UDC 519.866
JEL Classification: M 31; C 49

Bilobrova O.V., Holovko A.O., Naumenko Yu.Y., Kirieieva O.V.

USE OF ECONOMIC-MATHEMATICAL MODELING TO IMPROVE ASSORTMENT POLICY OF THE ENTERPRISE OF RETAIL TRADE

Ukrainian State University of Chemical Technology, Dnipro, Ukraine

To carry out successful activities on the market, an enterprise needs an elaborate commodity politics. As for the retail trade enterprises, that perfection of the organization of trade services for the population and the increase of economic efficiency of the enterprise functioning directly depend on the correct formation of the assortment of goods in the retail trade network. Economic – mathematical modeling is an important component of the process of formation and improvement of the assortment policy of retail enterprises. In the article, the process of forming of the range of goods is considered in shops on trading in non-food items commodities. A few universal methods of analysis of assortment is investigational, among that most attention presents combined ABC- XYZ-analysis. The combined matrix of ABC is built – XYZ-analysis. Bases are reflected plural regressive analysis. Built economic – mathematical model of volume of realization of commodities of groups of AX and BX. The linear regressive model of profit yield from realization of the indicated categories of commodities is built, adequacy of this model is well-proven. Advantages of the considered models are described and an example of their possible application is made at the perfection of assortment politics of enterprise of retail business. Is defined, that the use of the combined economic – mathematical modeling has a row of considerable advantages to that it is possible to take the following : exposure of priority commodities bringing a maximal profit and characterized by a stable consumption; increase of efficiency of control system by the commodities; increase of stake of highly remunerative commodities without violation of basic principles of assortment politics. It is proved that the use of economic – mathematical modeling in the formation of the assortment policy of a retail enterprise make it possible not only to conduct quantitative calculations, but also to choose the optimal forecast scenarios of actions.

Keywords: assortment, product, ABC analysis, XYZ analysis, regression analysis, economic and mathematical methods, modeling.

DOI: 10.32434/2415-3974-2019-10-2-17-24

Problem statement

On development of retail business substantial influence was rendered by transformations that took place in a market economy. On the modern stage a retail business actively influences on development of economy and market processes, assists satisfaction of demand of population on commodities and service that becomes the factor of upgrading and standard of living of population in turn. In such operating conditions, the competitiveness of trades enterprises largely depends on the high adaptability of commodity politics, timely updating of commodity nomenclature and assortment groups in relation to the requirements of market.[1] The center of commodity policy – is assortment policy, the main objective of which is to increase the competitiveness of goods in the market by improving the set of product groups. Possibility of commodity assortment of trade enterprise it is adequate to reply consumer demand assists providing of profitability of enterprise.

The enterprises of retail business regularly run into the necessity of the rapid reacting on the changes of market situation, that first of all, influences on the assortment bill of goods. Therefore, one of main tasks of management the assortment of products on an enterprise is his optimization. As basic criteria of optimality of assortment the indexes of profit, retail commodity turnover, expenses of appeal, are used.

For the decision of task of forming of assortment most acceptable is application of totality of methods economic-mathematical modeling (EMM), the questions of optimization of commodity assortment contingently complication.

Analysis and research of publications

Modern state of researches on the formation of a product range, means of its expansion is characterized by a significant development of theoretical and practical foundations and a sufficient number of works by domestic and foreign scientists, among which S.S. Harkavenko, N.I. Chukhrai, V.P. Onishchenko, L.I. Moroz, A.I. Kredisov, V.G. Herasimchuk, F. Kotler, E. Dichtil, H. Hershgen etc. In theirs works scientists have disclosed the essence and value of the enterprise's product range, the scientific ground of principles, receptions is carried out, management methods by a commodity assortment, basic factors influencing on this process are certain, the stages of forming of commodity assortment are given. At the same time, most researches carry general character and does not take into account the specific of commodity, specialization of enterprise on the market, does not allow detecting backlogs of increase of demand, expansion of adaptation possibilities of assortment of enterprise with the necessities of consumers. Also, it should be noted that the use of economic-mathematical tools is not widespread enough in the formation and optimization of the range of products of retailers. Among the scientists who studied the issues in the field of economic and mathematical methods and models we can highlight the works of Z.V. Alfyorova, I.I. Eliseeva, N.S. Kremer, B. Rents, G. Smith, E. Siegel, F. Fischer. Despite the value of the conducted researches, it is necessary to note that the unsolved problem of practical application of economic and mathematical modeling at perfection of assortment policy caused a choice of a research theme.

The purpose of the article

Design of activity of enterprise of retail business in the direction of improvement of assortment of commodity products on the basis of economic-mathematical methods.

Statement of the main material

For realization of successful activity at the market needed well carefully thought out commodity politics is worked out in detail. Perfection of organization of trade maintenance of population and increase of economic efficiency of enterprises of retail business in a great deal depend on the correct forming of range of goods in shops. In time forming of range of goods in a retail trade network a major requirement is maximal satisfaction of demand of customers at the least expenses of time on their acquisition at providing of profitable work of shops. Basic data of forming of range of goods in the trade network of region (district, settlement) it is been: quantity of population; his closeness; features of demand; existent material and technical base; specialization of shops; presence of enterprises-competitors, their placing and others [2]. Certainly, in every shop it is impossible and economically unprofitable to provide the presence of all trade range of goods. Therefore for every shop the optimal range of goods, that would allow, must be neat, from one side, to create the best terms for customers for acquisition of commodities, and from other – to provide profitability of work of shop.

The process of forming of range of goods in shops consists of three stages. [2, 3]

1. On the first stage the group range of goods is set, what is determine the assortment profile of enterprise. This work is conducted on the basis of marketing researches, that are basis of choice of target market.

2. On the second stage of formation of range of goods the structure of group assortment of shop is determined, that is to say.

3. On the third stage determine the unfolded range of goods, that is to say, carry out the selection of concrete varieties of commodities within the limits of every commodity group.

Trading in food commodities and non-food items stuffs has significant distinctive features, therefore principles of forming of assortment of shops on trading in food commodities and non-food items stuffs it is necessary to examine separately. In process considered non-food items group of commodities, namely office commodities.

In time forming of range of stuffs it is necessary to take into account in non-food items shops, that the origin of necessity and acquisition of one or another commodity is accompanied by the different degree of definiteness, clearness and formulation of demand. In one cases a customer comes in a shop with clearly certain requirements to the commodity (size, fashion, price, color etc.), in other – not quite clear imagines many signs of commodity that wants to purchase, defining only some general requirements to the commodity (size and cost of suit). Origin of alternative demand in the process of eventual choice by the customers of commodities is a very important factor of forming of range of goods in non-food items shops. [3] Interchangeability of commodities – one of major principles of forming of assortment of greater part of non-food items commodities. He gives an opportunity to give up a necessity to have in a shop a set of wares literally all models, fashions, colors, pictures, materials etc. and at the same time to satisfy demand of customers.

As is generally known, to have a complete assortment in a shop, it is practically impossible. Mastery in the selection of commodities and in the technique of their sale and consists in that, using possibilities of alternative demand, to satisfy the queries of bulk of customers, having a relatively limit

range of goods in a shop. The substantial factor of forming of assortment is a cost of commodity, as a level of purchasing power of different groups of population determines not only the general volume of demand but also features of demand depending on the cost of wares. [2, 3]

For a complete analysis of the range of products they combine several universal methods, which include ABC-analysis and XYZ-analysis. ABC-analysis is an instrument, that allows to study a commodity assortment, define rating of commodities on the indicated criteria and educe that part of assortment, that provides a maximal effect. XYZ-an analysis is an instrument allowing to divide products as far as stability of sales and level of vibrations of consumption. Combination of ABC and XYZ of analysis finds out absolute leaders and outsiders. Both methods complement each other well. If a ABC-analysis allows to estimate the contribution of every product to the structure of sale, then XYZ-an analysis allows to estimate the gallops of sale and his instability. [4].

At complex research of assortment of the goods it is most productive to combine results of ABC and HUZ-analysis. ABC- XYZ-analysis allows to divide sales data into 9 groups depending on the contribution to the company's revenue (ABC) and regularity of purchases (XYZ). Such classification simplifies work at planning and assortment formation. After these two types of analysis, the combined matrix consists of an evaluation of which allows to form an optimal assortment of goods. The combined matrix of ABC-XYZ-analysis was shown in Table [5].

Commodities of group A and B are provide basic commodity turnover of enterprise. It is therefore necessary, that they were constantly in a presence. The commodities of group AX and BX are characterized high commodity turnover and stability of sales, it is therefore necessary to provide the permanent presence of these commodity groups, but it is not necessary to create a surplus insurance supply. Positions that is included in a group AZ, it is necessary to control every day, applying technology «exactly in time» Management by supplies on positions that is included in the groups of BY, BZ, can come true both on identical and on personal technologies. Planning of supplies on commodity positions, that is included in a group CX, CY, CZ, can be executed on more long period, for example, on a quarter, with the monthly checking of presence of supply for storage.

Further, the study applies econometric methods, which allow not only quantitative calculations, but also the selection of the best prediction scenarios. Main setting of econometric analysis [6] consists is a model description of existent quantitative intercommunications and intercommunication between the analyzed indexes of economic processes. Taking into account character of the phenomena inherent to the economic

Combined matrix of ABC- XYZ-analysis

		XYZ-analysis groups		
		X	Y	Z
ABC-analysis groups	A	1. The paper is white 3. Drawing 5.Small-office tationery 7. Workbooks 8. Sale products	2. Pens 4. Office folders 6. Notebooks	–
	B	9. Sets of children's creativity 10. Souvenir production 11. Markers, felt-tip pens 12. Pencils 18. Staplers, punches, buttons	13. Discount cards 14. Glue 16. Tableware 17. Pen sets 21. Office paper-white products	15.Premium handles 19. Lepnina, the sculpture
	C	22. Calculators 23. Stamp products 27. Covers 31. Color paper 32. Paper and white products 34. Albums and paper for creativity 38. Erasers 41. Rulers 48. Rods 49. Scissors 51. Paper for drawing 54. Mosaic 56. School diaries	25. Adhesive tape 26. Puzzles 28. Other folders 29. Coloring 30. Pencils 35. Albums and drawing paper 36. Paper colored 42.Computer accessories 47. Decorative paper, cardboard 52. Other school products 55. Paper products 57. Copy paper 60. Counting accessories	24. Backpacks 33. Accessories for drawing 37. Decoration 39. Thermal paper 40. Other paper 43. Cardboard 44. School files 45. Special types of paper 46. Batteries 50. Globes, cards 53. Businesswomen 58. Dictionaries 59.Millimetre paper. 61. Magnetic board

processes, the mathematical vehicle of cross-correlation-regressive analysis allows to create stochastic models and show their advantage in the investigated area. A multivariable regressive analysis helps to find the obvious type of dependence of the investigated index from numerous factors influencing on his change, and also in number to estimate their influence. Primary purpose of multiple regression – to build a model with the large number of factors, determining the influence of each of them separately, as well as their combined effect on the indicator, which is modeled.

The construction of the multiple regression equation begins with the solution of two questions – the selection of factors and the choice of the type of regression. As the investigated economic indicator the volume of realization of commodities is accepted monthly (UAH) – Y. In the real economic connections on any economic indicator Y, as a rule, not the alone influences, and a few factors (regressors) $X_1,X_2,...,X_n$. It is suggested to investigate dependence of factor of volumes of realization of commodities of group AX and BX. As independent factors, the volume of sales of goods in the range of stationery products is used: – x_1–white paper, x_2 – painting, x_3 – small office chancellery, x_4– sets of children's art, x_5 – souvenir production, x_6 – markers, felt-tip pens, x_7 – pencils, x_8 – staplers, hole punches and buttons. From consideration the commodities of sale are excluded, as a volume of commodities given to the category it is impossible to provide for and these commodities always use large demand. For research we use these enterprises for three years. We will build a plural regressive model in linear to the form of kind [5]:

$$\hat{y} = a_0 + a_1x_1 + a_2x_2 + a_3x_3 + a_4x_4 + \\ + a_5x_5 + a_6x_6 + a_7x_7 + a_8x_8. \quad (1)$$

It is necessary to check at the construction of multiple regression, does not exist between the factors of multi-collinear [6]. For this purpose at first it is necessary to build a cross-correlation matrix, it is for what necessary to conduct standardization of initial statistical data – all factors must be in number comparable, therefore they are rationed and result in dimensionless sizes.

$$R = \begin{pmatrix} 1 & -0.218 & 0.167 & 0.299 & 0.256 & 0.406 & -0.284 & -0.015 \\ -0.218 & 1 & -0.217 & -0.163 & 0.064 & -0.008 & 0.046 & 0.056 \\ 0.167 & -0.217 & 1 & 0.106 & -0.031 & 0.211 & 0.105 & 0.017 \\ 0.299 & -0.163 & 0.106 & 1 & 0.207 & 0.024 & 0.137 & 0.256 \\ 0.256 & 0.064 & -0.031 & 0.207 & 1 & -0.148 & -0.293 & 0.316 \\ 0.406 & -0.008 & 0.211 & 0.024 & -0.148 & 1 & 0.423 & -0.311 \\ -0.284 & 0.046 & 0.105 & 0.137 & -0.293 & 0.423 & 1 & -0.218 \\ -0.015 & 0.056 & 0.017 & 0.256 & 0.316 & -0.311 & -0.218 & 1 \end{pmatrix}.$$

Essence of multi-collinear consists of that in a multivariable regressive model two or more independent variables bound by inter se linear dependence or, in other words, have a high degree of correlation. In practice mostly for the exposure of multi-collinear use the criterion of Farrar-Glauber, by means of that set there is multi-collinear in all array of independent variables [6].

Find the determinant of the correlation matrix detR=0.1872 and calculate the actual value of the criterion χ^2_{ϕ} by the formula:

$$\chi^2_{act} = -\left[n - 1 - \frac{2m+5}{6} \right] \cdot \ln\left|\det R\right| = 9.2154.$$

According to the tables of critical points Farrara-Glober determine $\chi^2_{табл}$:

$$\chi^2_{tab} = \chi^2\left(\alpha, \frac{1}{2} m\left(m-1\right) \right) = 16.92.$$

Compare the actual criterion with the table criterion, since

$$\chi^2_{act} < \chi^2_{tab},,$$

then there is no multicollinearity, and the coefficients of the regression equation can be determined. Multiple regression coefficients are calculated using the least squares method. In matrix form, the system of normal equations can be represented as follows [7]:

$$Y = A \cdot X. \quad (2)$$

By the method of least squares, the matrix of regression coefficients is determined by the expression:

$$A = \left(X^T \cdot X\right)^{-1} \cdot X^T \cdot Y\ . \quad (3)$$

$$A = \begin{pmatrix} a_0 \\ a_1 \\ a_2 \\ a_3 \\ a_4 \\ a_5 \\ a_6 \\ a_7 \\ a_8 \end{pmatrix} = \begin{pmatrix} 154.457 \\ 1.024 \\ 1.025 \\ 1.124 \\ 1.080 \\ 0.881 \\ 1.007 \\ 0.632 \\ 1.358 \end{pmatrix}.$$

Multiple regression model of revenue volume takes the form:

$$\hat{y} = 154,457 + 1,024x_1 + 1,025x_2 + \\ + 1,124x_3 + 1,080x_4 + 0,881x_5 + \\ + 1,007x_6 + 0,632x_7 + 1,358x_8. \quad (4)$$

Practical meaningfulness of multiple regression is estimated by means of index of plural correlation or coefficient of plural determination [7]:

$$R^2 = \frac{\sum_{i=1}^{n}\left(\hat{y}_i - \bar{y}\right)^2}{\sum_{i=1}^{n}\left(y_i - \bar{y}\right)^2} = 1 - \frac{\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)^2}{\sum_{i=1}^{n}\left(y_i - \bar{y}\right)^2} = 0,918.$$

Statistical meaningfulness of determination coefficient and adequacy of model of multiple regression on the whole can be checked by means of criterion of Fisher [7]. On the retrieval of basic data and built regressive model the actual Fisher F_{act} criterion value is calculated:

$$F_{act} = \frac{R^2}{1-R^2} \cdot \frac{n-m-1}{m} = 34.175.$$

Using statistical tables of critical Fisher distribution points or using special statistical packages or functions, we find the critical value of the criterion F_{tab}:

$$F_{tab} = F\left(\alpha,\ k_1, k_2\ \right) = 8.81.$$

Compare the actual value of the Fisher criterion with the critical value of criterion, since

$$F_{act} > F_{tab},$$

then the constructed regression model adequately describes the statistical data and can be used for further studies, and the coefficient of multiple determination is statistically significant.

Farther will define dispersions of values of parameters and estimation them standard errors on the criterion of Student (t-Student). At first, calculate the unbiased estimate of the variance of the residues [7]:

$$S_e^2 = \frac{1}{n-m-1}\sum_{i=1}^{n}\left(y_i - \hat{y}_i\right)^2 = 0,2564.$$

Then it is necessary to calculate the covariance matrix of variances of parameter values:

$$\mathrm{cov}(a) = S_e^2 \cdot \left(X^T \cdot X\right)^{-1}; \quad (5)$$

$S_{a_0}^2 = 0.0156$; $S_{a_1}^2 = 0.017$; $S_{a_2}^2 = 0.002$; $S_{a_3}^2 = 0.004$; $S_{a_4}^2 = 0.013$; $S_{a_5}^2 = 0.015$; $S_{a_6}^2 = 0.028$; $S_{a_7}^2 = 0.076$; $S_{a_8}^2 = 0.049$.

Checking of values of parameters for statistical importance envisages determination that, their mean values differ from a zero. For this confirmation it is necessary to use the formula of Student's criterion [7]:

$$t_{a_i}^* = \frac{a_i}{\sqrt{S_{a_i}^2}}. \quad (6)$$

Receive:

$t_{a_0}^* = 1236.65$; $t_{a_1}^* = 7.78$; $t_{a_2}^* = 26.14$; $t_{a_3}^* = 16.92$; $t_{a_4}^* = 9.37$; $t_{a_5}^* = 7.11$; $t_{a_6}^* = 6.07$; $t_{a_7}^* = 2.30$; $t_{a_8}^* = 6.15$.

If $t^* > t_{\gamma,k}$, the mean value of parameter of function differs from a zero. A value $t_{\gamma,k}$ is elected from the table of critical values of Student's creterion, where are $\gamma = 0,95$, k=n−m−1=27, $t_{\gamma,k} = 2,052$. As all settling values of criterion meet a condition $t^* > t_{\gamma,k}$, that mean value of each of parameters of function differs from a zero.

It is now possible to calculate the confidence intervals for the parameter values of the model function with the specified reliability is $\gamma = 0,95$. Confidence intervals for the values of the function model parameter are calculated using the formulas:

$$a_i - t_{\gamma,k} \cdot S_{a_i} < a_i < a_i + t_{\gamma,k} \cdot S_{a_i}. \quad (7)$$

Confidence intervals for the parameters of the multiple regression model of revenue volume take the form:

$154.201<a_0<154.457$;
$0.754<a_1<10.24$;
$0.945<a_2<1.025$;
$0.988<a_3<1.124$;
$0.844<a_4<1.080$;
$0.627<a_5<0.881$;
$0.667<a_6<1.007$;
$0.067<a_7<0.632$;
$0.905<a_8<1.358$.

The using the obtained values of confidence intervals for the parameters of the model, it is possible to obtain the function of the upper and lower limits of the confidence interval, within which the values of the dependent variable can be located with a given reliability. The regression model coefficients play an important role in assessing the influence of individual factors. However, it is not possible to directly compare factors by their influence on an independent variable because of differences in measurement units

and the scale of variation in the use of different sets of observation results. For the removal of such distinctions apply the private elasticity coefficients [8,9]:

$$E_i = \frac{a_i \cdot \overline{x_i}}{\overline{y_i}}. \quad (8)$$

The elasticity coefficient shows how many percent the investigated variable changes when the factor variable changes by 1%. The elasticity coefficients make it possible to order the factors according to the degree of their influence on the studied variable. For a multiple regression model of revenue volume, the elasticity coefficients take values:

E_1=20.91%; E_2=18.79%; E_3=14,00%;

E_4=12.18%; E_5=8.67%; E_6=9.02%;

E_7=4.94%; E_8=10.31%.

A linear regressive model is built is the effective instrument of estimation of degree of dependence of economic indicator (profit yields from realization) from the certain row of the selected factors in the process of analysis of activity of enterprise, adequacy of this model is well-proven, it is confirmed that factors really influence on a result.

Conclusions

In the market conditions of management of economic-mathematical methods become the important instrument of receipt of more thorough and complete knowledge about quantitative and quality parties of economic mechanism of one or another processes and phenomena. In the process of the use of economic-mathematical methods in an economic analysis a construction comes true and study of economic-mathematical methods, describing influence of separate factors on the summarizing economic indicators of activity of organizations.

At that rate the use of economic-mathematical modeling becomes expedient in practice of forming of commodity assortment, that will allow to the trade enterprise to promote efficiency of assortment politics, provide possibility to grow potential and quickly to score competition advantages. For realization of valuable analysis of assortment combine a few universal economic-mathematical methods. The results of analysis are compared inter se and on the basis of the got information suggestions are formed for optimizations of assortment. For more effective design, of economic processes, it is necessary to use reliable and reliable information generators, richly in content to describe an object, that is designed and to reproduce data essence of object, his quantitative descriptions, character of cooperation between making elements, place and importance of this phenomenon in the general process of functioning of the economic system.

Further researches must be sent to perfection of existing and development of new economic-mathematical models of forming of commodity assortment.

REFERENCES

1. Alekseeva, M.M. (2014). *Planirovanie dejatel'nosti firmy [Planning of the company's activities].* Moskva: Finansy i statistika *[in Russian].*

2. Prjadko, O.M., Popova, L.O., & Synycyna, G.A. (2014). *Upravlinnja torgovym asortymentom u rozdribnij torgivli v umovah nacional'noi' konkurentnoi' polityky [Management of commercial assortment in rozdribnoyi trade ivivili in the minds of the national competitive politics].* Kharkiv: Kharkivskii universytet kharch. ta torhivli [i*n Ukrainian].*

3. Balabanits, A.V. (2007). *Zbutova politika: problemi ta mozhlivosti ïkh pereborennya [Bout politics: problems and possible problems of their overstretch].* Donetsk: Lebid [i*n Ukrainian].*

4. Alesinskaya, T.V. (2009). *Osnovy logistiki. Fukntsionalnyie oblasti logisticheskogo upravleniya [Logistics fundamentals. Functional areas of logistics management].* Taganrog: TTI JuFU *[in Russian].*

5. Naumenko, N.U., Belobrova, E.V., & Korotka, L.I. (2017). *Improving product policy on the basis of ekonomik and mathematical modeling.* Klaipeda, Lithuania: Baltija Publishing.

6. Grin, V. (2015). *Ekonometrichnij analiz [Econometric analysis].* Kyiv: Osnovi [i*n Ukrainian].*

7. Vitlinskiy, V.V., & Velikoivanenko, G.I. (2005). *Modelyuvannya ekonomiki [Modeling the economy].* Kyiv: KNYeU [i*n Ukrainian].*

8. Korhin, A.S., & Turchaninova, I.Ju. (2016). *Modeljuvannja ekonomiki [Modeling the economy].* Dnipropetrovsk: DVNZ «NGU» [i*n Ukrainian].*

9. Ostrovs'kij, P.I., Gostrik, O.M., Dobrunik, T.P., & Radova, O.V. (2012*). Modeljuvannja ekonomichnih procesiv [Modeling of economic processes].* Odesa : ONEU [i*n Ukrainian].*

Received 26.09.19

Reviewer: Doct. of Econ. Sc., Ass. Prof. Harmider L.D.

ВИКОРИСТАННЯ ЕКОНОМІКО-МАТЕМАТИЧНОГО МОДЕЛЮВАННЯ ПРИ УДОСКОНАЛЕННІ АСОРТИМЕНТНОЇ ПОЛІТИКИ ПІДПРИЄМСТВА РОЗДРІБНОЇ ТОРГІВЛІ

Білоброва О.В., Головко А.О., Науменко Ю.Ю., Кірєєва О.В.

Для здійснення успішної діяльності на ринку підприємству потрібна детально розроблена товарна політика. Щодо підприємств роздрібної торгівлі, то удосконалення організації торговельного обслуговування населення і підвищення економічної ефективності функціонування самого підприємства безпосередньо залежать від правильного формування асортименту товарів у роздрібній торговельній мережі. Економіко-математичне моделювання є важливим компонентом процесу формування та удосконалення асортиментної політики підприємства роздрібної торгівлі. У статті розглянуто процес формування асортименту товарів у магазинах з торгівлі непродовольчими товарами. Досліджено декілька універсальних методів

аналізу асортименту, серед яких найбільшу увагу становить поєднаний АВС- XYZ-аналіз. Побудовано суміщену матрицю АВС- XYZ-аналізу. Відображено засади множинного регресійного аналіз. Побудовано економіко-математичну модель обсягу реалізації товарів груп АХ та ВХ. Побудовано лінійну регресійну модель виручки від реалізації зазначених категорій товарів, доведено адекватність цієї моделі. Охарактеризовано переваги розглянутих моделей і наведено приклад їх можливого застосування при удосконаленні асортиментної політики підприємства роздрібної торгівлі. Визначено, що використання суміщеного економіко-математичного моделювання має низку значних переваг, до яких можна віднести наступні: виявлення пріоритетних товарів, що приносять максимальний дохід і що характеризуються стабільним споживанням; підвищення ефективності системи управління товарами; підвищення частки високорентабельних товарів без порушення основних принципів асортиментної політики. Доведено, що застосування економіко-математичного моделювання при формуванні асортиментної політики підприємства роздрібної торгівлі дає можливість не тільки виконати кількісні розрахунки, але й вибрати оптимальні прогнозні сценарії дій.

Ключові слова: асортимент, товар, АВС-аналіз, XYZ-аналіз, регресійний аналіз, економіко-математичні методи, моделювання.

ИСПОЛЬЗОВАНИЕ ЭКОНОМИКО-МАТЕМАТИЧЕСКОГО МОДЕЛИРОВАНИЯ ПРИ СОВЕРШЕНСТВОВАНИИ АССОРТИМЕНТНОЙ ПОЛИТИКИ ПРЕДПРИЯТИЯ РОЗНИЧНОЙ ТОРГОВЛИ

Белоброва Е.В., Головко А.О., Науменко Ю.Ю., Киреева А.В.

Для осуществления успешной деятельности на рынке предприятию нужна детально разработанная товарная политика. Что касается предприятий розничной торговли, то совершенствование организации торгового обслуживания населения и повышение экономической эффективности функционирования самого предприятия напрямую зависят от правильного формирования ассортимента товаров в розничной торговой сети. Экономико-математическое моделирование является важным компонентом процесса формирования и совершенствования ассортиментной политики предприятия розничной торговли. В статье рассмотрен процесс формирования ассортимента непродовольственных товаров в магазинах. Исследовано несколько универсальных методов анализа ассортимента, среди которых наибольшее внимание заслуживает совмещенный АВС- XYZ-анализ. Построено совмещенную матрицу АВС- XYZ-анализа. Отражено основы множественного регрессионного анализ. Построена экономико-математическая модель объема реализации товаров групп АХ и БХ. Построена линейная регрессионная модель выручки от реализации указанных категорий товаров, доказано адекватность этой модели. Охарактеризованы преимущества рассмотренных моделей и приведен пример их возможного применения при совершенствовании ассортиментной политики предприятия розничной торговли. Определено, что использование совмещенного экономико-математического моделирования имеет ряд значительных преимуществ, к которым можно отнести следующие: выявление приоритетных товаров, приносящих максимальный доход и характеризующихся стабильным потреблением; повышение эффективности системы управления товарами; повышение доли высокорентабельных товаров без нарушения основных принципов ассортиментной политики. Доказано, что применение экономико-математического моделирования при формировании ассортиментной политики предприятия розничной торговли дает возможность не только провести количественные расчеты, но и выбрать оптимальные прогнозные сценарии действий.

Ключевые слова: ассортимент, товар, АВС-анализ, XYZ-анализ, регрессионный анализ, экономико-математические методы, моделирование.

USE OF ECONOMIC-MATHEMATICAL MODELING TO IMPROVE ASSORTMENT POLICY OF THE ENTERPRISE OF RETAIL TRADE

Bilobrova O.V.* *, *Holovko A.O., Naumenko Yu.Y., Kirieieva O.V.
SHEI "Ukrainian State University of Chemical Technology", Dnipro, Ukraine

* **e-mail: elena_kib@ukr.net**

Bilobrova O.V. ORCID: **https://orcid.org/0000-0002-1759-4066**

Holovko A.O. ORCID: **https://orcid.org/0000-0001-6544-1323**

Naumenko Yu.Y. ORCID: **https://orcid.org/0000-0002-8071-7153**

Kirieieva O.V. ORCID: **https://orcid.org/0000-0002-3700-9602**

To carry out successful activities on the market, an enterprise needs an elaborate commodity politics. As for the retail trade enterprises, that perfection of the organization of trade services for the population and the increase of economic efficiency of the enterprise functioning directly depend on the correct formation of the assortment of goods in the retail trade network. Economic − mathematical modeling is an important component of the process of formation and improvement of the assortment policy of retail enterprises. In the article, the process of forming of the range of goods is considered in shops on trading in non-food items commodities. A few universal methods of analysis of assortment is investigational, among that most attention presents combined ABC- XYZ-analysis. The combined matrix of ABC is built − XYZ-analysis. Bases are reflected plural regressive analysis. Built economic − mathematical model of volume of realization of commodities of groups of AX and BX. The linear regressive model of profit yield from realization of the indicated categories of commodities is built, adequacy of this model is well-proven. Advantages of the considered models are described and an example of their possible application is made at the perfection of assortment politics of enterprise of retail business. Is defined, that the use of the combined economic − mathematical modeling has a row of considerable advantages to that it is possible to take the following : exposure of priority commodities bringing a maximal profit and characterized by a stable consumption; increase of efficiency of control system by the commodities; increase of stake of highly remunerative commodities without violation of basic principles of assortment politics. It is proved that the use of economic − mathematical modeling in the formation of the assortment policy of a retail enterprise make it possible not only to conduct quantitative calculations, but also to choose the optimal forecast scenarios of actions.

Keywords: assortment, product, ABC analysis, XYZ analysis, regression analysis, economic and mathematical methods, modeling.

REFERENCES

1. Alekseeva, M.M. (2014). *Planirovanie dejatel'nosti firmy [Planning of the company's activities].* Moskva: Finansy i statistika *[in Russian].*

2. Prjadko, O.M., Popova, L.O., & Synycyna, G.A. (2014). *Upravlinnja torgovym asortymentom u rozdribnij torgivli v umovah nacional'noi' konkurentnoi' polityky [Management of commercial assortment in rozdribnoyi trade ivivili in the minds of the national competitive politics].* Kharkiv: Kharkivskii universytet kharch. ta torhivli [i*n Ukrainian].*

3. Balabanits, A.V. (2007). *Zbutova politika: problemi ta mozhlivosti ïkh pereborennya [Bout politics: problems and possible problems of their overstretch].* Donetsk: Lebid [i*n Ukrainian].*

4. Alesinskaya, T.V. (2009). *Osnovy logistiki. Fukntsionalnyie oblasti logisticheskogo upravleniya [Logistics fundamentals. Functional areas of logistics management].* Taganrog: TTI JuFU *[in Russian].*

5. Naumenko, N.U., Belobrova, E.V., & Korotka, L.I. (2017). *Improving product policy on the basis of ekonomik and mathematical modeling.* Klaipeda, Lithuania: Baltija Publishing.

6. Grin, V. (2015). *Ekonometrichnij analiz [Econometric analysis].* Kyiv: Osnovi [i*n Ukrainian].*

7. Vitlinskiy, V.V., & Velikoivanenko, G.I. (2005). *Modelyuvannya ekonomiki [Modeling the economy].* Kyiv: KNYeU [i*n Ukrainian].*

8. Korhin, A.S., & Turchaninova, I.Ju. (2016). *Modeljuvannja ekonomiki [Modeling the economy].* Dnipropetrovsk: DVNZ «NGU» [i*n Ukrainian].*

9. Ostrovs'kij, P.I., Gostrik, O.M., Dobrunik, T.P., & Radova, O.V. (2012*). Modeljuvannja ekonomichnih procesiv [Modeling of economic processes].* Odesa : ONEU [i*n Ukrainian].*