



SENSITIVITY ANALYSIS AS A TOOL FOR MANAGEMENT DECISION-MAKING IN CONDITIONS OF RISK

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Abstract: For more than two decades companies in Bulgaria have operated in a market economy. Although these market conditions provide entrepreneurial freedom and opportunities for initiatives they are uncertain and have risk. Furthermore, the globalization of this market is a prerequisite for strengthening this uncertainty. In such a risky and highly competitive environment, it is imperative that managers evaluate and predict economic activity as accurately as possible. This is the foundation for optimal decision-making which could be supported by sensitivity analysis.

This article discusses the application of sensitivity analysis for studying the influence of negative change in sales, prices and costs (variable and fixed) over financial result. The application of sensitivity analysis is demonstrated by sample data for a hypothetical company.

Key words: business risk, sensitivity analysis, margin of safety, operating leverage, return on assets

INTRODUCTION

In carrying out their activities, companies face different risks. In economic theory three main types of risk affecting different aspects of business are known. These are financial, investment and business risk. The business risk, which is dealt with in this paper, is defined as the possibility of adverse changes in economic and market conditions in which companies operate. Typical of these conditions in the modern world is that they become more uncertain and risky. A prerequisite for such a tendency, on the one hand, is the globalization of the market; on the other hand, it is contributed to by occurring and constantly deepening global economic and financial crisis. Although the market economy provides opportunities and freedom of initiative, it is essentially uncertain and risky.

In such a risky and highly competitive environment, company business activity has to be assessed and prognosticated by managers as realistically as possible which is a prerequisite for making optimal decisions. As a result of continuous research and analysis of company activities, it is necessary to make a preliminary assessment of risk and to take measures to eliminate possible losses. Economic risk is associated with the fluctuations of gross profit.

The study of risk is a multifaceted activity that leads to some difficulties. Similar difficulties arise from the understanding of the separate components of risk, which are influenced by some factors:

-The risk manifests itself through its different characteristics and in different situations, which makes its identification and assessment very difficult.

-The risk is inherently a subjective item, because the perception of a risky situation varies in different individuals [2].

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There are different points of view on the nature of risk, which is considered by some authors as a "possible hazard of accidental occurrence of adverse effects" [3]. This is the so called objective concept of risk.

Other authors are proponents of the subjective concept of risk. They say that risk has a specific nature because it manifests as a subjective assessment of activities and tasks by deliberate choice taking into account the possible alternatives of actions [5].

There is a third point of view regarding the concept of risk - its subjective-objective nature. Because risk is a product of a specific activity implemented under conditions of uncertainty and necessary choice, it is a choice of objective and subjective. Thus, the risk is always associated with both the choice of a given alternative and the assessment of the probability of occurrence of one or other effect [1].

Regardless of the treatment of the concept of risk, company management should explore the manifestation of different aspects of risk and on this basis make their solutions for future development of the company. As for the business risk, it should be stressed that adverse changes in market and economic conditions have a negative impact on financial results, and hence on company profitability. It is therefore necessary to study the factors affecting the profit and profitability.

SENSITIVITY ANALYSIS - ESSENCE AND CHARACTERISTICS

One of a variety of possible methods aiding the decision making process under conditions of risk and uncertainty is sensitivity analysis. This method of analysis explores the influence of certain risk factors on a given resultant magnitude. At the same time, other factors are assumed to be constant. Such an assumption is not absolutely correct because there is usually a correlation among some factors. And yet, in circumstances of uncertainty quantitative analysis (such as sensitivity analysis) could help managers within the decision-making process. Sometimes in cases which are not too complicated this method allows the choice of an optimal decision. In the case of a more complex situation it is useful to explore some variants. Thus, the risk would be reduced to a minimum level when decision-making. Through sensitivity analysis, the influence of different values of an independent variable upon a given dependent variable can be determined.

The major aim of each manager should be profit for the company which he/she manages. But the realisation of a positive financial result does not always mean effective activity. The indicators of company profitability show the possibility for a company to generate income. Although, profit is not an indicator for company profitability it is a driving force to earnings capacity. Therefore, factors determining the financial result are crucial to profitability. In this context, negative changes of selling prices, sales volume and costs (variable and fixed) affect financial results and profitability. At the same time, these impact on the indicators of business risk - safety zone and operating leverage. The application of sensitivity analysis allows the examination of profit reaction, profitability, safety zone and operating leverage upon change of influencing factors. In the course of sensitivity analysis, the following models are basic equations regarding financial results and profitability:

$$R_{AMLB} = \frac{\sum_{i=1}^n q_i p_i - a - \sum_{i=1}^n q_i b_i}{AMLB},$$

where:

GP - gross profit;

q_i - sales volume of i -th product;

a - fixed costs;

p_i - sale price of i -th product;

b_i - individual variable cost i -th product;

R_{AMLB} - profitability of productive assets;

$AMLB$ - assets connected with the main company activity.

Depending on the nature of the business, the sensitivity of financial results and profitability regarding their influencing factors may be different. In other words, the business risk level is determined by the specifics and state of the sector within which the company functions. In this context, low certainty indicates a large proportion of fixed costs in the structure of the total costs. Practical experience shows that certainty indicators are usually determined in circumstances of crisis with a decline in sales volume. The higher these indicators are, the lower is the probability of reaching the critical point of sales (upon decrease of company activity).

The most important indicators for determining the level of certainty are the rate of economic certainty and the operational leverage. The rate of economic certainty ($Z\%$) demonstrates (within the current level of performance) what percentage the sales or sales price may fall, and what percentage the fixed or variable costs per unit can be increased without incurring a loss. Operating Leverage (OL) measures the sensitivity of financial results, in terms of changes in sales and is calculated as the ratio of the total marginal revenue and profit:

$$Z\% = \frac{\sum_{i=1}^n q_i p_i - q_{CV}}{\sum_{i=1}^n q_i p_i} \cdot 100; \quad OL = \frac{mq_{CPU}}{GP},$$

where:

q_{CV} - break-even point expressed in value;

q_{CPU} - break-even point in physical units.

THE PRACTICAL APPLICATION OF THE SENSITIVITY ANALYSIS FOR ASSESSMENT OF THE ECONOMICAL RISK

In order to demonstrate the implementation of the method of sensitivity the following practical case has been developed:

For the production company "ABC" Ltd. data regarding some indicators for a given past period are known and presented in Table 1. For the objectives of company management and planning it is necessary to explore the change of financial result (GP), profitability (R_{AMLB}), margin of safety ($Z\%$) and operating leverage (OL) upon the variation of sales volume, prices, fixed and variable costs with 5% in a negative direction.

Because two products are considered in the example, some assumptions must be made. An average selling price and an average variable cost per unit are used when calculating the safety zone and operating leverage. The exploration could be implemented by the following stages:

Table 1

INDICATORS	Product "X"	Product "Y"	Total
Sales volume (q), (unit)	2 760	3 940	6 700
Sale price (p), (euro)	120	230	
Sales income (qp)	331200	906200	1237400
Variable cost (b)	55	120	
Fixed costs (a)			361530
Total cost of sales			986130
Gross profit from sales (GP)			251270
Margin of safety (Z%)			41,00
Operating leverage (OL)			1,44
Assets used in company's major line of business			1559500
Return on assets (R ^{AMLB} %)			16,11

1. Upon 5% reduction in sales volume, the changes that occur in the financial result, profitability, margin of safety (Z %) and operating leverage (OL) are shown in Table. 2.

Table 2

INDICATORS	Product "X"	Product "Y"	Total
Sales volume (q), (unit)	2 484	3 546	6 030
Sale price (p), (euro)	120	230	
Sales income (qp)	298080	815580	1113660
Variable cost (b)	55	120	
Fixed costs (a)			361530
Total cost of sales			923670
Gross profit from sales (GP)			189990
Margin of safety (Z%)			34,45
Operating leverage (OL)			1,90
Assets used in company's major line of business			1559500
Return on assets (R ^{AMLB} %)			12,18

2. Upon 5% decrease in selling prices – the changes in financial results, profitability, margin of safety (Z %) and operating leverage (OL) are listed in Table. 3.

Table 3

INDICATORS	Product "X"	Product "Y"	Total
Sales volume (q), (unit)	2 760	3 940	6 700
Sale price (p), (euro)	108	207	
Sales income (qp)	298080	815580	1113660
Variable cost (b)	55	120	
Fixed costs (a)			361530
Total cost of sales			986130
Gross profit from sales (GP)			127530
Margin of safety (Z%)			26,08
Operating leverage (OL)			2,83
Assets used in company's major line of business			1559500
Return on assets (R ^{AMLB} %)			8,18

Table 4

INDICATORS	Product "X"	Product "Y"	Total
Sales volume (q), (unit)	2 760	3 940	6 700
Sale price (p), (euro)	120	230	
Sales income (qp)	331200	906200	1237400
Variable cost (b)	60,50	132	
Fixed costs (a)			361530
Total cost of sales			1048590
Gross profit from sales (GP)			188810
Margin of safety (Z%)			34,31
Operating leverage (OL)			1,91
Assets used in company's major line of business			1559500
Return on assets (R ^{AMLB} %)			12,11

3. Upon 5% increase in variable costs - the changes in financial results, profitability, margin safety (Z %) and operating leverage (OL) are listed in Table. 4.

Table 5

INDICATORS	Product "X"	Product "Y"	Total
Sales volume (q), (unit)	2 760	3 940	6 700
Sale price (p), (euro)	120	230	
Sales income (qp)	331200	906200	1237400
Variable cost (b)	55	120	
Fixed costs (a)			397683
Total cost of sales			1022283
Gross profit from sales (GP)			215117
Margin of safety (Z%)			35,10
Operating leverage (OL)			1,85
Assets used in company's major line of business			1559500
Return on assets (R ^{AMLB} %)			13,79

4. Upon 5% increase in fixed costs - the changes in financial results, profitability, margin of safety (Z %) and operating leverage (OL) are listed in Table. 5.

Table 6

INDICATORS	Base situation	Factor 1	variation (%)	Factor 2	variation (%)	Factor 3	variation (%)	Factor 4	variation (%)
Gross profit (GP)	251270	189990	-24,39	127530	-49,25	188810	-24,86	215117	-14,39
Margin of safety (Z)	41,00	34,45	-6,56	26,08	-14,93	34,31	-6,70	35,10	-5,90
Operating leverage (OL)	1,44	1,90	0,46	2,83	1,40	1,91	0,48	1,85	0,41
Return on assets (R ^{AMLB})	16,11	12,18	-3,93	8,18	-7,93	12,11	-4,01	13,79	-2,32

As a result of the example and data (shown in Table 6), when assessing the sensitivity of financial results, profitability and certainty indicators some conclusions may be drawn:

➤ The financial result is mainly influenced by the changes of selling prices. The decrease in prices by 10% leads to a decrease in profit by 49.25 percent. This shows that in terms of production, there is little elasticity of demand by price. The safety zone decreases by 14.93%, which is as a result

of shifting of the critical point to the right, i.e. the critical volume increases. In the situation, characterised by the second factor (sales price), the operating leverage is twice as large as in the underlying situation. This shows a much greater sensitivity of financial results to changes in sales volume. Assets profitability decreases considerably.

➤ The influence of changes in fixed costs is weakest. The increase in fixed costs by 10% leads to a reduction of financial results of 14.39%. In this situation, the margin of safety decreases by a smaller percentage - 5.90 %. Asset profitability decreases by only 2.32% and is highest in comparison with the other three situations. The operating leverage is very low (0.41), which shows a lower sensitivity of financial results to changes in sales volume.

CONCLUSION

This method itself does not give a complete picture of the economic situation. However, by its use, information about the effectiveness of usual activity and degree of business risk in the short term can be obtained. This information should be used to assist managers in making decisions concerning the main parameters of economic activity. In combination with others, the method of sensitivity would contribute to the making of more precise and adequate solutions. To achieve such an objective, simulation methods can be applied (e.g. Monte Carlo method), where some iterations of the developed model are realised, with a main aim of determining the relationship between factors which have been explored. The simulation approach is not within the scope of this article and will not be scrutinized.

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