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THE POSSIBILITIES OF APPLYING QUANTITATIVE METHODS IN POSTULATED COSTING

Summary: The paper presents the possibilities of applying selected quantitative methods in various types of postulated costing. First, the essence and objectives of postulated costing as a distributive form of costing are explained. Subsequently, the employment of simple statistical methods, i.e. averages and functions of a trend in normal costing, is indicated. In the further part, the manner of estimating planned costs on the basis of the cost regression equation depending on production volume is presented. The following point is devoted to determining standard costs by means of the descriptive economic model.

Key words: costing, postulated costs, quantitative methods.

1. Introduction

Managing enterprise activity costs requires relevant information on incurred costs and factors influencing their level. With this information, managers are able to evaluate the level of the costs that they control. The demand for analytical information with respect to activity costs is particularly high in the conditions of the market economy, with continuously growing competition. The basic source of this information is undoubtedly costing.

From the viewpoint of enterprise management, the control function is certainly the most important function of costing. Fulfilling this function requires determining an appropriate reference basis for costs actually incurred. This is also related to the distributive form of costing. Postulated costing has appropriate means with this respect at its disposal. The two crucial issues related to keeping postulated costing are as follows:

– determining postulated costs,
– analyzing variations of costs actually incurred from postulated costs.

The proper performance of these tasks requires the application of appropriate tools, which will allow providing possibly objective information on cost postulates and cost variances. Quantitative methods undoubtedly have high capacities in this respect. The research on cost behavior by means of these methods is free from subjective evaluations, which is crucial from the viewpoint of the effective fulfillment of the control function of costing.

The aim of this paper is to indicate the possibilities of using quantitative methods at the most important stage of postulated costing, which is determining postulated costs. These will be primarily statistical and econometric methods, which are particularly attractive due to their interpretation possibilities and, at the same time, the simplicity of their practical applications.

2. The essence of postulated costing

Postulated costing is a costing system where various categories of model costs are employed and which is directly related to the distributive manner of presenting costs actually incurred. This is because costing allows determining a viable cost level and presenting the costs actually incurred in an appropriate manner. This costing allows achieving a viable level of activity costs by creating a basis for controlling the behavior of costs over time, both before they are incurred and on the ongoing basis when enterprise resources are being used up. The introduction of postulated costs enforces the selection of the resources and procedures which are most appropriate from the point of view of effectiveness. Once specified postulated cost values, which may be updated, if needed, become units of measurement of enterprise activity [Bek-Gaik 2009].

Postulated costing is primarily employed in the enterprises which have an effective budgetary cost control system. This is because there are strong relations between postulated costing and cost budgeting. On the one hand, direct postulated costs constitute a basis for preparing a budget of these costs split by calculation items. On the other hand, postulated (standard) department costs, sales costs and general management costs are derived from the budgets of indirect costs. Postulated costs are specified for the unit of a cost item, which is usually a product or a technological operation. Costs in budgets, in turn, are determined for a whole responsibility centre.

Postulated costing is a costing system which employs the category of postulated costs in cost keeping and accounting. Postulated costs are the costs specified *a priori*, which determine the amount of costs which is model and necessary to incur. It is also assumed that enterprise resources are used reasonably in given conditions of conducting activity. Hence, postulated costs provide information on what the costs related to a production unit should be. These costs are characterized by their planned, directive and stimulatory nature, and are treated as the cost level that is necessary to be incurred to complete a production unit [Jarugowa, Malc, Sawicki 1983, p. 210]. Thus, the level of postulated costs is created in advance, before enterprise resources are used in its activity.

Postulated costing enables the distributive manner of presenting costs actually incurred, grouped along cost centers and cost objects (products) in each of its varieties. Costs actually incurred are indicated by dividing them into two components:

– postulated costs,
– variations of costs actually incurred from postulated costs.

If the conditions of conducting activity change with time, postulated costs are updated. This is expressed by the change of the initial level of postulated costs into the level considered indispensable at a given time. Postulated costs should not be changed too frequently because this hampers discovering permanent regularities in cost behavior and does not facilitate the performance of the motivating function of costing. This is how postulated costing enables the dynamic approach to the process of incurring costs.

Postulated costs are the aim assumed in advance with respect to unit costs, for which an enterprise should strive. These costs allow the evaluation of task performance in terms of resource use effectiveness. Therefore, variances of costs actually incurred from postulated costs reflect the level of achieving this aim while conducting activity. Reports on variances detected in responsibility centers should be regularly forwarded to senior management staff.

Variances of costs actually incurred from postulated costs are the subject of analytical research. The analysis of variances is a significant instrument of activity cost control conducted by cost centers (cost responsibility centers) and cost objects. At the same time, the level of variances of costs actually incurred from postulated costs constitutes a basis for evaluating the activity of cost responsibility centers. Moreover, the degree of detected variances is a criterion for evaluating the reasonability of using property resources engaged in enterprise activity. Additionally, the analysis of cost variances provides guidelines as to what needs to be improved to enhance the effectiveness of resource use.

The process of controlling activity costs by means of postulated costing is presented in Figure 1.

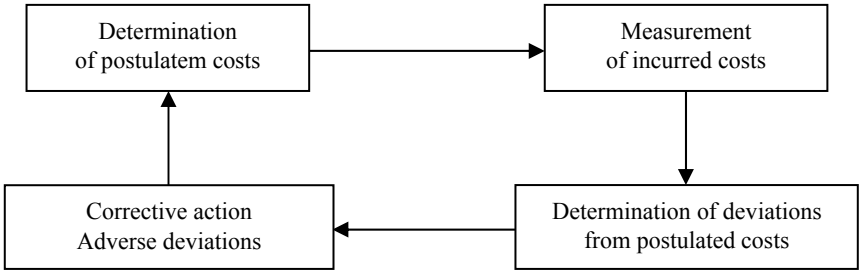

Figure 1. Postulated costing in controlling the activity

Source: author's own work based on Mott [2005, p. 256].

Postulated costing is included in the recording system of an economic entity and constitutes an integral part of systematic costing.

Postulated costs may be determined based on various model values. Taking into consideration the nature of cost postulates, three varieties of postulated costing may be distinguished [Nowak, Wierzbiński 2010, pp. 85–106]:

– normal costing,
– planned costing,
– standard costing.

These varieties are listed according to the criterion of the increasing degree of cost postulate accuracy.

Postulated costs are determined for a unit of a cost object (product, technological operation). Therefore, in accordance with the so-called "basic cost equation", they may be presented as a product of two factors:

– postulated price (rate),
– postulated consumption per one production unit.

Hence, the following correlation needs to be taken into account when determining the level of postulated costs:

$$C = p \cdot U,$$

where: C – postulated cost for a product unit,
p – postulated price (rate),
U – postulated resource consumption per product unit.

Postulated costs may be estimated by means of quantitative methods in two manners. The first one consists in estimating the total level of postulated costs without considering two indicated factors affecting their level. This manner of determining postulated costs shall be called the synthetic approach. The second one consists in determining the postulated price (rate) and the postulated consumption for a production unit separately. Postulated costs are then determined as a product of these both values. Such an approach to determining postulated costs may be called analytical.

The possibilities of using quantitative methods for determining postulated costs differ depending on the nature of costs. They are relatively largest when determining normal costs. The possibilities are smaller when determining planned costs, and the smallest when determining standard costs, which are based on technological standards.

The practical application of various statistical methods to determine postulated costs is effective when there are traditions related to budgetary cost control in an enterprise. The use of these solutions is particularly legitimate in stable conditions of pursuing the activity, with high inertia of economic processes. Furthermore, the empirical data on the basis of which postulated costs are estimated should satisfy

the comparability condition. The indicated assumptions are acceptable particularly for short periods but they are difficult to accept for long periods.

The application of quantitative methods comes down to the analysis and processing of empirical data related to examined economic phenomena. In the case of costing these are data related to the costs of activity and the factors affecting the level of costs. Postulated costs for a current period are determined with their level and the factors influencing them in previous reporting periods are taken into consideration. These are usually empirical data from individual months in a business year preceding a current year.

In the following sections of this paper suggestions related to applying relevant quantitative methods for determining individual types of postulated costs will be presented: normal, planned and standard. In the last section, in turn, the manners of analyzing the variations of costs actually incurred from postulated costs will be presented.

3. Statistical methods for determining normal costs

The essence of normal costing is to determine model costs with the level of the costs incurred in previous periods taken into account. Normal costs are determined based on the empirical data related to the costs incurred in a specific number of reporting periods. Based on such data, statistical considerations are determined with respect to the behavior of the costs observed in the past. These may or may not be predicative costs, and this depends on the assumptions taken when determining them. The primary aim of normal costing is to decrease the influence of fluctuations of the conditions of conducting activity on the level of postulated costs.

The arithmetic mean is the simplest statistical method of determining normal costs. The mean is calculated from a specified number of reporting periods preceding the period under examination. Periods taken into consideration should not be too numerous, e.g. individual months in a quarter preceding the examined period. This manner of determining normal costs may be applied to both the synthetic and the analytical approach.

When calculating the arithmetic mean, it is advisable to reject unusual and extreme values, which significantly vary from the normal level. The presence of such values may result from random factors. A good solution may be to apply the moving average method, which allows updating normal costs when the conditions of cost increase change significantly.

However, normal costs determined based on the arithmetic mean are not predicative. When employing this manner of determining them, there is a danger of transferring mismanagement, if any, from the past to the future. Therefore, it may be applied only when enterprise resources are effectively used and prices or rates achieve a reasonable level.

Normal costs may be determined also by the extrapolation of the trends observed in the past. In this case, when employing the synthetic approach, the task comes down to estimating the function of a trend:

$$C = f(t),$$

where: C – costs,
t – time variable ($t = 1, 2, \ldots, n$),
f – specific form of the function of a trend.

The parameters of this function are estimated based on the empirical data related to the costs from previous periods. By extrapolating this function, normal costs are determined for the examined reporting period. In this case, the level of normal costs results from a general development tendency and these are predicted values, which means that they are characterized by predicative qualities. This manner of determining normal costs is directly applicable when the course of trends is stable. In less stable conditions, the approach using the creeping trend and forecasting by means of the harmonic weight method may be employed [Nowak 2009, pp. 76–82].

In a short term, a linear form of the function of the cost trend, which is expressed with the following formula, is frequently assumed:

$$C = b + a \cdot t.$$

In this formula the parameter b is interpreted as the level of normal costs in the period preceding the period $t = 1$. The parameter a, in turn, means an average one-period increase ($a > 0$) or decrease ($a < 0$) of costs.

Another analytical form of the non-linear function of the cost trend is the exponential function, the formula of which is as follows:

$$C = b \cdot c^t.$$

In this formula, the parameter c means the cost dynamics index. The value $c - 1$, in turn, may be interpreted as the growth rate ($c > 1$) or the fall rate ($c < 0$).

Determining normal costs based on the function of a trend by means of the analytical approach comes down to estimating two separate functions of a trend:

– function of price (rate):

$$p = g(t),$$

– function of consumption per production unit:

$$U = h(t).$$

In this case normal costs are determined by the product of these two functions of a trend:

$$C = g(t) \cdot h(t).$$

Normal costing in the presented approaches is a certain bridge between costs actually incurred and postulated costing. It constitutes the development of costing in the *ex-ante* mode towards the *ex-post* mode of costing. Normal costing is applied mainly in order to decrease the influence of the fluctuations of the cost level on the results of the measurement of costs actually incurred. This costing significantly simplifies postulated costing.

4. Estimating planned costs based on the regression function

Planned costing is a variety of postulated costing which is included in the planning (budgeting) system in an enterprise. The basic objective of planned costing is to determine the cost level that is necessary to achieve the objectives assumed in a production plan. Planned costs are the predicted costs to be incurred in the future when assuming a reasonable use of production factors. Thus, the level of planned costs is commercially viable in given conditions of pursuing activity.

Determining normal costs based on the moving average and the function of a trend does not account for specified factors affecting the cost level. The application of the function of cost regression towards certain parameters of enterprise activity is a more attractive approach which eliminates this deficiency. Production volume plays this role most frequently. Thus, planned costs are not directly derived from the value of costs actually incurred in previous periods but are determined as a result of planning them.

The function of cost regression depending on production volume is employed with the assumption that it is production – which is the derivative of sales volume – that is the most important cause of incurring costs in an industrial enterprise. This is because pursuing production activity requires engaging various activity factors which constitute costs in terms of value. Although there are a large number of diverse factors that influence the level of production costs, the fundamental one is undoubtedly production volume, on which the degree of engaging specific factors and the effectiveness of enterprise operation depend.

The changes in production volume are directly reflected not only in the level of total costs but also in the level of product cost per unit. The scale of production shows the degree of applying production capacities, which, in turn, affects the level of unit costs. This is what is justified by the description of the correlations between unit costs and production volume by means of the regression function.

The correlations between the level of unit costs and the production level are determined with an assumption that the remaining conditions of pursuing activity are unchangeable in the examined period. This assumption is particularly justified in a short-term analysis. This is because technical, organizational and economic conditions of conducting activity normally do not change in a short period. Since postulated costing is short-term, the indicated assumption may be accepted.

In its general form, the function of unit cost regression against production volume is expressed with the following formula:

$$C = w(Q),$$

where: Q – production volume,
w – a specific form of the regression function.

The parameters of this function are estimated based on the empirical data related to the production costs per unit and the production volume from the subsequent reporting periods (months) in a given period (business year).

In the short term the following form of the hyperbolic function of unit cost regression against production volume is usually employed:

$$C = c_f + C_s ,$$

where: C_s – standing costs,
c_f – unit floating cost,
Q – production volume.

With this correlation postulated costs are the decreasing function of production volume.

Postulated costs are determined based on the regression function with assumed (planned) production volume. Postulated costs determined in this manner are predicted costs since they depend on planned production volume. Thus, they may be considered planned costs. The condition of applying planned costing is planning various areas of activity in its presented production version.

5. Determining standard costs by means of descriptive econometric models

In standard costing the role of cost postulates is played by standard costs. The analytically derived standards of production factors consumption are a basis for determining standard costs. These standards are distinguished by a high level of detail and accuracy of determining and justified with technological considerations. Hence, standard costs determine a model cost level that is justified with technological and organizational considerations. Thus, the major aim of standard costing is including production organization and the conditions of implementing a production process, presented according to the increasing accuracy of determining cost postulates in postulated costing.

The regression function presented in the previous section of the paper makes the cost level conditional on only one factor, which is production volume. A range of other organizational, economic, technological and technical factors affect cost behavior. It is possible to take these considerations into account by applying descriptive econometric models of costs. Such a model can be expressed in a general form as:

$$C = u\,(Q, X_1, X_2, \ldots, X_m),$$

where: u – a specific form of the cost model,

$X_1, X_2, \ldots, X_m$ – factors affecting the cost level.

This model is also estimated based on the empirical data related to the values present in it and observed in previous reporting periods. Taking into consideration predicted values of explanatory variables in a current period provides an estimation of postulated costs. The postulated costs determined in this manner are a bridge between planned costs and standard costs because they take into account both the volume of planned production and the conditions of production.

The econometric models describing the dependence of unit costs on production volume and the conditions of enterprise activity may assume diverse analytical forms. Specific forms of these models depend on the form of dependence of standing costs on the conditions of enterprise activity. Hence, the following three situations may be distinguished:

– standing costs depend on the conditions of enterprise activity, while floating costs are independent of these conditions,
– floating costs depend on the conditions of enterprise activity, while standing costs are independent of these conditions,
– both standing costs and floating costs depend on the conditions of enterprise activity.

It will be also assumed that the dependence of unit costs on production volume is hyperbolic, whereas the costs depend on the variables describing the conditions of enterprise activity in a linear manner.

If standing costs do not depend on the conditions of enterprise activity, while the floating costs do, the econometric model of product costs per unit may be expressed in the following manner:

$$K = \left(K_S + \sum_{i=1}^{m} a_i x_i \right) \frac{1}{Q} + k_z .$$

In a situation where floating costs depend on the conditions of enterprise activity and standing costs do not depend on these conditions, the described cost model per unit has the following form:

$$K = K_S \frac{1}{Q} + \left(k_z + \sum_{i=1}^{m} a_i X_i \right).$$

The most general form of the econometric model of unit costs is the one where both standing costs and floating costs depend on the conditions of enterprise activity. Such a model is expressed with the following formula:

$$K = \left(K_S + \sum_{i=1}^{m} a_i x_i \right) \frac{1}{Q} + \left(k_z + \sum_{i=m+1}^{s} a_i X_i \right).$$

In the presented models the parameter $a_i a_i$ shows the influence of enterprise activity on the level of unit costs.

6. Conclusion

Postulated costing is one of the most popular models of enterprise activity costing. This is so because it constitutes an instrument for predicting costs, controlling incurred costs and evaluating cost responsibility centers. In this costing, the variances of costs actually incurred from postulated costs are a basis for detecting reserves with respect to improving the effectiveness of using enterprise resources. In the actions oriented on achieving this aim, detecting the causes of occurring variances is a crucial issue. Due to this, postulated costing satisfies the needs of operative enterprise management [Biadacz 2011, p. 143].

The efficacy of the activity control effectiveness by means of postulated costing depends to a large degree on the correctness and accuracy of determining postulated costs. It is important that these costs are determined in an objective manner so that they may be considered an appropriate basis for the reference of costs actually incurred. This postulate largely ensures the application of quantitative methods in postulated costing.

The present paper indicates the possibilities of applying only selected quantitative methods, i.e. statistical and econometric, in postulated costing. In this costing more advanced quantitative methods, such as operational research or cross-company flows, may be also applied. The paper was restricted to indicating relatively simple methods as they may be applied by practitioners. The point is that the methods are intuitively comprehensible, which is extremely important from the applicative point of view.

Moreover, the discussion was restricted to the manners of determining postulated costs. The analysis of the variances of costs actually incurred from postulated costs is undoubtedly a significant issue related to applying postulated costing as an instrument of controlling activity costs. Certain quantitative methods, in particular statistical relevance tests, may be also employed in this analysis. However, this issue exceeds the limits of this paper.

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MOŻLIWOŚCI ZASTOSOWANIA METOD ILOŚCIOWYCH W RACHUNKU KOSZTÓW POSTULOWANYCH

Streszczenie: W artykule przedstawiono możliwości wykorzystania wybranych metod ilościowych w różnych odmianach rachunku kosztów postulowanych. Na początku wyjaśniono istotę i zadania rachunku kosztów postulowanych jako rozdzielczej postaci rachunku kosztów. Następnie wskazano na zastosowanie prostych metod statystycznych, tj. średnich i funkcji trendu w rachunku kosztów normalnych. W dalszej części ukazano sposób szacowania kosztów planowanych na podstawie równania regresji kosztów w zależności od wielkości produkcji. W kolejnym punkcie omówiono wyznaczanie kosztów standardowych z wykorzystaniem opisowego modelu ekonomicznego.

Słowa kluczowe: rachunek kosztów, koszty postulowane, metody ilościowe.