Service Sector: Problems of Regional Development

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Abstract

The article offers an algorithm of forecasting a potential capacity of a regional market of chargeable customer services. There was developed a factor model of dependency between a potential capacity of the regional chargeable customer services market in Samara region, a segment of population having income equal to or higher then a minimum subsistence level and average per capita income index. The developed model was later used as a basis for interval forecast of the chargeable customer services market capacity in Samara region.

Keywords: *forecasting, model, mathematical modeling in economics, services market, consumption of services, market capacity.*

1. Introduction

The current trends in economic development under the conditions of transforming market environment demonstrated that consumption of services predominated over consumption of material benefits (Hill, 1977). With development of service sector the national economy becomes more service-oriented and gradually transforms from the economy of manufacturers into the economy of the most complete satisfaction of a specific consumer's demand (Bashmachnikova & Abramova, 2013). Therefore the problem of consumption of chargeable customer services is particularly acute and urgent. Intensive development of the service sector, commercialization of services, occurrence of new types of services requires timely identification of the market development prospects and adequate response of market participants to the possible changes (Yerokhina & Bashmachnikova, 2004).

In these circumstances any enterprise functioning in the service sector is faced with a significant level of uncertainty about the future state of the environment. In its turn lack of information on the potential volume of services consumption in the region may result in loss of competitive position of an enterprise in the market, reduction of incomes, profitability and the level of consumer loyalty or withdrawal from the market. Consequently timely obtaining of information about future condition of the regional chargeable services market capacity can become the key to effective management of a service company and improve its competitive position. Use of forecasting tools in commercial activity of an enterprise facilitates reduction of the degree of uncertainty of the future state of environment (Bell, 1973). It is necessary to identify patterns of services consumption by the population and to develop forecasts of possible states of this indicator in the future.

2. Methodology

Forecasting of the chargeable services market capacity consists in substantiation of the services consumption volumes within a definite time period (Yeliseyeva, Kurysheva, Kosteyeva, & et al., 2005).

An algorithm of forecasting a potential capacity of the regional chargeable customer services market is composed of four basic stages (Figure 1).
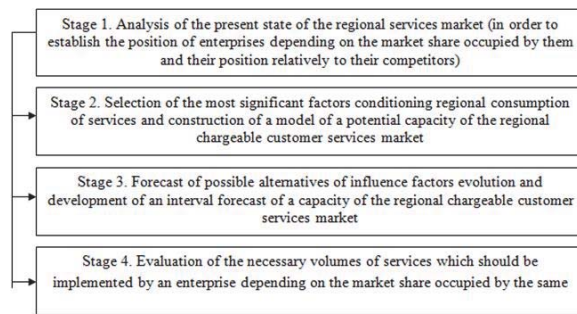
Figure 1. The algorithm of forecasting a potential capacity of the regional chargeable customer services market

Application of the developed forecasting algorithm for prediction of a potential capacity of the regional chargeable customer services market is being realized using Samara region as an example.

3. Main Part

Analysis of data contained in the materials of the Samara region territorial agency of the Federal State Statistics Service allowed to distinguish a growth trend in the volume of implemented services in Samara region for the last five years (the rate of growth of this index in 2012 made 49.18% by analogy with 2008. This confirms a positive trend in socio-economic development of Samara region, since the scope and the level of development of the chargeable services sector to a large extent determines an economic status of the region and the quality of life of its population.

The following factors can influence on a potential capacity of the chargeable customer services market: 1) a consumer price index in regard to the services; 2) a per capita income growth index; 3) a region population size; 4) a minimum subsistence level; 4) a share of population having income equal to or higher then the minimum subsistence level; 5) a quality of life of the region population; 6) a degree of the market saturation etc.

The results of the factor analysis made it possible to exclude irrelevant factors and to identify the most significant ones. The factors under consideration are the price index for the chargeable consumer services, the share of population in Samara region having income equal to or higher then the minimum subsistence level, and the per capita income growth index.

It's worth noting that the demand for the chargeable services in the region is predominantly satisfied and grows uniformly; the growth trend is maintained due to adequate and timely replenishment of the range of services. Therefore the forecasting model for a potential capacity of the chargeable customer services market in Samara region will have the form of a straight line represented by the following equation:

$$E_t = a_0 + a_1 x u_t + a_2 x r_t + a_3 d_t + a_4 v_t \quad (1)$$

where t - 1,2,...

where E_t - a potential capacity of the chargeable services market of Samara region, mln. rubles.

u_t - a price index for the chargeable customer services in Samara region, %

r_t - a share of population in Samara region having income equal to or higher then the minimum subsistence level, %

d_t - a per capita income growth index in Samara region, %

v_t - other unaccounted factors effecting the chargeable services market development in Samara region at time point t.

a - the model parameters.

The data for construction of the model of a potential capacity of the chargeable services market in Samara region are given in Table 1.

Table 1. Data for construction of the model of the Samara region chargeable services market capacity

Year	Actual capacity of the chargeable services market, mln. rub. (E_t)	Price index for the chargeable customer services in Samara region, %, u_t	Share of population in Samara region with income equal to or higher then the minimum subsistence level, %, r_t	Per capita income growth index in Samara region, %, d_t
2008	81728.1	116.30	84.50	123.28
2009	95585.1	115.00	83.30	121.28
2010	106470.3	111.90	84.30	113.04
2011	112061.3	107.70	84.90	115.84
2012	121925.7	108.70	84.70	110.77

REMARK: (statistical data – Samarastat and Rosstat) (Official web-site of the Federal State Statistics Service; Regions of Russia. Socioeconomic indices)

Presentation of an equation of the economic and mathematical model of a potential capacity of the chargeable customer services market in Samara region uses a least-squares method.

In order to find the necessary parameters we need to build a set of equations which will appear as follows (Kaldor, 1957):

$$\left.\begin{array}{l}\sum E_t = na_0 + a_1\sum u_t + a_2\sum xr_t + a_3\sum d_t + a_4\sum v_t \\ \sum E_t u_t = a_0\sum u_t + a_1\sum u_t^2 + a_2\sum u_t r_t + a_3\sum u_t d_t + a_4\sum u_t v_t \\ \sum E_t r_t = a_0\sum r_t + a_1\sum u_t r_t + a_2\sum r_t^2 + a_3\sum r_t d_t + a_4\sum r_t v_t \\ \sum E_t d_t = a_0\sum d_t + a_1\sum u_t d_t + a_2\sum r_t d_t + a_3\sum d_t^2 + a_4\sum d_t v_t \\ \sum E_t v_t = a_0\sum v_t + a_1\sum u_t v_t + a_2\sum r_t v_t + a_3\sum d_t v_t + a_4\sum v_t^2 \end{array}\right\} \quad (2)$$

Data for building and solving of the set of equations is given in Table 2.

Table 2. Background data for building and solving of the set of equations

Index	E_t	u_t	r_t	d_t	v_t
2008	81728.1	116.3	84.5	123.28	1
2009	95585.1	115	83.3	121.28	2
2010	106470.3	111.9	84.3	113.04	3
2011	112061.3	107.7	84.9	115.84	4
2012	121925.7	108.7	84.7	110.77	5
AMOUNT	517770.5	559.6	421.7	584.21	15

Index	$E_t u_t$	u_t^2	$u_t r_t$	$u_t d_t$	$u_t v_t$
2008	9504978.03	13525.69	9827.35	14337.46	116.3
2009	10992286.5	13225	9579.5	13947.2	230
2010	11914026.57	12521.61	9433.17	12649.18	335.7
2011	12069002.01	11599.29	9143.73	12475.97	430.8
2012	13253323.59	11815.69	9206.89	12040.7	543.5
AMOUNT	57733616.7	62687.28	47190.64	65450.51	1656.3

Index	$E_t r_t$	r_t^2	$r_t d_t$	$r_t v_t$	$E_t d_t$
2008	6906024.45	7140.25	10417.16	84.5	10075440.17
2009	7962238.83	6938.89	10102.62	166.6	11592560.93
2010	8975446.29	7106.49	9529.272	252.9	12035402.71
2011	9514004.37	7208.01	9834.816	339.6	12981180.99
2012	10327106.8	7174.09	9382.219	423.5	13505709.79
AMOUNT	43684820.7	35567.73	49266.09	1267.1	60190294.59

Index	d_t^2	$d_t v_t$	$E_t v_t$	v_t^2	
2008	15197.9584	123.28	81728.1	1	
2009	14708.8384	242.56	191170.2	4	
2010	12778.0416	339.12	319410.9	9	
2011	13418.9056	463.36	448245.2	16	
2012	12269.9929	553.85	609628.5	25	
AMOUNT	68373.7369	1722.17	1650182.9	55	

Through substitution of indices in the set of equations by the values from Table 2 we'll be able to get the following

interpretation:

$$\left.\begin{array}{l} 517770.5 = 5a_0 + 559.6a_1 + 421.7a_2 + 584.21a_3 + 15a_4 \\ 57733616.7 = 559.6a_0 + 62687.28a_1 + 47190.64a_2 + 65450.51a_3 + 1656.3a_4 \\ 43684820.7 = 421.7a_0 + 47190.64a_1 + 35567.73a_2 + 49266.09a_3 + 1267.1a_4 \\ 60190294.59 = 584.21a_0 + 65450.51a_1 + 49266.09a_2 + 68373.7369a_3 + 1722.17a_4 \\ 1650182.9 = 15a_0 + 1656.3a_1 + 1267.1a_2 + 1722.17a_3 + 55a_4 \end{array}\right\} \quad (3)$$

Solution of the above set has the below given form:

$a_0 = 1216.44$; $a_1 = -0.143$; $a_2 = 700.29$; $a_3 = 95,44$; $a_4 = 10256.76$.

The results of solving the set of equations demonstrate that growth of the price index for the chargeable customer services has a negative effect on the level of the services consumption in the region since the value of the corresponding parameter a_1 is negative.

Thus the model of a potential capacity of the chargeable services market in Samara region will be as follows:

$$E_t = 1216.44 - 0.143u_t + 700.29r_t + 95.44d_t + 10256.76v_t \quad (4)$$

In this manner there was developed a factor model of dependency of a potential capacity of the chargeable services market in Samara region on the price index for the chargeable customer services, the share of population with income equal to of higher then the minimum subsistence level and the per capita income growth index.

A retrospective forecasting method can be used for verification of the resulting model for the magnitude of an error (Dudakova & Gladkova, 2010). The background data for determining a calculating error are shown in Table 3.

Table 3. Background data for determining a calculating error

Period	Actual market capacity, E_t	$\hat{E}_t$, retrospective forecast	$E_t - \hat{E}_t$	$\left|\frac{E_t - \hat{E}_t}{E_t}\right|$, error level
2008	81728.1	82397.41	-669.31042	0.00819
2009	95585.1	91623.12	3961.97968	0.04145
2010	106470.3	101794.2	4676.14494	0.04392
2011	112061.3	112738.9	-677.63286	0.00605
2012	121925.7	122371.6	-445.89078	0.00366
Итого	517770.5	510925.2	6845.29056	0.10327

Let's determine an average relative error m with the help of the following equation:

$$m = \frac{1}{n}\sum \frac{y_i - \hat{y}_i}{y_i} \times 100\% = \frac{1}{5} \times 0.10327 \times 100\% = 2.07\% \quad (5)$$

The average relative error is equal to 2.07%. This evidences that the resulting data of forecasting a potential capacity of the chargeable customer services market in Samara region will have the highest level of reliability.

The given model serves as a basis for forecasting a potential capacity of the chargeable customer services market in the region. Therefore the next stage suggests building of a forecast for development of a potential capacity of the chargeable customer services market in the region relying on predicted values of the influencing factors.

The results of calculations of the predicted values of the factors having influence on consumption of services in the region are shown in Table 4.

Table 4. Predicted values of the factors influencing services consumption in Samara region

Scenario	YEAR		
	2013	2014	2015
Price index for the chargeable customer services in Samara region, %			
Realistic	107.04	84.73	108.00
Optimistic	105.96	85.58	109.27
Pessimistic	109.27	83.89	106.89
Share of Samara region population with income equal to or higher then the minimum subsistence level, %			
Realistic	105.41	84.76	105.30
Optimistic	104.34	85.61	106.50
Pessimistic	107.59	83.92	104.22

Per capita income growth index in Samara region, %			
Realistic	103.81	84.79	102.67
Optimistic	102.75	85.64	103.72
Pessimistic	105.96	83.95	101.61

REMARK:
— realistic scenario (when an average trend of the index change remains constant)
— optimistic scenario (when an average trend of the index change increases by 1%)
— pessimistic scenario (when an average trend of the index change decreases by 1 %)

By substituting the indices in the developed factor model by the obtained values of factors with breakdown by year it is possible to present an interval forecast of a potential capacity of the chargeable customer services market in Samara region (Table 5).

Table 5. Interval forecast of the chargeable customer services market capacity in Samara region, mln. Rubles

Scenario	YEAR		
	2013	2014	2015
Realistic	132385.217	142405.52	152432.4998
Optimistic	133101.8318	143115.4523	153128.114
Pessimistic	131690.7124	141713.8851	151742.7781

The last stage of forecasting offers to evaluate the position of a service enterprise in the future depending on its share on the potential chargeable customer services market. With this purpose it is necessary to build a matrix of a possible position of the service enterprise versus the desired market share and the services realization volumes necessary for occupying the stated share (Table 6).

Table 6. Matrix "market share/necessary volume of chargeable services realization under the forecasted market capacity conditions (in case of realistic forecast)"

Market share	Necessary services realization volume, mln. rubles.		
	2013	2014	2015
1%	1323.85	1424.06	1524.32
5%	6619.26	7120.28	7621.62
10%	13238.52	14240.55	15243.25
20%	26477.04	28481.10	30486.50
30%	39715.57	42721.66	45729.75
etc	…	…	…

We'd like to mention that at time of construction of similar matrices for interval values of indices it is possible to calculate the minimum and the maximum services realization volumes necessary for ensuring occupation of the required market share depending on expected patterns of the regional economy development and their dynamics.

4. Findings

Therefore the prepared interval forecast of the chargeable customer services market capacity in Samara region suggests that development of the stated market will be accompanied by an increase in volume of the chargeable services. However, increase in price of the services in the region will act as a limiting factor.

Verification of the forecasting results showed that the difference between the actual values and the predicted ones (forecast error) made 2.07%. In accordance with the obtained realistic forecast in 2013-2015 the general growth trend of the volume of the chargeable services consumption by the population which was established during the previous years will remain unchanged. Pursuant to the forecast in 2013 the volume of the chargeable services consumed by the population may reach 132385.217 mln. rubles (i.e. will increase by 8.58% as compared to the previous year), in 2014 – 142405.52 mln. rubles (i.e. will increase by 7.57% as compared to the previous year) and in 2015 – 152432.4998 mln. rubles (i.e. will increase by 7.04% as compared to the previous year). The rate of increase of the chargeable services consumption volume in 2015 will constitute 25.2% as against 2012.

5. Conclusions

Hence the chargeable customer services sector functions in accordance with common market economy development mechanisms under the conditions when the trends of environmental factors development have highly uncertain nature (Bower & Doz,2001). Due to this a manager of a service enterprise should master the methods of building economical and mathematical forecasting models in order to ensure significant competitive advantages, achieve a definite market share or obtain a credit on beneficial terms. For these reasons the developed approach to forecasting of a potential capacity of the chargeable customer services market in Samara region based on the built factor model seems to be important and useful at any level of service enterprise management in the region.

6. Acknowledgement

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