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SEASONAL FORECASTING SALES PERFORMANCE IN ENTERPRISE SYSTEM BY THE METHOD OF THREADS

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Губерник А.О. Прогнозування сезонних показників продажу підприємства за методом трендів.

Проаналізовано показники роздрібного товарообігу підприємств Одеського регіону. Обгрунтована актуальність науково-методичних рекомендацій з розробки інструментарію аналізу маркетингової інформації для вибору маркетингових стратегій, адекватних національним та світовим тенденціям в економіці.

Ключові слова: прогнозування, збут, трендові моделі, сезонні індекси, часові ряди

Губерник А.А. Прогнозирование сезонных показателей продаж в системе предприятия по методу трендов.

Проанализированы показатели розничного товарооборота предприятий Одесского региона. Обоснована актуальность научно-методических рекомендаций по разработке инструментария анализа маркетинговой информации для выбора маркетинговых стратегий, адекватных национальным и мировым тенденциям в экономике.

Ключевые слова: прогнозирование, сбыт, трендовые модели, сезонные индексы, временные ряды

Gubernik A.A. Seasonal forecasting sales performance in enterprise system by the method of threads.

Analyzes the performance of the retail trade of enterprises of Odessa region. The urgency of scientific guidelines for the development of marketing information analysis tools to select the marketing strategies of adequate national and global trends in the economy.

Keywords: Forecasting, sales, trend models, seasonal indices, time series

Most of the industrial enterprises of Ukraine are in a quandary in recent years. They need a scientific guidance on the development of tools for analyzing marketing information for selecting marketing strategies appropriate national and international trends in the economy. Marketing information system of industrial enterprise is a set of procedures and methods designed for regular, systematic collection, analysis and distribution of information, preparing and making marketing decisions.

Such system should facilitate the optimization of the sale. Modeling and forecasting future sales volumes is an important task for all levels of the economy. Seasonal changes in demand affect the macro-and microeconomic indicators. It is impossible to make strategic or tactical plan of the company development without demand for its products. It is impossible to compare the economic performance enterprise index that sells a seasonal product, without correction for the season.

Analysis of recent research and publications

Evaluation of projected sales figures and demand is made by statistical, mathematical and econometrical methods. Many different approaches is used in analyzing the dynamics of statistics number. (determined by the growth rate, growth, index) [1, 2]. Analyzing the annual sales figures are often used trend model, evaluation is carried out using the apparatus of mathematical statistics [3, 4].

Unsolved aspects of the problem

For the develop the marketing plans need to anticipate the type of demand, since the mechanisms of marketing exposure should be adequate for most types of demand. If the time series contains seasonal variations (monthly or quarterly) used different methods kovzke average model decomposition of time series model ARIMA, ARMA [5-8]. The problem is to develop a systematic algorithm using these methods.

The aim of the article is to study the algorithm of using scientific methodology of mathematical and statistical tools for forecasting sales volumes enterprises.

The main material

The forecast is getting with the method "Analysis of trends and seasonality", which is a direct, intuitive approach to the evaluation of the four basic components of monthly or quarterly time series

— Long-term trend (trend);
— Seasonality;
— Cyclic variation;
— Irregular component.

The base model of time series showing the number in this series as the product obtained by multiplying these components:

data = trend ×seasonal× cyclical ×irregularity

Evaluate the above basic components in various ways. One of the most common is a method related to the kovzkoho average. The method is based on the distribution of values of a number of smooth kovzke mean that way

— Kovzke medium used to remove seasonal effects by averaging across the rock to reduce irregular component and receiving the combination of trend and cyclical component;
— Divide the original number on the adjusted average number kovzkoho gives relevance to kovzkoho average that includes both seasonal and irregular values. Performing grouping by the year time and then averaging the obtained groups, we find the seasonal index for each season. Doing dividing each value in the corresponding rows seasonal index for that time of year, we find the values adjusted for season;
— Number of regression adjusted for season (B) Time (t) is used to assess the long-term trend in a straight line (or the trend) as a function of time. This trend does not reflect seasonal fluctuations and to produce weather without seasonality;
— Forecasting can be performed using the seasonal trend yield from the regression equation predicted values (trend) for future periods of time and then multiply them to the appropriate seasonal index . As a result, we obtain predictions that reflect both the long-term trend and seasonal behavior;

Table. 1 shows the quarterly volume of retail trade enterprises of Odessa region from 2005 to 2013, this time series shows a pronounced seasonal variation

Table 1. Volume of retail trade enterprises of Odessa region [9]

Year	Quarter	Retail trade enterprises, mln.
2005	1	912,5
	2	1128,1
	3	1407,3
	4	1498,5
2006	1	1378,4
	2	1714,3
	3	2001,3
	4	2007,7
2007	1	1792,6
	2	2206,2
	3	2748,6
	4	2976,6
2008	1	2709,9
	2	3334,7
	3	3958,9
	4	3838,8
2009	1	3075,1
	2	3446,4
	3	3920,7
	4	4020,4
2010	1	3337,1
	2	4397,8
	3	4875,5
	4	4963,2
2011	1	4189,0
	2	5394,3
	3	6691,4
	4	6199,6
2012	1	5311,1
	2	6217,0
	3	7334,5
	4	8058,9
2013	1	6060,9
	2	7034,2
	3	7334,5

Volume of retail trade turnover reaching a peak in the fourth quarter, as evidenced by the schedule time series for the relevant data (Fig. 1).

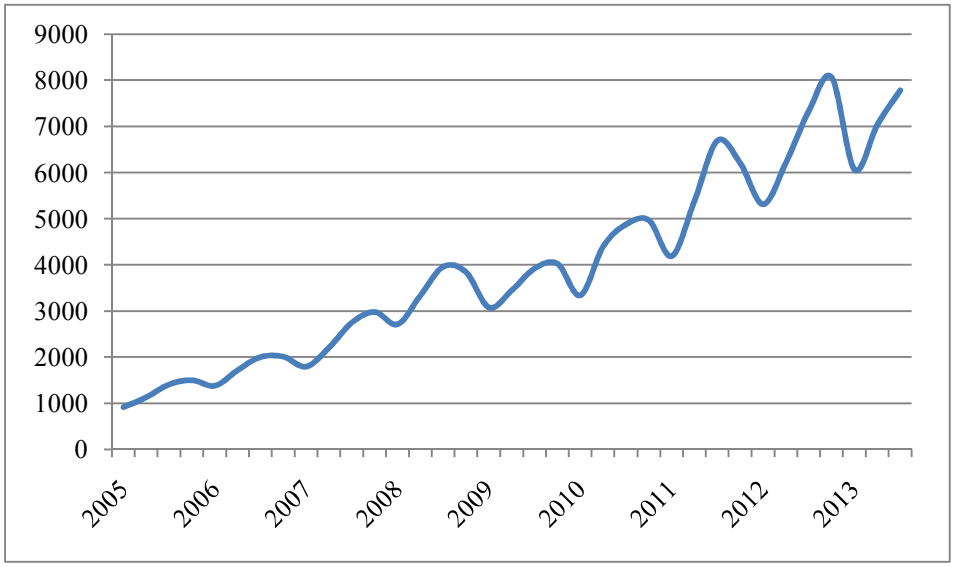


Fig. 1. Seasonal fluctuations in retail turnover of Odessa region, mln.

Then they fall sharply in the first and begin to grow in the second quarter. Seasonal scenario is not repeated every year because the time series is characterized by cyclical and irregular behavior. It should be divided into four basic components of time series. Start of averaging data over the year to get rid of the seasonal component and reduce the irregular component. Kovzke average is a new series produced by averaging adjacent observations of time series and advance to the next period in the end we get a smooth line.

Kovzke average for quarterly data over time are as follows. To add the current value of the value of its neighbors, then these neighbors half the values and divide by 4 (Table 2).

Kovzke average for the third quarter of 2005 is calculated as follows:

$$(\frac{1}{2}912{,}5 + 1128{,}1 + 1407{,}3 + 1498{,}5 + \frac{1}{2}1378{,}4) / 4 = 1294{,}84 \quad \text{(mln.uah)}$$

To select seasonal behavior, first, you need to obtain relevant source data to kovzkoho average (6th column in Table. 2). The result will include seasonal and irregular components as kovzke average excludes data trend and cyclical components.

Then, to eliminate the irregular component values are averaged for each season. The seasonal component is shown as it is present every year, while the irregular component fails to average. Deliverables include a seasonal index for each season – a factor that indicates how much more or less will be considered an indicator of a certain period of time compared with a typical period of a year.

Seasonal index for a given quarter is calculated as the average of all indexes during this quarter.

Seasonal indices show that the volume of retail trade enterprises of Odessa region, usually reaching peak in the third quarter, falling to a minimum in the first quarter, then go up to the fourth quarter (7th column of Table 2., Fig. 2).

It is seen that the maximum amount of retail sales in the Odessa region in the third quarter – 9.8% higher than the average for the year. Then he falls to a minimum in the first quarter for 14.7% less than the average for the year (Table 2).

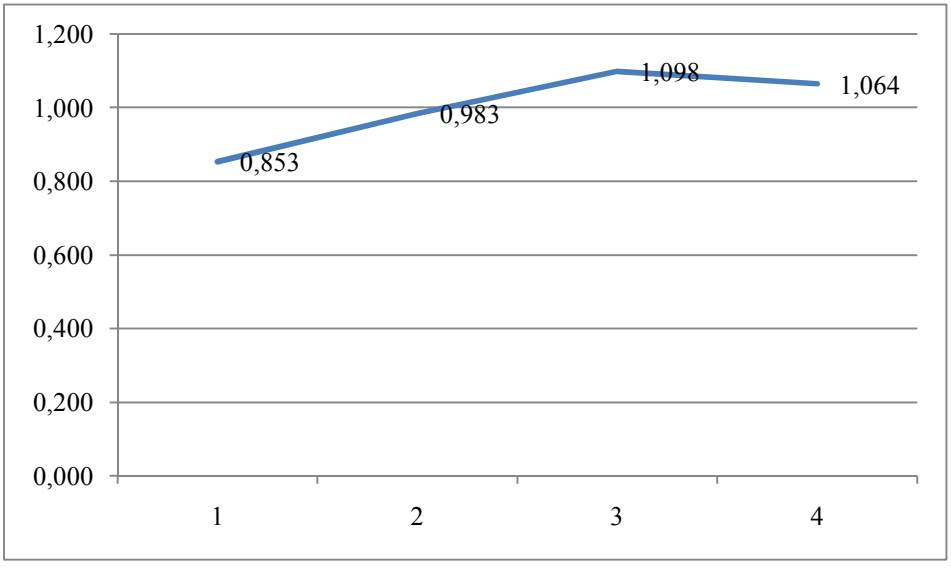
Once calculated each seasonal index, you can use it anywhere – even in places where it is impossible to calculate the average kovzke because by definition, seasonal variations are repeated every year. The seasonal component of retail trade turnover of Odessa region extracted from the original series, in exactly the same each year. To find the value, adjusted for seasonal variations, it is enough to split the original data on the seasonal index for the corresponding quarter (8-column table. 2).

For retail turnover of Odessa region mentioned in the first quarter of 2005, adjusted for seasonal variation is calculated as the actual volume of trade (in millions of USD 912.5) divided by the seasonal index of the second quarter (0.853). The volume of trade in the first quarter of 2005 = 912.5 / 0.853 = 1070.22 (mln.) (Adjusted for seasonal variations).

However, the results adjusted for seasonal variation was greater than the actual volume of trade. This is because the volume of trade in the first quarter is usually lower than a typical quarter. In fact, necessary to rely on the fact that the volume of trade in the first quarter will be about 14.7% lower (based on the seasonal index). Division by seasonal index eliminates the impact of the expected seasonal fluctuations, resulting in turnover in the first quarter in line with the typical quarter of the year (increasing it).

Table 2. Retail turnover of Odesa region and seasonal indices

Year	Quarter	number of period t	Retail trade million.	Kovzke average, mln. hrn.	Attitude kovzkoho average	Seasonal indexes	The turnover of amendment in season million.
2005	1	1	912,5			0,85263	1070,22
	2	2	1128,1			0,98328	1147,28
	3	3	1407,3	1294,84	1,08685	1,09822	1281,43
	4	4	1498,5	1426,35	1,05058	1,06404	1408,31
2006	1	5	1378,4	1573,88	0,8758		1616,64
	2	6	1714,3	1711,78	1,00148		1743,44
	3	7	2001,3	1827,2	1,09528		1822,3
	4	8	2007,7	1940,46	1,03465		1886,86
2007	1	9	1792,6	2095,36	0,85551		2102,44
	2	10	2206,2	2309,89	0,95511		2243,7
	3	11	2748,6	2545,66	1,07972		2502,77
	4	12	2976,6	2801,39	1,06254		2797,45
2008	1	13	2709,9	3093,74	0,87593		3178,28
	2	14	3334,7	3352,8	0,9946		3391,39
	3	15	3958,9	3506,23	1,12911		3604,82
	4	16	3838,8	3565,84	1,07655		3607,75
2009	1	17	3075,1	3575,03	0,86016		3606,6
	2	18	3446,4	3592,95	0,95921		3504,99
	3	19	3920,7	3648,4	1,07464		3570,03
	4	20	4020,4	3800,08	1,05798		3778,42
2010	1	21	3337,1	4038,35	0,82635		3913,89
	2	22	4397,8	4275,55	1,02859		4472,56
	3	23	4875,5	4499,89	1,08347		4439,44
	4	24	4963,2	4730,94	1,04909		4664,48
2011	1	25	4189,0	5082,49	0,8242		4913,03
	2	26	5394,3	5464,03	0,98724		5486
	3	27	6691,4	5758,84	1,16194		6092,92
	4	28	6199,6	6001,94	1,03293		5826,47
2012	1	29	5311,1	6185,16	0,85868		6229,08
	2	30	6217,0	6497,96	0,95676		6322,69
	3	31	7334,5	6824,1	1,07479		6678,51
	4	32	8058,9	7019,98	1,148		7573,86
2013	1	33	6060,9	7177,74	0,8444		7108,47
	2	34	7034,2				7153,78
	3	35	7779,4				7083,61



Pic. 2. Seasonal indices

Table. 2 shows the volume of goods, adjusted for seasonal variations for the entire time series. When long-term time series shows a linear trend to increase or decrease, to assess this trend and predict the future, you can use regression analysis.

Number the time series level 1, 2, 3 ... 35 (3rd column of Table. 2). Use the equation to obtain trend spreadsheet EXCEL: You must enter the Tools menu, choose Data Analysis, Regression. Then, the input interval as the dependent variable (Y), select the column data adjusted for season as the input interval of the independent variable (X) to select numbered time periods (column t).

As a result we get:

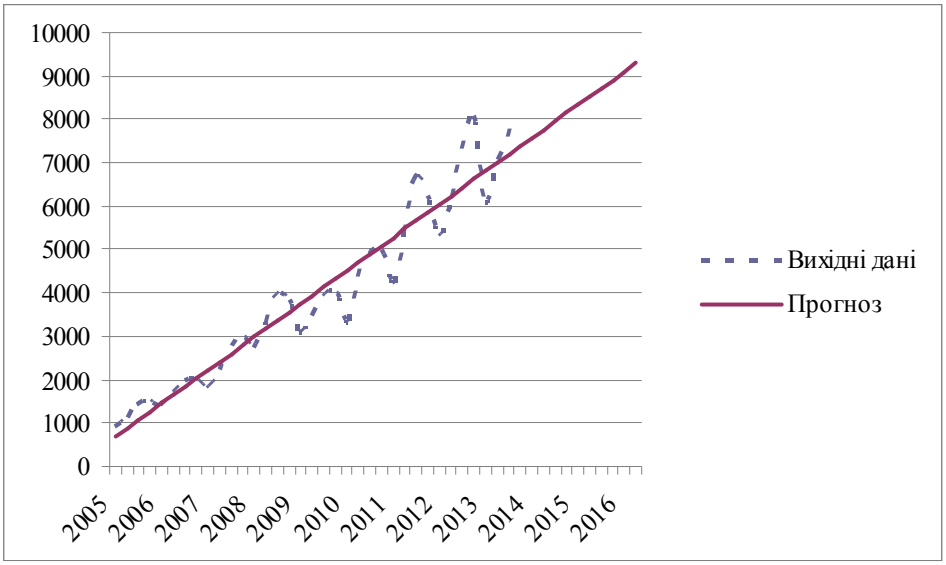
long-term trend = 496,80 + 191,17 (period of time),

$$\hat{Y}=496,80+191,17t,$$

This long-term trend is easy to predict in the regression equation by substituting the appropriate time period. In Table. 3 and Fig. 3 shows the predicted values.

Table 3. Projections of turnover retailers Odessa Oblast trend and seasonality considering mln.

Year	quarter		Weather adjusted for season (a trend)	Weather taking into account the seasonality
2013	4	36	7378,851	7851,402
2014	1	37	7570,019	6454,428
	2	38	7761,187	7631,457
	3	39	7952,355	8733,474
	4	40	8143,523	8665,045
2015	1	41	8334,691	7106,411
	2	42	8525,859	8383,348
	3	43	8717,027	9573,256
	4	44	8908,195	9478,688
2016	1	45	9099,364	7758,393
	2	46	9290,532	9135,238



Pic. 3. Original data and trend line with the forecast for the eleven quarters million

To predict the future, it is necessary to take into account the seasonality in the long-term trend, returning him to the expected seasonal variations. Simply multiply the value of the trend in the seasonal index values corresponding period.

The resulting prediction involves a long-term trend and seasonal variation:

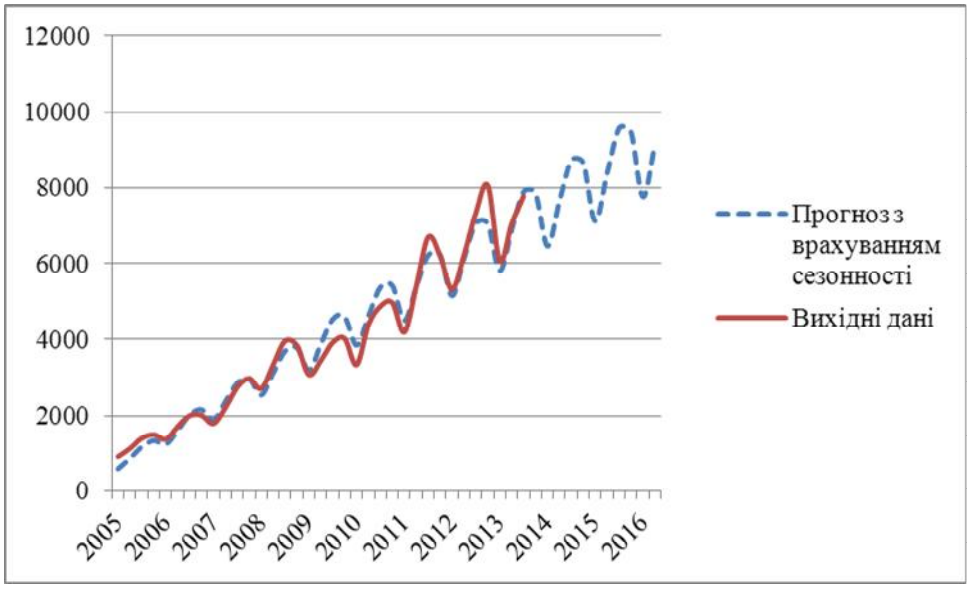
Forecast = Trend × Seasonal code.

To predict the volume of goods retailers Odessa region in the first quarter of 2014, it is enough to multiply the value of the trend at 7570.02 seasonal index for the first quarter, which is equal to 0.853

Forecast = 7570.02 0.853.

Table 3 shows the forecasts for eleven quarters ahead, with respect to available data. Fig. 4 shows how this, given the seasonal trend reflects the considered range and extended by extrapolation to the right, providing a fairly reliable predictions that include the expected seasonal turnover retailers Odessa.

Similarly, we can obtain predictions with regard to the seasonality of monthly data. In this case, the difference is in the calculation kovzkoho average. For data averaging calculations for the year must begin from the middle row – the seventh irrelevant, because the formula will have thirteen terms.



Pic. 4. Imprint obtained model and the forecast for the eleven quarters million

Conclusions

Almost all forecasts are not very reliable. Finally, the irregular component it is impossible to predict by definition. In addition, all predictions based on trends and seasonal fluctuations do not reflect the cyclical component. However, the scientific value of the proposed algorithm implementing complex mathematical and statistical methods is that brings out the long-term trend of increase or decrease, as well as recurring seasonal fluctuations. By using the seasonal trends can obtain reasonably accurate predictions, but they are "intuitive" basis. In subsequent studies suggest promising and justify tool that compares the macroeconomic forecasts of the seasonal component for a variety of economic indicators and linking them to relevant microeconomic seasonal indicators

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