Economical and Mathematical Background of the Strategy of Regional Expansion of Retail Networks

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Abstract: The study offers an original approach to economical and mathematical background of the strategy of regional expansion of retail networks. The proposed approach supposes implementation of an original methodology for evaluation of commercial appeal of regions. Two models namely an econometric model of multiple selection in a rank scale and a matrix predictor are used as basic instruments for realization of the said methodology. Application of the mentioned instruments allows to ensure comprehensive survey and therefore to improve the degree of feasibility of the decisions taken with the aid of such instruments. Applicability of the approach is shown by way of example of selection of the most attractive region in the central federal district of the Russian Federation for trading activity.

Keywords: Retail network, regional expansion strategy, commercial appeal of a region, economic and mathematical model, forecast

INTRODUCTION

In many countries the trade sector has an important economical and social function for its share in GDP of such countries is rather appreciable, it considerably contributes to solution of such important problems as occupational level support, consumer demand satisfaction, generation of state budget revenues.

According to information reported by Accenture (Infoline) experts in 2012 Russia took the first place among TOP-5 of the European countries in retail turnover: Russia (509.5 bln Euro), France (418.2 bln Euro), Germany (410.1 bln Euro), Great Britain (377.6 bln Euro), Italy (253.1 bln Euro).

Despite of the retail turnover growth rates slowdown in our country trade can so far be rightfully referred to as motive power of the Russian economy due to being ahead of many other economic activities in terms of growth rates (Fig. 1).

Analysis of the current trends in the Russian product retail market allows identifying the following tendencies: retail trade turnover increase via retail chains. In this case hypermarkets gain the lead which can be explained not so much by the buyers' preferences as by the problems related to retail property. The fact is that a ready-to-use building is offered for allocation of a hypermarket quite rarely; usually a suitable building is constructed on the request of a hypermarket brand owner. Supermarkets as a rule are housed in already built premises number of which is rather limited.

In general, this sector is experiencing 5-8% decline in demand. However the major retailers have suffered from this situation in a much lesser degree. Thus, the following leaders of the Russian retail sale market as "Magnit" and "Dixy" have increased their revenues in 2015 by 20 and 12% correspondingly. These companies as well as other large retail market players (X5 Retail Group, "Lenta", "O'key") have managed to open new trading sites. According to Infoline analytical forecasts seven major retailers ("Magnit", X5 Retail Group, "Auchan", "Dixy", Metro Cash & Carry, "Lenta" and "O'key") will be able to increase their share in the national commodity turnover by >2% points. The main reason for this was indicated as reduction of the share of traditional non-chain stores and markets.

At the present day, we can observe saturation of the markets in the largest metropolises, therefore quite logically mature trade networks start to focus their economic interests on the regions. For example, the federal networks started to show their expressed interest in small Russian cities where only "Magnit" which traditionally placed stake on little towns was represented. Interest of the federal and the international retail chains in regional expansion is confirmed by positive growth of the number of opened stores of such chains in the local consumer markets.

Due to the current crisis it would be reasonable to expect increase in volume of transactions on the product retail market connected with purchase of small deteriorated regional networks by the large market players. In such a manner expansion of the large players into new regions will get more intensive.

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Fig. 1: Time-course retail trade turnover of trading organizations in the Russian Federation and turnover growth rate for the period from 1999-2015

To be fair it ought to be noted that in fact sooner or later all trading networks face with the problem of expansion into regions due to various reasons whatever economical situation in the country may be. The main reasons among other are gain of market share through retail sale sector development, dissatisfaction with the results of own dealer network functioning, following the revenue-intensive customers (Narver *et al.*, 2004; Kotler and Keller, 2011).

Such practice obtained its theoretical background due to the researches by Ansoff (1979) who stated that the companies had several strategic options for choice of growth direction, i.e., a strategy of business perfection, of commodity expansion (development of new or advancement of already existing commodities), of market development, of diversification. At that it should be understood that the strategy of market development (regional expansion) requires considerable costs, it is connected with higher risks as compared to other strategies thus involving special attention at time of the strategy elaboration.

Literature review: A scaled-up version of the regional expansion strategy supposes implementation of the following principal stages: analysis of a retail network functioning providing identification of weak and strong points of a company.

Marketing research of potential marketing outlets of a region the results of which will be used for substantiation of the decision on reasonability of expansion of any given regional marketing outlet (Tull and Hawkins, 1980; Kotler *et al.*, 2002; Malhotra, 2009; Kublin *et al.*, 2015).

Organization of a retail network at the territory of a region selected for expansion. At time of regional expansion strategy elaboration one ought to bear in mind that since entry to a new marketing outlet always involves high risks the second stage connected with substantiation of the choice of a region becomes increasingly important.

Implementation of the mentioned stage involves variety of problems which among other things are conditioned by the following reasons: first of all marketing research is usually performed under time pressure and restricted resources (financial above all) conditions and secondly it supposes processing of mass data which in its turn requires use of complicated formalized procedures. All these reasons keep up permanent motivation of the scientists and practicing professionals to develop more cost-effective methods (which will nevertheless ensure high reliability and objectiveness) which may be used by a company for rapid substantiation of decisions in relation to choice of a region of operation without need to use the services of specialized agencies.

Various aspects of regional appeal evaluation in regard of their potential consumptive capabilities were covered by the scientific reesearces by Bagautdinova *et al.* (2012) and Soboleva and Parshutina (2015). The researches by Davnis and Tinyakova demonstrate individual elements of formalization of evaluation of demand for new products and of commercial appeal of potential regional marketing outlets.

Summary of deficiencies of the methodologies which have been developed so far allow making a conclusion on the following problematic aspects of their use:

- Use of criteria access to which is difficult or which are not in free access
- Some methodologies use obviously insufficient number of factors for comprehensive analysis, other to the contrary operate excessive set of factors; the both cases render the calculations difficult
- Wide use of expert estimates which by virtue of evident reasons increases the level of subjectivity of the taken decisions

Here, you can find a methodology for evaluation commercial appeal of the regions free from the above mentioned disadvantages. We suppose that this methodology should be used for substantiation of a strategy of regional expansion of retail networks.

MATERIALS AND METHODS

The offered methodology for evaluation of appeal of a region for commercial activity involves use of a whole set of models, methods and procedures formulation of which is necessary for realization of the following stages as shown in Fig. 2.

Each of the stages involves logically bracketed calculations with use of the methods and models ensuring adequacy of comparison between commercial appeals of the regions at time of taking alternative decision. The methodology is specific for its distinctive aspect namely use of forecasting information on principal characteristics of potential marketing outlets which gives an opportunity to realize whether the current selection of the regions will remain the same. All of the above obviously increases reasonability and reliability of the decisions taken by the retail networks management in relation to appropriateness of entry to new regional marketing outlets.

Let's go into particulars of an economical and mathematical apparatus technique which is used at each stage of the proposed methodology. The first stage uses a criteria standardization procedure. This is due to the fact that as a rule the criteria under consideration have various measurement scales which do not allow obtaining objective results of comparison of commercial appeal of the regions. It is suitable to use indicator variables which can be obtained from initial criteria representation through their standardization. The standardized criteria enable to form a multidimensional concept of uniformly commercially-attractive regions and to achieve integral estimates of such commercial appeal.

There are several methods for criteria standardization which are used in the course of solution of the problems of multidimensional classification and generation of integral estimates. In this case we offer to use the following equation for standardization of the criteria:

$$\tilde{x}_{ij} = \frac{x_{ij} - x_{jmin}}{x_{jmax} - x_{jmin}} \tag{1}$$

Where:
$\tilde{x}_{ij}$ = A standardized value of criterion at i time
x_{j} = A minimum value of a criterion being standardized
x_{jmin} = A maximum value of a criterion being standardized

In order to ensure similar direction of all of the criteria at time of estimation of commercial appeal of the regions the criteria with negative value should be standardized with use of the following equation:
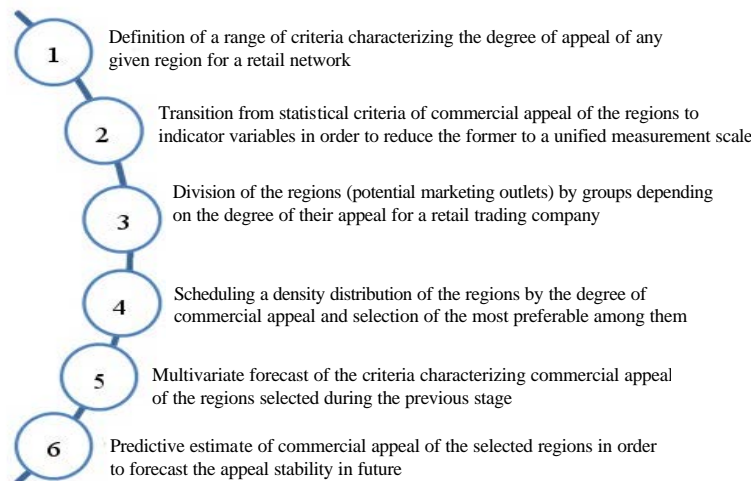

Fig. 2: The stages of implementation of the methodology for evaluation of appeal of regions for commercial activity

$$\tilde{x}_{ij} = \frac{x_{jmax} - x_{ij}}{x_{jmax} - x_{jmin}} \qquad (2)$$

After that the regions are divided into groups which include the regions (potential marketing outlets) with similar commercial appeal. Classification is made on the basis of an integral estimate which is represented by a cumulative value of indicator variables. As a result all of the regions should be divided into three classes from the point of view of likability to open retail network branches at their territory:

- Totally unattractive regions (r = 1)
- Attractive regions (r = 2)
- The most attractive regions (r = 3)

We offer to verify the classification objectiveness by means of an econometric model of multiple selection in a rank scale. It's worth noting that this class of models is widely represented in the researches of the following researchers: Gourieroux (2000) and Green (2000). The basic concept of the offered verification procedure relies on the results of empirical studies which theoretically should demonstrate that use of the data describing the objective classification for construction of a multiple selection model results in obtaining an adequate model.

The model should be made in two variants, i.e., with a normal probability distribution function and with a logistic probability distribution function. There is no any vital difference between the models, therefore recommendations on preferred use of any given model in certain case can not be given. The only recommendation which can be provided is that it makes sense to construct models in the situations when a problem variable is measured within a rank scale.

Note that the model of multiple selection in a rank scale is used during the third and the fourth stages. The fifth stage of the methodology supposes getting of a multivariate forecast. For this purpose we offer to use matrix models basic variant of which was developed by Davnis and Tinyakova. Construction of the matrix model is based on assumption that there is sufficiently stable structural correlation between the forecasted criteria.

In order to go over to formal description of a matrix model let's introduce the following symbols: x_{ti} is the value of the ith criterion at t time; x_{t-1i} is the value of the ith criterion at t-1 time; Δx_{ti} is the value of variation (growth) of the ith criterion.

Further, it is naturally can be supposed that any change of certain ith criterion depends on the value of the rest criteria. This can be represented by a functional or regressional relationship like $\Delta x_{ti} = F(x_{t1}, x_{t2}, ..., x_{tn})$. Let's consider the case when small volume of retrospective data does not allow implementing the known methods of identification of such relationship. The approach ensuring considerable simplification of this relationship will be a unique alternative to identification.

A model of this elementary relationship will be constructed on the assumption that the growth of any of the criteria is generated under the influence of the rest criteria being a kind of cumulative value, at that every individual criterion will have insignificant influence and non of the criteria may be considered as being predominant. In order to implement this assumption, we've introduced for consideration a characteristic which measures the degree of influence of the ith criterion on the changes experienced by the ith criterion. Indirect growth rate could be suitably used as such characteristic:

$$V_{ij} = \frac{x_{ti}}{x_{tj}} \qquad (3)$$

With the understanding that all of the criteria have uniform effect on growth formation we'll achieve the fraction in the growth of the jth criterion which was formed under the influence of the jth criterion through dividing v_{ij} by (n-1). Use of the introduced degree of influence of the jth criterion on the jth criterion allows expressing Δv_{ti} growth by means of the sum of products:

$$\Delta x_{ti} = \frac{1}{n-1}\sum_{j\neq i} v_{ij} x_{tj} \qquad (4)$$

Given that $\Delta x_{ti} = x_{ti} - x_{t-1i}$ the value of any jth index may be equated as follows:

$$x_{ti} = x_{t-1i} + \frac{1}{n-1}\sum_{j\neq i} v_{ij} x_{tj}, \; 1 = \overline{1,n} \qquad (5)$$

By introduction of the following notation to the obtained set of Eq. 5:

$$x_t = \begin{pmatrix} x_{t1} \\ x_{t2} \\ \vdots \\ x_{tn} \end{pmatrix}, \; v = \frac{1}{n-1}\begin{pmatrix} 0 & v_{t2} & \cdots & v_{1n} \\ v_{21} & 0 & \cdots & v_{2n} \\ \vdots & \vdots & \vdots & \vdots \\ v_{n1} & v_{n2} & \cdots & 0 \end{pmatrix} \qquad (6)$$

The same may be represented through a short matrix formulation:

$$x_t = x_{t-1} + Vx_t \qquad (7)$$

Basing on the assumption that x_t is an unknown vector in this set of equations let's write down its solution in the form of the following equation:

$$x_t = (I + V)^{-1} x_{t-1} \qquad (8)$$

Where, I is a unity matrix.

RESULTS AND DISCUSSION

Let's consider application-oriented aspects of implementation of the offered approach with use of the government statistics published on the official website of the Federal State Statistics Service (http://www.gks.ru/), information for the period from 2008-2013 about the regions (Belgorod, Bryansk, Vladimir, Voronezh, Ivanovo, Kaluga, Kostroma, Kursk, Lipetsk, Orel, Ryazan, Smolensk, Tambov, Tver, Tula and Yaroslavl region) constituting the Central Federal District of the Russian Federation except for Moscow and Moscow region which have considerably higher criteria as compared to other regions. By means of expertise the following criteria were selected for analysis:

- Population income per capita (per month; rubles) (x_1)
- Number of inhabitants having cash earnings lower than the level of the subsistence minimum (expressed as percentage of the total population of a constituent) (x_2)
- Retail sale turnover per capita (expressed in effective prices; rubles) (x_3)
- The level of recorded unemployment (as of the end of the year), in percents (x_4)
- Average size of granted pensions, rubles (x_5)
- Consumption expenditures per capita (month, rubles) (x_6)

The results of constructing the multiple selection model in a rank scale with use of the specified standardized criteria showed that all calculated estimated coefficients were statistically significant except for the coefficients related to two factors, i.e., "population income per capita" and "consumption expenditures per capita".

As is known use of a model with a parameter which does not have statistical significance will result in misrepresentation of calculations and erroneous conclusions. In such cases it is recommended to make a problem analysis and introduce corrections to a model based on the analysis results. The analysis resulted in decision to exclude the mentioned factors from consideration. The similar decision was taken in relation to the factor of "retail sale turnover per capita" due to ambiguous assessments of its influence on decision of a company regarding entering to any given regional marketing outlet. As a consequence there was constructed the following multiple selection model in a rank scale:

$$P(r=1) = \frac{e^{12.6782-17.5293\bar{x}_2-4.7689\bar{x}_4+16.9331\bar{x}_5-19.4334\bar{x}_7+5.1866\bar{x}_8}}{1+e^{12.6782-17.5293\bar{x}_2-4.7689\bar{x}_4+16.9331\bar{x}_5-19.4334\bar{x}_7+5.1866\bar{x}_8}};$$

$$P(r=2) = \frac{e^{16.7223-17.5293\bar{x}_2-4.7689\bar{x}_4+16.9331\bar{x}_5-19.4334\bar{x}_7+5.1866\bar{x}_8}}{1+e^{16.7223-175293\bar{x}_2-4.7689\bar{x}_4+16.9331\bar{x}_5-19.4334\bar{x}_7+5.1866\bar{x}_8}} - P(r=1);$$

$$P(r=3) = 1 - P(r=0) - P(r=1)$$

By means of this model there were calculated probability values for assigning each region to the corresponding class (P_1-probability of belonging to the class with absolutely unattractive regions for a retail network; P_2-probability of b elonging to the class with low-efficient regions for commercial activity; P_3-probability of belonging to the class with the most attractive regions for commercial activity) depending on its criteria (Table 1).

Table 1: Calculated values of probability of belonging of the regions to the classes of commercial appeal

variables	Years	x_2	x_4	x_5	x_7	x_8
Belgorod region	2012	6.5	1	8777	331010	106.2
	2013	7.4	0.9	9635	354982.9	106.2
Prediction estimate of a criterion		8.71	0.81	10853.44	361458.63	106.20
Prediction estimate of an index		0.94	0.94	1.09	1.02	0.16
Forecasted probability of belonging to the most attractive group of regions						0.9906
Kaluga region	2012	8.6	0.7	9139	232722	107.6
	2013	9	0.6	10000	286496.7	107.6
Prediction estimate of a criterion		9.452	0.51	11024.08	303581.07	107.60
Prediction estimate of an index		0.91	1.02	1.12	0.84	0.26
Forecasted probability of belonging to the most attractive group of regions						0.5482
Lipetsk region	2012	8.4	0.6	8584	246213.8	106.6
	2013	7.9	0.6	9404	253302.1	106.3
Prediction estimate of a criterion		7.43	0.60	10295.48	255162.69	106.30
Prediction estimate of an index		0.97	1.00	1.02	0.68	0.16
Forecasted probability of belonging to the most attrective group of region						0.5473

The results allowed identifying the following most attractive regions for commercial activity: Belgorod region, Kaluga and Lipetsk region. In order to improve feasibility of the taken decision it is necessary to determine whether these regions will maintain their commercial appeal in a long-range period. The results of forecast analysis with use of matrix models are shown in a Table 1.

The Table 1 data show that only Belgorod region with high forecasted probability will maintain its belonging to the group of the most attractive regions. On the basis of this it could be recommended to a retail network to implement the market expansion in this particular constituent of the Russian Federation.

CONCLUSION

The offered approach to the economical and mathematical background of the strategy of regional expansion of retail networks ensures generation of more reasonable estimate of the degree of commercial appeal of the regions (as compared to the estimates obtained within the current widely recognized approaches) due to integrated use of models and first of all of predictive models used for obtaining advance information on the principal characteristics of the potential marketing outlets. We'd like to draw attention to the fact that the used methodology is based on the principle of strengthening reliability of the marketing decision supposing versatile substantiation based on econometric adequacy and alternative character of predictive simulations. We'd like to mention that franchising was recognized as the most efficient method of regional expansion.

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