that this model enables not only to determine the critical level of the input variables leading to a crisis in a business but also to calculate their new adjusted amount, which the business needs to reach so that a potential crisis can be solved. The presented theoretical model was successfully applied to solve a real potential crisis in a particular Czech company which supports the correctness and practical applicability of this general model. There are two main advantages of this model: 1) it can use the data commonly available in the managerial accounting system, 2) this model is generally valid, i.e., it can be used in any business producing goods or services.

INTRODUCTION

Recently, more than ever, we have realized the growing importance of the crisis management. The number of businesses that will face crisis immediately or in the near future will certainly increase dramatically. The question does not stand if the crisis occurs but when it occurs. The situation requires presenting and discussing new approaches and models to predict or solve the crisis.

Analytical activity focused on the signalling of a potential crisis in a business is very significant for the effective decisions of the stakeholders (Parent and Deephouse, 2007; Post et al., 2002). It's a question of effective decision-making related to the future business development with an aim of creation an effective value creation process (Keul, 2009; Wiengarten et al., 2015). It's also a question of decision-making related to well-timed solution of a potential crisis based on analytically obtained signalling information about possibility of its occurrence. This signalling information is even more significant if it enables occurrence of adequate time space for the formation and realization of the actions enabling solving the potential crisis. This is especially relevant for potential crises, which can develop to the next phases: warning signals, acute stage and amplification, which can even lead to a business bankruptcy (Turner, 1976; Fink, 1986; Mitroff and Pearson, 1993; Roux-Dufort, 2007).

Some approaches and models for analysing potential crises in a business are described in literature. However, these models usually assume that a set of data is approximately normally distributed. By this, some businesses, which by their excessive values within extraordinary situations may fall down to a crisis, are excluded. In addition, these models use historical data, and thus are not congruent with the actual possibilities of the solution of capital development in a business. The capital development in a business is a reflection of effectiveness or non-effectiveness of the value-creating process. Hence, the objective of this paper is to create a new original approach for the signalization of a possible potential crisis in an enterprise. Based on the DuPont system of financial analysis, a new general model for identification and solving potential crisis in a business is created and described in detail.

1. THEORETICAL BACKGROUND

There are two main approaches used to analyses of a potential crisis in a business. One of the analytical model-based system approaches how to obtain information associated with the occurrence of a potential crisis in the enterprise is an approach based on analysis of the complex value chain. Kasik and Snapka (2019) described the functional structure of this chain. This chain starts with the determination of the products based on the customers' needs and continues to the next system elements of the value chain. The aim is to achieve the output effect of the last element (block) at the end of the value-creating chain, i.e. manufacture and sale of the demanded-by-customers products, and obtain the sales for the products being sold (Elsubbaugh and Rose, 2004; Adrot and Moriceau, 2013; Robert and Lajtha, 2002). The sales, respectively their part, are used as own capital resources for the reproduction of realization of the complex value chain. In our case of analyses, it will be a business, which uses a flow production method.

In the case of appearance of failures influencing behaviour of particular elements of the value chain, a possible potential crisis occurs in this unit or in the business as a whole. The potential crisis is signalized at the end of the value chain. It is an insufficient level of the volume of the production and primarily of the sales of the manufactured and sold products in relation to the price and demanded quantity of the product. In the given time, it will express itself in an insufficient amount of creation of the financial resources for the required reproduction of the value chain in the business. If a business does not create the target-expected financial resources from its manufacturing and selling activities, it is in danger of a potential crisis. Therefore, a potential crisis in a business manifests with the insufficient profitability. That is why there is a need in management of the value chain in a business to have an early warning system for a potential crisis. That means to get signalling information for analysing and decision-making based on critical values of the input variables, forming outputs from particular elements of the variable chain with relation to the specified testing criterion of the outputs from these elements.

We focused our analyses on the businesses that ensure the reproduction of their value chain by creating and using their own capital. It means that they have to be profitable. They have to fulfil the condition of profitability measured by the profit margin ratio. This ratio is also known as return on sales or ROS (Fairfield and Yohn, 2001; Jansen et al., 2012). The profit margin is also one of the ratios of the DuPont system decomposing the return on equity or ROE (Brealey et al., 2012; Higgins, 2012; Palepu, 2007; Soliman, 2008). We use the decomposition of ROE in the following form (1):

$$ROE = \frac{EAT}{EBT} \times \frac{EBT}{EBIT} \times \frac{EBIT}{S} \times \frac{S}{A} \times \frac{A}{E} \quad (1)$$

where *EAT* means earnings after taxes, *EBT* means earnings before taxes, *EBIT* means earnings before interest and taxes, *S* means sales, *A* means assets and *E* means equity of the analysed organizational unit.

We consider the effective sale of the given product to customers to be a base for the reproduction of the business capital. We determine the critical limits of the input variables based on the reduced *return on equity (ROE) indicator* under the condition that *ROE equals zero, i.e. ROE = 0*. Within this condition, valuation of the equity is at the zero value as the critical level. As will be specified in the next part of the paper, the *profit margin or return on sales (ROS)* will be considered as the reduced form of ROE.

We can use the analytic *criterion comparison system* for the test of possibility of a potential crisis based on the project analysis while defining the target values of the value-creating chain and evaluating the course of realization of this chain in relation to the defined-for-it targets (Lee *et al.*, 2017). For the comparison of the possible result during the course of the value-creating process, it is possible to use informational knowledge derived from the defined criterion for a potential crisis. It will be, as was already mentioned, determination and use of the criterion level of the input variables forming outputs for the considered elements (blocks) for the analysis of the specified value-creating chain.

Consequently, for our considerations, it will be a *product value chain* realized by a business unit. Within these analytical comparisons, it will be specification of criterion-based signalling information, namely determination of the critical levels of the input variables of the last element of the analysed product value-creating chain. As was already mentioned, the testing criterion for the determination of the critical levels of the input variables will be the profit margin or ROS ratio as the reduced form of the ROE ratio. In case that we are not able to ensure at least critical level of profit margin, realization of the equity reproduction as a result of own value-creating activity cannot be performed (Balezentis et al., 2018; Kozel et al., 2017).

This comparison provides information whether it is necessary or not to carry out changes within the analysed value-creating chain. It can be both a phase of projection or already realization of the analysed chain. Otherwise there is a threat of a potential crisis situation in this chain. At the weight significance of the realization of sales from the analysed product in case of the specified crisis, a potential crisis may be signalized in the whole business. While applying this system approach for the determination of a potential crisis, it is possible ex ante during the target projection of the value-creating chain or directly in real operative time and struggle for the realization of corrective actions for the solution of a potential crisis in this chain. This is a very important aspect of this analytic approach.

The second analytic model-based system approach is based on analysis and evaluation of aggregate statistical data files related to the flow of capital in the business. The data files are based on the application of financial ratios, which may be monitored in businesses or obtained from the primary business data associated with the flow of capital. The financial ratios are used within different types of the financial analyses, including models for the evaluation of business capital development, for example, bankruptcy prediction models. One of the analytical methods used for the creation of these models is, for example, the discrimination analysis (Altman, 1983; Boďa *et al.*, 2016; Karas *et al.*, 2017). The used financial ratios for the evaluation of capital development in the business are marked as discriminators. By statistic testing the aggregate data in relation to the delimited discriminators and applying the statistically known procedures of the derived discrimination function, it is possible to rank the analysed business among businesses heading into insolvency and bankruptcy or among successful businesses, i.e. with an effective flow of capital.

2. METHODOLOGY

As a basic testing criterion for the evaluation of the possibility of a potential crisis occurrence, we use the return on equity criterion in a reduced form, i.e. the profit margin (ROS) ratio. As was already mentioned, as a critical limit associated with the possibility of a potential crisis, we consider the critical limit, at which ROS will equal zero, i.e. ROS = 0. Of course, based on the DuPont analysis, there is also ROE = 0. In this case, the final output from the analysed value-creating process causes simple reproduction. However, when changing the level of input variables in the direction of worsening the course of the value-creating process, a potential crisis in a business can be identified and signalized. Not only profitability and value creation is threatened, but also if the situation is not solved properly, there is a real risk of the business bankruptcy.

The values of the indicators presented in the formula (1) are quantified for the determined time. The analysed product is considered to be an input from the value-creating chain. It has, however, a fundamental economical meaning for the business revenues (sales) in considered practical example.

With regard to the presented initial considerations, we will be interested in a partial ratio of the decomposed ROE ratio, and that is the return on sales ratio in the following form (2).

$$ROS = \frac{EBIT}{S} \tag{2}$$

If the value of this ratio will be zero, i.e. ROS = 0, then it is clear that the values of the other ratios in the DuPont system cannot affect the resulting value of the total ROE ratio. Its value will be at the zero level, i.e. ROE = 0. That is why for the next considerations, we will go analytically from this ratio under the criterion condition that ROS = 0.

After having inserted the variables into the formula (2), we will get it in a form (3).

$$ROS = 1 - \frac{1}{p}\left(\frac{FC}{Q} + v\right) \tag{3}$$

where p is the average price, for which the analysed product is being sold in monetary units per piece, i.e. [m.u./pc] for the evaluated period of time, Q is the average produced and sold quantity of the analysed product in pieces for the evaluated period of time, i.e. [pc/t], FC is the average level of fixed (relatively fixed) costs for the evaluated period of time in monetary units per period of time, i.e. [m.u./t], and v is the average level of the unit variable costs in monetary units per piece, i.e. [m.u./pc] for the evaluated period of time.

In our example, we consider a period of one month within the whole period for the determination of the average amount of values of the input variables. It is necessary to decrease the testing period with regard to the possible growth of frequency of failures in the value chain, which can initiate a new crisis.

The critical level of these variables will be derived within fulfilment of the condition of a potential crisis in the analysed organizational unit, i.e. for ROS = 0. They will be considered to be signalling information for a potential crisis in the analysed organizational unit.

The first task will be derivation of the critical amount of the input variables determining the level of ROS under condition that ROS = 0. In relation to the formula (3) for the determination of the level of ROS, it will be thus the delimitation of critical level of four already mentioned input variables which we designate as the critical levels with the following symbolic indexing: (pc); (Qc); (FCc); (vc). It means for the condition that ROS=0. Consequently, we will specify formulas for the determination of the critical level of particular variables, namely:

a) critical amount for the input variable (p), i.e. (p_c)

$$p_c = \frac{FC_A}{Q_A} + v_A \tag{4}$$

b) critical amount for the input variable (Q), i.e. (Q_c)

$Q_c = \frac{FC_A}{p_A - v_A}$ (5)

c) critical amount for the input variable (FC), i.e. (FC_c)

$FC_c = (p_A - v_A) . Q_A$ (6)

d) critical amount for the input variable (v), i.e. (v_c)

$v_c = p_A - \frac{FC_A}{Q_A}$ (7).

If one of the above-mentioned input variables achieves the actual amount determined according to the formulas from (4) to (7), then this information signalizes a potential crisis. Average values from the data file of the achieved values of these variables in the analysed business unit will be applied for the determination of a critical amount of the input variables. That is why we designate the value of these variables in the formulas from (4) to (7) by index (A) as the actual values, i.e. p_A, Q_A, FC_A, and v_A. It also can be a level determined, for example, based on strategic analysis.

From the above-mentioned formulas (4) to (7) and relations of particular input variables, it is clear how the value of the input variable affects this critical amount. To solve a potential crisis in the analysed unit, there is important information about a "safety gap" (reserve) in the amount (S_g). This information is given by the difference of the actual amount of the particular input variable and its critical level.

It means that for separate input variables the safety gap (reserve) is valid under the following conditions:

- for the variable (p), the gap (S_{gp}) is real, when it is true that $p_A - p_c > 0$, it means that, for example, the actual price of the product can decline in the market in time up to the critical value of the price; the amount of the reserve is then $S_{gp} = p_A - p_c$;
- for the variable (Q), the gap (S_{gQ}) is real, when it is true that $Q_A - Q_c > 0$, it means that, for example, the actual production and sale of the respective product can decline in the market during a time up to the critical amount of production; the amount of the reserve is then $S_{gQ} = Q_A - Q_c$;
- for the variable (FC), the gap (S_{gFC}) is real, when it is true that $FC_A - FC_c < 0$, it means that the critical amount of the fixed costs (relatively fixed costs) is higher than actual one. It means that in the delimited period of time fixed costs can increase as a result of situation in the market, for example due to the purchase of services for operation. The actual amount of reserve is then given by a difference in absolute value between the actual amount of the fixed costs and their critical amount, i.e $|FC_A - FC_c| = S_{gFC}$;
- for the variable (v), the gap (S_{gv}) is real, when it is true that $v_A - v_c < 0$, it means that the critical amount of the variable costs per unit is higher than the actual amount of the variable costs per unit. Within the delimited time, the variable costs per unit can grow due to the situation in the market. The amount of reserve is then given by a difference in absolute value between the variable costs per unit in their actual level and their critical amount, i.e. $|v_A - v_c| = S_{gv}$.

To determine actual amount of the input variables for the test of their critical amount, we considered their average amount based on a simple arithmetic mean. For the analysis, we considered one month as a time unit for the time interval in a range of 14 months. We determined the average actual amounts of the input variables using confidence intervals. Because of the relatively small sample, we used Student's t-distribution for the construction of confidence intervals of the input variables (Rémillard, 2013; Freund and Wilson, 2003).

The standard error of the mean (δ) can be determined using the formula (8).

$\delta = \frac{s}{\sqrt{n}} . tp = \mu - m$ (8)

where s is the sample standard deviation, n is number of input data, t_p is a Student-t random variable with (k) degrees of freedom (whereas k = n -1) at the specified confidence level, m is the sample mean, μ is the estimated sample mean in relation to the standard error of the mean (δ).

The sample mean (m) can be determined with the help of the following formula (9):

$$m = \frac{1}{n} \sum_{i=1}^{i=n} x_i, \qquad (9)$$

where (x_i) are values of input data of the sample and the sample standard deviation can be determined using the formula (10).

$$s = \sqrt{\frac{\sum_{i=1}^{i=n}(x_i - m)^2}{n}} \qquad (10)$$

Based on formula (8), it is possible to determine a confidence interval, namely from the formula (11).

$$\mu = m \pm \frac{s}{\sqrt{n}} . tp \qquad (11)$$

The formula (11) can be transformed to the range form (12):

$$\mu \in \langle m - \frac{s}{\sqrt{n}} . tp;\ m + \frac{s}{\sqrt{n}} . tp \rangle \qquad (12)$$

where $\mu_{min} = m - \frac{s}{\sqrt{n}} . t_p$ and $\mu_{max} = m + \frac{s}{\sqrt{n}} . t_p$.

In our case, these formulas will be used for the determination of actual average values of the input variables for the calculation of the critical levels of the variables for the signalization of a potential crisis. It means that these will be input data on the basis of an arithmetic mean (μ) in interval (μ_{min}) and (μ_{max}). For example, an average price will be determined in an interval (μ), namely in the amount of (p_{Amin}) and (p_{Amax}). Further we will calculate the intervals for actual variables, namely for the quantity of production (Q_{Amin}) and (Q_{Amax}), for the actual level of the fixed costs (FC_{Amin}) and (FC_{Amax}) and for the actual level of the unit variable costs (v_{Amin}) and (v_{Amax}).

By using this analysis, we get two possible statistically-derived limits for the determination of the critical amounts of input variables, namely (p_{cmin}) and (p_{cmax}), (Q_{cmin}) and (Q_{cmax}), (FC_{cmin}) and (FC_{cmax}), and (v_{cmin}) and (v_{cmax}).

We can use the average values of the input variables as actual values for a specified period of time in case of a relative market stability. If we find out that there are significant changes or failures in the market, it is necessary to use the actual values of the input variables for the consequential analysis with the evaluation of the possibility of a potential crisis.

3. MODEL-BASED DETERMINATION OF THE POSSIBILITY OF SOLUTION OF THE REAL POTENTIAL CRISIS

In this chapter we will specify the analytical procedure of model-based determination of the possibility of solution of the real potential crisis. It means that at least one of the input variables affecting the level of ROS achieves such an actual level that it will cause a decrease of ROS below the critical level of ROS = 0. This will change the theoretical potential crisis to the real potential crisis with a possibility of transfer up to a real crisis in case that the occurred situation is not solved. It means that the actually achieved level of ROS will be lower than 0, i.e. ROS < 0.

Occurrence of this situation, as was already mentioned, can be caused by a change of the original actual value of the input variables determining the level of ROS to a level, which can be described as *a new actual level*. These input variables from the point of view of their level will be then symbolically indexed as p_{NA}, Q_{NA}, FC_{NA}, and v_{NA}.

The real potential crisis will occur with relation to the considered evaluating criterion, i.e. ROS < 0. For example, it means for a price input variable that the level of new actual level p_{NA} will decline in relation to the prior actual level p_A that this decline initiates a situation when ROS < 0. There is a new situation in a business that the amount of difference $|p_{NA} - p_A| = \Delta_{cs}$, i.e. crisis-significant difference which leads to a situation that ROS < 0. Then we can describe the level of the input variable $p_{NA} < p_c$ as critical and we can symbolically index it as (p_{cr}). In case that the difference is lower than Δ_{cs}, there is a reserve in relation to the critical level of this variable (p_{cr}).

In the same way, it is possible to consider the other input variables influencing the achieved level of ROS within the analysed value-creating chain.

3.1 Model-based solution of the real potential crisis

Now we will specify the proposed possible solution of a real potential crisis in a particular business unit. It means a situation in the business, when new actual level of any input variable or variables affecting the level of the achieved level of ROS leads to a situation that ROS < 0. We will propose via modelling a corrective analytical solution of the real potential crisis in the business to achieve fulfilment of the critical condition for the potential crisis, i.e. ROS = 0.

The achievement of the status of fulfilment of this condition will be derived by means of projection with a necessary correction in the level of some other variables, which influence the level of ROS. The designed amount of the corrected (adjusted) levels of the input variables could be symbolically indexed as p_{AD}, Q_{AD}, FC_{AD} and v_{AD}. Any changes of the level which are higher than the level which is necessary to meet the condition ROS = 0, i.e. the level which is newly defined via correction for the particular input variable, leads to such a situation that the level of ROS is higher than 0 (ROS > 0). The corrective changes of the level of the input variables for the solution of a real crisis situation (for example, at the level of the product price) may be considered in the following structure:

a) we will carry out analysis of a possibility with a real proposal of corrective actions within one of the remaining input variables affecting the level of ROS;
b) we will carry out analysis of a possibility with a real proposal of corrective actions in a partial amount of the remaining input variables enabling a solution of the situation, at which ROS < 0.

A decision of by which method it is possible to solve the real crisis situation can be made not earlier that after analytical evaluation of variants with regard to the possibilities of realization of the change of input variables. Now, we are going to specify a model-based presentation of relations for the determination of the corrective (adjusting) amount of the input variables for the analytical approach mentioned above under letter a). We will derive the necessary corrective amount of the input variable upon achievement of the actual level of one of the input variables, namely the amount under their critical level. It means that, for example, in case of a price as an input variable under situation that $p_A < p_c$, tj. $p_A = p_{cr}$, or it is true $p_{NA} < p_c$, this means that $p_{NA} = p_{cr}$. Similarly, it will be also in case of other input variables.

We are going to describe analytical approach of solution of the situation in the following example. There is a situation in a business that an amount of input variable is set in the market, namely the price at the level of $p_A < p_c$, i.e. at the level of p_{cr}. We will derive and test a possible corrective solution of the occurred situation, i.e. of the real existence of the crisis conditions in the business. The determination of the amount of the necessary change in the actual amount of the input variable for the solution of the crisis situation initiated by the decrease of the actual amount of the price will be derived for an input variable which is the quantity of the products being manufactured and sold (Q) within the specified time. It means that for the corrective change of the actual amount within the input variable (Q), i.e. for the level (Q_A), it is necessary to derive an amount of their change, namely the level (Q_{AD}) so that the minimum criterion-based condition was met for the level of ROS, i.e. ROS = 0. It is the level of Q_{AD} as a newly adjusted amount of the quantity.

In relation to the formula (3) for the determination of ROS, we can determine a formula for the determination of the level of the variable Q_{AD} for the criterion ROS = 0 as follows (see formula 13)

$$Q_{AD} = \frac{FC_A}{p_{cr} - v_A} \qquad (13)$$

The newly determined level of production and sale of the particular product has to be further tested to check that it is achievable from the point of view of the production and sale. It is a question of application of the testing criterion

$$Q_{max} \geq Q_{AD} \qquad (14)$$

It means, for example, that it is possible - via the maximum possible daily production and sale of the product Q_{max} - to ensure the specified monthly production Q_{AD} in the business. It means to ensure fulfilment of the condition (14).

In case that the business is not able to ensure solution of the above-mentioned real crisis, namely in relation to the price situation, i.e. $p_A = p_{cr}$, it is necessary to carry out a test of changing the level of the next input variable. Firstly, we are going to determine the amount of FC_{AD} for the change in the level of the fixed costs again by the application of the relation for the determination of the amount of ROS under the condition ROS = 0 at the level of price p_{cr}.

By using the formula (3) with application of the condition that ROS = 0, the level of the fixed costs FC_{AD} can be determined according to the formula (15) in the following form:

$$FC_{AD} = Q_A\,(p_{cr} - v_A) \qquad (15)$$

We have to test the possibility to reduce the level of the fixed costs from the existing actual level, i.e. FC_A or FC_{NA} to the level of FC_{AD} within the possible variants of the reduction of these costs via particular structural items of the costs.

In case that the business is not able to change the level of fixed costs (achieving the level FC_{AD} or lower), it is possible to consider a solution of the situation through the unit variable cost. It means to change the level of v_A to the level of v_{AD}. Determination of the level of the input variable v_{AD} can be again carried out by using the formula (3) with the application of the condition that ROS = 0. The formula for the determination of the amount of v_{AD} will be as follows (16):

$$v_{AD} = p_{cr} - \frac{FC_A}{Q_A} \qquad (16)$$

In case of the determination of an interval of the average values of the input variables, i.e. by the presented statistical determination of the confidence interval of the sample mean of the input variables, it is possible to proceed to solution of the above-mentioned task at least on the basis of the limit values of the input variables.

As for a sequence of testing the possibility to solve a real crisis on the basis of suitability of the change of the actual level of the input variable to the newly adjusted level, it is possible to analyse the effectiveness, realization possibility, and risks associated with the implementation of the proposed change of the input variable. It means that easier accessibility in realization of the change of the level of the input variable will be ensured for such variables, which are more effectively controllable by business. In general, businesses can more easily influence those input variables related to the costs of production. The level of possibility of the change of quantity or price depends on the position of the business in the market. If the business has, for example, a monopoly position, a possibility of realization of these changes will be easier and more realistic than in case of its lower competitiveness.

To select one from the analytically derived variants for the solution of the real crisis in the business, we can use decision-making analysis based on the determination of utility of the variants, including expert determination of risks of realization of a particular variant. It means that we should assess the resulting effect of application of the particular variant. Within testing and evaluating the utility and risk of the particular variant, it is necessary to proceed systematically within the elements of the value-creating chain. For these analytical purposes, it is possible to use a number of methods, which are also applied within strategic management, for example, the SWOT analysis, financial analysis, marketing strategy methods, optimization methods, and statistics methods.

4. APPLICATION OF THE SYSTEMIC PROCEDURE OF THE ANALYSIS OF THE POTENTIAL AND REAL POTENTIAL CRISIS

In this chapter, we are going to introduce a practical application of the presented theoretical considerations. Briefly, we will present how to solve a real potential crisis in a particular business. It will be presented on the basis of analysis and evaluation of the product chain.

The particular solution will be carried out within a product of one of the Czech companies producing different types of products. One of the products is also a low-pressure boiler for heating the single-family houses and for warming water. Application of the theoretical procedures and considerations will be presented within this product. Input values based on actual values for the determination of their average amount for the input variables were obtained from the business information system.

To determine the critical levels of the input variables for the analysed product with the aim to obtain information about the possibility of a potential crisis, we will use the relations from (4) to (7) specified in the theoretical part. The amounts of the input variables both in the actual amount and in critical amount are presented in the following table (Table 1). We also calculated the percentage change of the input variables to get the critical level from the actual level. The percentage change is indexed as (p.c.).

Table 1. The amount of the input variables (actual, critical) and their percentage change

Input variable	*Actual amount (A)*	*Critical amount (cr)*	*Percentage change from the actual amount (p.c.)*
p	14,717 CZK/pc.	13,148 CZK/pc.	-11 %
Q	2,101 pcs.	1,636 pcs.	-22 %
FC	11,593,847 CZK	14,899,787 CZK	+28.4 %
v	7,630 CZK/pc.	9,199 CZK/pc.	+20.6 %

Source: own elaboration

Data in the form of a ratio can be informatively used for the analytical specification of the importance of a particular evaluated input variable from the point of view of priority of possibility of a potential crisis for the analysed business value-creating product process. It is obvious that the lower the percentage change (p.c.), the higher the probability of a potential crisis within this input variable. There is the following importance of the input variables within the analysed situation: 1) the price of production (p), 2) the unit variable cost (v), 3) the product quantity (Q), and 4) the fixed costs (FC). The interval-based determination of a possible level of the average actual amounts of the input variables via application of the formulas (9) to (12) is possible for the determination of the critical amounts and consequential analytical solution. The presentation of the interval amount of the input variables is in Table 2.

Table 2. Interval amount of the input variables

Input variables in the actual amount	*Minimum interval amount (min)*	*Maximum interval amount (max)*	*Relation of the max and min amount*
p_A	14,412 CZK/pc.	15,022 CZK/pc.	104.2
Q_A	1,084 pcs.	3,118 pcs.	287.6
FC_A	5,260,812 CZK	17,926,882 CZK	340.7
v_A	7,498 CZK/pc.	7,762 CZK/pc.	103.5

Source: own elaboration

As is clear from the Table 2, the percentage change of the average value within the actual amounts of the input variables is high for the input variable of the fixed costs (FC_A). We can consider this fact in the search for variants of actions in case that a real potential crisis occurred.

The percentage relation of the maximum and minimum amount of the input variable is also significant in case of the quantity (Q). It documents the fact that besides the statistical confirmation, there is also practical confirmation regarding a reserve in the production process and in possible sale of the product for the market prices. This fact should be used in preparing the correction actions for the solution of the real potential crisis, as will be presented in the solution of the analysed crisis within the product. On the contrary, as is clear from Table 2, there is a relatively low amount of divergence between the maximum and minimum in case of the level (amount) of the actual product price and the unit variable cost. Moreover, the market price of the product cannot be fully controlled by the business that is not a monopoly in the market. It means that in this example the price of the product can become a real cause of a real crisis in the business. In case of the unit variable cost, the situation is more solvable within the business, because it can search by itself an ex ante solutions in the direction of decreasing the expected level of the variable costs, and realize them in case of a potential crisis within this input variable.

4.2 Signalization of a real potential crisis

By using the analytical information knowledge presented within this article, we discovered a real potential crisis connected primarily with the sale of the product marked as U22. It was a market pressure to decrease the amount of the actual price (p_A) connected with the necessity of application of a new actual market price at the amount of (p_{NA}). The original actual price p_A = 14,717 CZK/pc dropped to the level of p_{NA} = 11,833 CZK/pc, and it is lower by 19,6% . Under this situation, the new actual price got to such a level when the testing condition for the existence of a real potential crisis is fulfilled, i.e.: $p_{NA} < p_c$. By this, the condition $p_{NA} = p_{cr}$ is achieved. Concretely, it means that $p_{cr} = p_{NA}$ = 11,833 CZK/pc. It is significantly lower compared to the critical level of the product price p_c = 13,148 CZK/pc. The new actual product price dropped to the crisis level, i.e. it decreased by 10 % compared to (p_c), and it caused a real potential crisis.

4.3 Solution of the real potential crisis

A proposal of possible actions for the solution of the real above-mentioned crisis was within consultation with the management of the business realized on the basis of the use of knowledge presented within subchapter 3.1. To quantify possible alternatives of the necessary changes compared to the existing actual amount of the remaining input variables (excluding the price variable (p)), i.e. changes of (Q_A), (FC_A) and (v_A), the following formulas were applied: (13), (15) and (16). Based on the calculations of the necessary changes for the above-mentioned input variables, i.e. determination of their adjusted level, (Q_{AD}), (FC_{AD}) and (v_{AD}), after evaluating the situation with the management of the business, a decision about a solution was made. The solution of the real potential crisis with regard to the product and sale possibilities and considering the risks of realization, the variant of increasing the production and sale of the analysed product was selected. It was the increase to the minimum average monthly amount Q_{AD} = 2,758 pieces per month. This amount (Q_{AD}) was derived by applying the formula (13). The possibility of achieving the amount of (Q_{AD}) to the specified level results from the marketing analysis for the analysed product and also from the presented information about the possible maximum of the input variable (Q) – see Table 2.

Any higher volume of production than (Q_{AD}) and its sale at the critical price p_{cr} = 11,833 CZK/pc will improve the level of (ROS) within the analysed product chain. The realization of this decision really led to the solution of the real potential crisis in the business. Since the sale of the analysed product represents about 40 % of the business revenue, the solution of the situation significantly contributed to the rational reproduction of the business equity.

CONCLUSIONS

A general model based on the DuPont system of financial analysis was presented in this article. As a basic testing criterion for the evaluation of the possibility of a potential crisis, we used the return on equity criterion in a reduced form, i.e. the profit margin ROS ratio. We considered the critical limit, at which ROS will equal zero, i.e. ROS = 0. By definition, based on the DuPont analysis, there is also ROE = 0. This model can be used for an identification of a possible potential crisis and for a solution of a real potential crisis in any for-profit business. The concept of real potential crisis is specified because although the crisis status is real, it is possible to prepare the business for the real potential crisis and remove this status. We can use the signalling leading information that help the business to have sufficient time for developing, evaluating and selecting the right strategy to solve this situation in case of its occurrence. It means to have ex ante systematically prepared possible corrective actions. The presented theoretical model was successfully applied for the solution of the real potential crisis in the particular Czech business producing low-pressure boilers. The advantage of this model is the availability of the data in the managerial accounting systems. In the next research, it is possible to consider theoretical and practical application of other methods for solution of potential crises within the presented analytical approach.

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