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BREAK-EVEN POINT MODELLING AS A TOOL FOR STRATEGIC PLANNING AND BUSINESS RISK ASSESSMENT

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Abstract:
The article examines the use of break-even point modelling as an instrument of strategic planning and enterprise risk assessment. It analyses the economic foundations of the cost-volume-profit (CVP) model, methods for calculating the critical sales volume, and the influence of the structure of fixed and variable costs on contribution margin and operating leverage. The study highlights the role of financial analysis, the model's sensitivity to price and cost parameters, and the use of scenario-based and probabilistic approaches for forecasting the risks of crossing the break-even threshold. It is shown that integrating break-even modelling into managerial decision-making supports the development of flexible pricing and investment policies, optimises the product portfolio, and enhances the resilience of the business model under conditions of uncertainty.

JEL: M15; M31; L81; D91

Keywords: break-even modelling, CVP analysis, financial analysis, strategic planning, operating risk, scenario modelling, business model resilience

1. Introduction

Break-even point modeling is a key tool of strategic and financial analysis that makes it possible to quantitatively assess the interaction between production volume, cost structure, and pricing policy. The relevance of this research is determined by increasing market volatility, intensified competitive pressure, and the need to make managerial decisions based on objective financial indicators. Under conditions of uncertainty, the break-even point becomes a benchmark that allows one to determine the boundaries of business stability, assess profit sensitivity to parameter changes, and construct well-grounded forecasts of enterprise development. In addition, the expanding use of analytical models in digital ecosystems reinforces the importance of a precise

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understanding of the mechanisms underlying the formation of the critical sales volume and the improvement of financial analysis quality.

The aim of this study is to analyze the break-even point model as a tool for strategic planning and business risk assessment, as well as to identify its potential for forecasting the consequences of managerial decisions in the long term. The paper examines the theoretical foundations of break-even formation, methods for calculating the critical sales volume, and the impact of cost structure on the resilience of the business model.

2. Main part. Theoretical foundations of the break-even model

The economic nature of break-even is determined by the fundamental relationship between costs, sales volume and price, which makes it possible to identify the minimum level of sales at which a firm covers all its expenses and begins to generate profit [1]. The conceptual foundations of cost–volume–profit (CVP) analysis, which underlie the modern break-even model, were formed in the first half of the twentieth century in the works of John Maurice Clark, who was one of the first to propose an analytical assessment of the relationship between costs, output and profit. Subsequently, the methodology was further developed within the framework of management accounting and gained wide acceptance owing to the works of Charles T. Horngren and the subsequent standardisation of CVP analysis in Western managerial literature [2].

In strategic management, the break-even model is interpreted as a tool for assessing the resilience of a business model and analysing the permissible parameters of operating activity. It provides management with information on the range of safe production and sales volumes, makes it possible to evaluate the impact of pricing decisions on product margin, and supports the development of well-founded long-term growth strategies [3]. Under conditions of uncertainty and market volatility, this tool becomes particularly important, as it enables a quantitative assessment of the consequences of managerial decisions and the identification of threshold values that are critical for maintaining profitability. The applicability of the model is determined by compliance with a number of analytical assumptions that ensure the correctness of calculations and the interpretation of results (Table 1).

Table 1: Key features of the break-even model and their analytical significance

Feature of the model	Description of the feature	Analytical significance
Linearity of revenue and costs	The selling price and variable cost per unit remain constant; fixed costs are stable within the relevant range of activity.	Enables the use of linear functions and the construction of a graphical CVP model; simplifies profit forecasting.
Homogeneous product or stable product mix	The firm produces a single product or maintains a fixed, predetermined sales mix.	Ensures correct calculation of contribution margin and break-even point.
Clear separation of fixed and variable costs	Costs can be unambiguously classified according to their behavior.	Determines the accuracy of break-even calculations and operating leverage estimates.
No changes in inventory levels	Sales volume is assumed to be equal to production volume.	Eliminates distortions in cost allocation and profit measurement in short-term analysis.
Constant technological and operating efficiency	Productivity, technology, and resource utilization remain unchanged over the period considered.	Ensures comparability of cost and revenue parameters.
Short-term time horizon	Activity parameters are stable within a limited planning period.	Increases the reliability of forecasts and the validity of managerial conclusions.

The presented features define the general conditions under which the break-even model can be applied and form the foundation for further analysis of its quantitative parameters. In this context, the classification of costs plays a particularly important role, as it constitutes a key component of the model: the cost structure directly determines the firm's sensitivity to changes in sales volume (Table 2).

Table 2: Classification of costs and their analytical characteristics [4]

Type of cost	Definition	Impact on profit	Role in break-even modeling
Fixed costs	Do not vary with the level of output or sales volume.	Determine the mandatory coverage threshold before the firm begins generating profit.	Form the baseline level of the break-even point; higher fixed costs increase operational leverage.
Variable costs	Change proportionally with output volume.	Directly influence contribution margin and the rate at which profit grows with additional sales.	Affect the speed of reaching the break-even point and determine contribution margin per unit.
Semi-variable (mixed) costs	Contain both fixed and variable components.	Create a combined effect on profitability; complicate profit forecasting.	Require refined modeling techniques; may distort linear assumptions of classic CVP analysis.
Step costs	Change discretely when activity reaches certain thresholds.	Cause non-linearities in cost behavior and affect profit sensitivity.	Important for scenario-based analysis; modify the break-even point at different production levels.

The relationship between these categories of costs determines the magnitude of operating leverage, which reflects the degree to which profit depends on fluctuations in revenue. The higher the proportion of fixed costs in the cost structure, the more pronounced the changes in financial results when sales volumes vary, thereby increasing the riskiness of the business model. Consequently, analysing the cost structure makes it possible to forecast the firm's stability, assess its ability to adapt to changes in market conditions, and develop decisions aimed at stabilising financial performance.

3. Methodology for calculating and analysing the break-even point

The methodology for determining the break-even point is based on the use of marginal analysis, which requires the separation of costs into fixed and variable components and the calculation of contribution margin as the key parameter for covering expenses. The contribution margin per unit of output is defined as the difference between the selling price and variable cost:

$$MD_{unit} = P - VC, \quad (1)$$

Where P is the selling price and VC is the variable cost per unit. The total contribution margin is obtained as the product of the unit contribution margin and the sales volume:

$$MD = (P - VC) \times Q, \quad (2)$$

Where Q – quantity of units sold.

The resulting value is compared with the amount of fixed costs, which makes it possible to determine the break-even point in physical units:

$$Q_{BE} = \frac{FC}{P - VC}, \quad (3)$$

Where FC denotes fixed costs, Q_{BE} – break-even sales volume (units).

In monetary terms, the critical level of revenue is calculated using the contribution margin ratio:

$$R_{BE} = \frac{FC}{MR}, \quad (4)$$

Where R_{BE} – break-even revenue; MR – contribution margin ratio;

$MR = \frac{P - VC}{P}$ – share of contribution margin in each unit of revenue.

An important component of break-even analysis is the calculation of operating leverage, which measures the sensitivity of profit to changes in revenue. It is defined as:

$$OL = \frac{MD}{Profit}, \quad (5)$$

Where OL – operating leverage; MD – total contribution margin; $Profit$ –operating profit of the period.

In expanded form, the indicator is expressed as:

$$OL = \frac{Q(P - VC)}{Q(P - VC) - FC}, \quad (6)$$

Which highlights the dependence of leverage on the proportion of fixed costs in the cost structure.

High values of operating leverage indicate substantial volatility of profit when sales volumes change, which makes this indicator a key measure of the riskiness of the business model.

The graphical interpretation of CVP analysis, typically presented as a break-even chart, serves as an important tool for visualising the relationship between revenue, costs and sales volume and for identifying the break-even point and the range of profitable and loss-making activity (Figure 1).

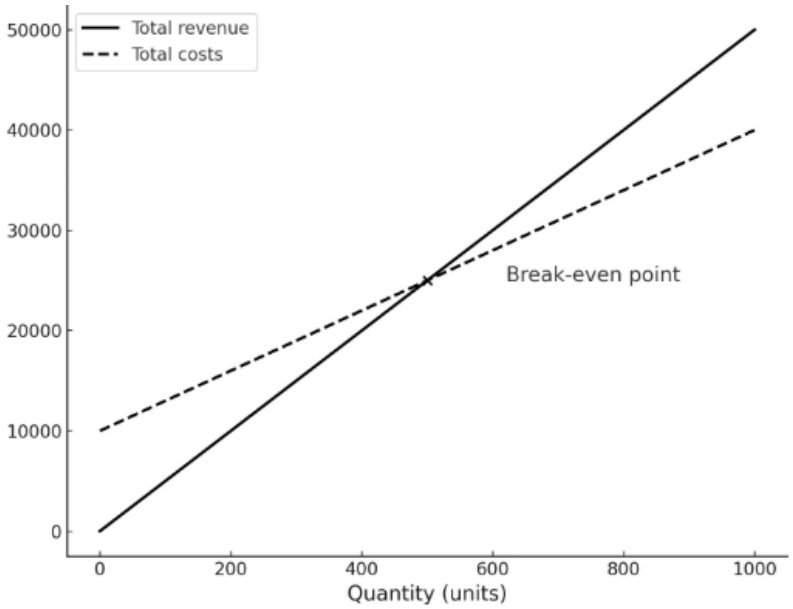

Figure 1: Break-even chart (CVP analysis)

The figure illustrates the classical linear CVP model, in which the intersection of the total cost function and the revenue line identify the break-even point. The area to the left of this point corresponds to the loss zone, while the area to the right represents the profit zone.

An essential element of the methodology is sensitivity analysis, which is aimed at assessing the influence of key model parameters on the magnitude of the break-even point. Within this approach, the selling price, variable costs, fixed costs and sales volume are varied, which makes it possible to identify the factors that exert the greatest impact on the stability of the business model. Sensitivity analysis supports the development of managerial decisions aimed at cost optimisation, adjustment of pricing policy and stabilisation of the enterprise's financial performance.

For illustrative purposes, a stylised numerical example was used to demonstrate the mechanics of sensitivity analysis. The baseline parameters – a selling price of $50, variable costs of $30 per unit and fixed costs of $10,000 – correspond to the model used in the CVP chart and serve solely to illustrate the effect of parameter variation on the break-even point (Table 3).

Table 3: Sensitivity of the break-even point

Parameter change	Baseline value	Adjusted value	Break-even point (units)	Deviation from baseline, %
Price –10%	50	45	667	+33%
Price +10%	50	55	400	-20%
Variable costs +15%	30	34.5	645	+29%
Variable costs – 10%	30	27	435	-13%
Fixed costs +20%	10,000	12,000	600	+20%
Fixed costs –20%	10,000	8,000	400	-20%

Taken together, the presented methodological tools form a comprehensive analytical framework for determining and interpreting the break-even point. The combination of marginal analysis, graphical CVP representation and sensitivity testing provides a multidimensional view of how cost structure, pricing decisions and output levels jointly shape the financial viability of an enterprise. These techniques not only enhance the accuracy of break-even calculations but also enable managers to anticipate the consequences of operational changes, identify critical risk factors and develop more resilient financial and strategic plans. Consequently, the break-even model serves as a robust instrument for evaluating the stability of business operations under varying internal and external conditions, forming a basis for informed decision-making in both short-term and long-term planning horizons.

4. Break-even point as a tool for strategic planning

The break-even model functions not only as an instrument of operational analysis but also as a powerful component of strategic planning. In product portfolio management, it enables decision-makers to concentrate investments on products with higher contribution margins and shorter time to break-even. Empirical evidence indicates that the automation of pricing and the use of data analytics support assortment optimisation and improve profitability; in retail, quantitative approaches make it possible to forecast the break-even threshold more accurately and manage risk exposure more effectively [5, 6].

The strategic application of the model involves a systematic analysis of pricing decisions, cost structure and capital investments: changes in the selling price, increases in fixed costs due to new investments, or shifts in the structure of variable costs all affect the critical sales volume and the size of the safety zone. Studies in the field of procurement management show that cost optimisation through category-based analysis increases the robustness of the model to external shocks by reducing both fixed and variable costs [7]. Moreover, the integration of machine learning into management accounting systems allows firms to forecast operating costs and adjust the break-even point in advance, thereby strengthening the role of the model as a tool for business risk assessment [8]. From a strategic perspective, companies delineate a safety zone of sales and acceptable deviations from it: they set minimum revenue levels below which operations become unsustainable and define permissible variations in volume, cost or price within which the business remains profitable.

A telling illustration of the strategic use of the break-even model is provided by the practices of large U.S. corporations. According to industry analytical commentary, Tesla, Inc. employs break-even and scenario modelling when planning the utilisation of its gigafactories and evaluating investment scenarios, in order to quantify the impact of changes in battery component prices and the timing of new capacity roll-out on the threshold of economic viability.

In parallel, Amazon.com, Inc. applies CVP-based models when choosing directions for capital investment – in particular, in assortment expansion, warehouse network development and logistics optimisation. According to the company's 2024 annual report, Amazon generated revenue of $638 billion and operating profit of $68.6 billion, which underscores the need for strategic control over cost structure and for analysing the minimum sales volume required to cover capital-intensive investments. These examples demonstrate that the break-even model extends far beyond short-term operational analysis and becomes a key instrument for shaping long-term financial strategy, managing investment risk and enhancing the adaptability of businesses to changing external conditions.

5. Modeling business risks based on the break-even point

Modeling business risks using the break-even point provides a structured framework for identifying how volatility in key financial parameters affects the firm's ability to cover its costs. Unlike traditional CVP analysis, which focuses on determining a single critical sales volume, a risk-oriented approach evaluates the distribution of potential outcomes and the likelihood of falling below the break-even threshold. This links break-even modeling directly to financial analysis, risk forecasting and managerial decision-making.

Scenario analysis serves as the primary tool: variations in demand, pricing decisions, variable cost fluctuations and changes in fixed-cost commitments are incorporated into alternative trajectories. Each scenario is assessed in terms of its distance from the break-even point, forming a risk profile that reflects the firm's exposure to adverse conditions. When probabilistic methods such as Monte Carlo simulation are applied, the model yields the probability of operating below the break-even point – a quantitative indicator of operational vulnerability.

A critical component of risk modeling is the establishment of threshold values that trigger managerial actions. These thresholds may relate to declining contribution margin, erosion of the safety margin or the convergence of expected sales toward the break-even level. Decision rules derived from the model define which measures must be implemented when risk levels increase: price adjustments, cost-reduction initiatives, portfolio restructuring or temporary suspension of unprofitable activities. In this way, the break-even point becomes a boundary indicator linking operational performance with the resilience of the business model (table 4).

Table 4: Qualitative risk profile based on proximity to the break-even point [9, 10]

Risk level	**Position relative to break-even point**	**State of the business**	**Typical drivers**	**Managerial response**
Low risk	Safely above BEP.	Stable and predictable performance.	Steady demand, controlled costs.	Planned execution; capacity or investment expansion.
Moderate risk	Narrowing distance to BEP.	Stability under pressure.	Demand fluctuations, rising variable costs.	Selective cost optimisation; price fine-tuning.
Elevated risk	Fluctuating around BEP.	Reduced resilience.	Higher fixed costs, weak product mix.	Portfolio adjustment; cost restructuring.
High risk	Persistently below BEP.	Financial fragility.	Sales decline, cost shocks.	Urgent corrective measures; strategic revision.

This approach transforms the break-even model into an operational risk-assessment tool that integrates financial analysis with forward-looking risk evaluation and supports evidence-based managerial decisions. It also enables firms to quantify their vulnerability

to adverse market conditions and to prioritise corrective actions based on the severity and likelihood of potential deviations from the break-even threshold.

6. Conclusion

Break-even modeling serves as a universal analytical tool that links operational decision-making with long-term strategic planning. Its application within financial analysis enables the identification of the key factors shaping profitability, the assessment of business-model resilience, and the determination of the threshold below which operations become economically unsustainable. The integration of scenario-based and probabilistic techniques broadens the capacity for risk forecasting and allows for a quantitative evaluation of the likelihood of falling into the loss zone under changing internal and external conditions. Embedded into the managerial decision-making framework, the break-even model supports the development of flexible pricing strategies, cost optimisation initiatives and product-portfolio adjustments, thereby enhancing the firm's adaptability to uncertainty and strengthening its long-term financial stability.

Conflict of Interest Statement
The author declares no conflicts of interest.

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