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PROCEDURE FOR COMPUTATION AND INTERPRETATION OF BUSINESS CLIMATE INDICATOR FOR UKRAINE

Abstract. Construction of indicators of business expectations used to monitor the periods of economic growth and recession with monthly or quarterly periodicity and to predict turning points, has become of special importance today. In constructing indicators of business expectations countries tend to use the results from Business Tendency Survey of Enterprises (BTSE) supplying information about the current situation and future expectations of enterprises. The objective of the article is to show the procedure for computation of business climate indicator by use of factor analysis implemented in SPSS. Business climate indicator that sums up the opinions and estimates of many economic agents can be compared with aggregated statistical indicators, such as the seasonally adjusted rates of GDP growth.
Keywords: Business Tendency Survey of Enterprises, indicators of business expectations, business climate indicator, factor analysis, method of principal components.

Construction of indicators of business expectations used to monitor the periods of economic growth and recession with monthly or quarterly periodicity and to predict turning points, has become of special importance today.

When constructing indicators of business expectations, countries tend to use the results from Business Tendency Survey of Enterprises (BTSE) supplying information about the current situation and future expectations of enterprises. BTSE, as a survey aiming to study the opinions of enterprise managers, provide a tool for studies of economic phenomena with due consideration to subjective opinions of market agents.

The key indicators of business expectations, computed in the EU member countries in keeping with the Harmonized Program of the EU [1] are as follows:

– indicators of business confidence in industry, construction, retail trade, services sector, financial services sector;
– business clime indicator;
– economic sentiment indicator.

These indicators, incorporated in the system of obligatory harmonized European composite indicators, are computed on monthly basis by the European Commission's General Directorate of Economic and Financial Issues.

The purpose of computation of business expectations indicators in Ukraine is to produce statistical information on business activity tendencies, comparable with relevant data of EU member countries. Methodological framework for computation is "Methodological Guidelines for Computation of Indicators of Business Expectations According to the Requirements of the Special Standard for Dissemination of Data of the International Monetary Fund"[2].

[1] *The Joint Harmonised EU Programme of Business and Consumer Surveys: User Guide*. – Brussels : European Commission, Directorate General for Economic and Financial Affairs, 2014. <http://ec.europa.eu/economy_finance/db_indicators/surveys/documents/bcs_user_guide_en.pdf>

[2] *Методика розрахунку індикаторів ділових очікувань згідно з вимогами розширеного Спеціального стандарту поширення даних Міжнародного валютного фонду, наказ № 411 (30 грудня 2014).* < http://ukrstat.org/uk/metod_polog/metod_doc/2014/411/411_2014.htm>

Issues of constructing indicators of business expectations have been in focus of studies of Ukrainian and other researchers, such as R. Nilsson, E. Guidetti[3], L. Kitrar[4], M. Pugachova[5], N. Raiska, Ya. Sergiyenko, F. Frenkel[6].

The article aims to highlight the procedure for computation of business climate indicator by use of factor analysis implemented in SPSS and compare the estimates of business climate indicator and seasonally adjusted rates of GDP growth in Ukraine.

Business climate indicator is an aggregate estimate produced by factor analysis (method of principal components) of seasonally adjusted balances of production output for the latest three months and the forthcoming three months, estimates of the current domestic demand measured by the amount of domestic orders, the current export demand measured by the amount of orders from abroad, the current stocks of finished goods.

Factor analysis allows for breaking the data array into a small number of groups referred to as factors[7]. For purposes of constructing business climate indicator the number of factors is defined as 1. One factor combines the variables with high correlation.

Computation of business climate indicator ($I_{ДК_t}$) involves searching for a linear combination of standardized variables $\tilde{X}_{1_t}$, $\tilde{X}_{2_t}$, $\tilde{X}_{3_t}$, $\tilde{X}_{4_t}$, $\tilde{X}_{5_t}$ given the following condition:

$$I_{ДК_t} = a_1 \cdot \tilde{X}_{1t} + a_2 \cdot \tilde{X}_{2t} + a_3 \cdot \tilde{X}_{3t} + a_4 \cdot \tilde{X}_{4t} + a_5 \cdot \tilde{X}_{5t}$$

where a_i is derived from the matrix of estimates' ratios;

$i = 1, ..., 5$;

$$\tilde{X}_{jt} = \frac{X_{jt} - \bar{X}_j}{S_j},$$

$$\bar{X}_j = \frac{1}{T'} \sum_{t=1}^{T'} X_{jt},$$

$$S_j = \sqrt{\frac{1}{T'-1} \cdot \sum_{t=1}^{T'} (X_{jt} - \bar{X}_j)^2},$$

де $j = 1, \ldots, 5$; $t = 1, \ldots, T'$;

T' – length of a time series (number of quarters in our case);

X_{1t} – seasonally adjusted estimate of the balance of the current demand at the time t;

X_{2t} – seasonally adjusted estimate of the balance of change in production output in the forthcoming three months at the time t;

X_{3t} – seasonally adjusted estimate of the balance of the current stocks of finished goods at the time t;

X_{4t} – seasonally adjusted estimate of the balance of change in business situation over the past three months at the time t;

X_{5t} – seasonally adjusted estimate of the balance of export demand at the time t.

Figure 1 shows the algorithm for computation of business climate indicator in SPSS.

Practical implementation of the above algorithm is highlighted below.

1. Preparing time series in Demetra+ software

The following data are used for factor analysis:

– seasonally adjusted balances of change in production output in the current quarter relative to the previous one (method X-12-ARIMA, specification RSA4(c) without calendar effects);

[3] Nilsson, R., and E. Guidetti (2008), *Predicting the Business Cycle: How Good are Early Estimates of OECD Composite Leading Indicators?*, OECD Statistics Brief No. 14, February.

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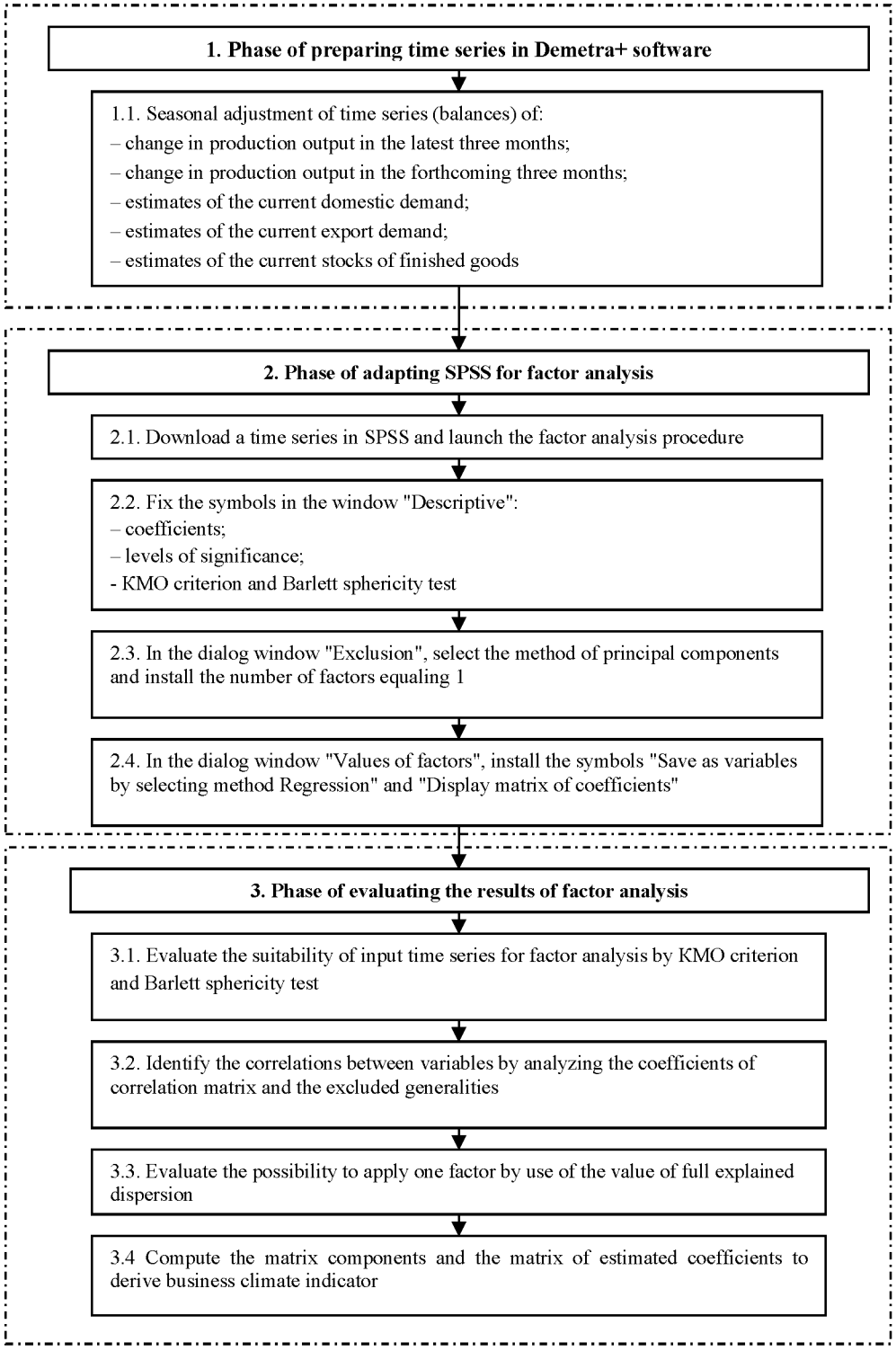

Fig. 1. Algorithm for constructing business climate indicator in SPSS

– seasonally adjusted balances of change in production output in the next quarter relative to the current one (method X-12-ARIMA, specification RSA4(c) without calendar effects);

– seasonally adjusted balances of the estimates of the current domestic demand (method TRAMO-SEATS, specification RSA4 without calendar effects);

– seasonally adjusted balances of the estimates of the current export demand (method TRAMO-SEATS, specification RSA4 without calendar effects);

– seasonally adjusted balances of the estimates of the current stocks of finished goods (method X-12-ARIMA, specification RSA4(c) without calendar effects).

The procedure of seasonal adjustment in Demetra+ software is given in[8].

2. Adapting SPSS for factor analysis

The method of principal components uses standardized data (computerized procedure of SPSS package).

The Kaiser–Meyer–Olkin criterion (KMO criterion) and Barlett sphericity test are used to evaluate the suitability of data. KMO criterion is the value characterizing the applicability of factor analysis to the available variables:

- > 0.9 – full applicability (adequacy);
- > 0.8 – high applicability (adequacy);
- > 0.7 – acceptable applicability (adequacy);
- > 0.6 – satisfactory applicability (adequacy);
- > 0.5 – low applicability (adequacy);
- < 0.5 – not applicable to the variables.

Barlett sphericity test is the criterion of the correlativity of variables (with zero hypothesis indicating on absence of correlation between variables). If $P < 0.05$, the data are quite applicable for factor analysis, because the correlations between variables are essential.

The correlation matrix is derived, to identify the correlations between variables. If the correlation coefficient > 0.3 occurs in each line of the matrix, it shows that the variables can be applied for further analysis.

3. Phase of evaluating the results from factor analysis

3.1. Evaluate the suitability of input time series for factor analysis by KMO criterion and Barlett sphericity test

The suitability of input data for factor analysis is determined by KMO criterion value (>0.5) and p-value for Barlett sphericity test (< 0.05) (Table 1).

Table 1

KMO criterion and Barlett sphericity test

KMO criterion and Barlett sphericity test KMO criterion		0.623
Barlett sphericity test	Approx. Xi-square	129.050
	Statistical parameters	10
	High	0.000

3.2. Identify the correlations between variables by analyzing the coefficients of correlation matrix and excluded the generalities The correlation matrix of variables is shown in Table 2.

Table 2

Correlation matrix

		VAR1	VAR2	VAR3	VAR4	VAR5
Correlation	VAR1	1.000	0.759	0.642	–0.217	0.393
	VAR2	0.759	1.000	0.532	–0.322	0.555
	VAR3	0.642	0.532	1.000	0.266	0.485
	VAR4	–0.217	–0.322	0.266	1.000	–0.070
	VAR5	0.393	0.555	0.485	–0.070	1.000
High (one-way)	VAR1	–	0.000	0.000	0.053	0.001
	VAR2	0,000	–	0.000	0.007	0.000
	VAR3	0,000	0.000	–	0.023	0.000
	VAR4	0,053	0.007	0.023	–	0.302
	VAR5	0,001	0.000	0.000	0.302	–

[8] Ященко, Л.О., Мотузка, О.М. (2014) *Сезонне коригування як один з основних етапів розрахунку індикатора ділової впевненості для промисловості*. Статистика України, 3, 17–24.

Because a correlation coefficient that is > ±0.3 and the significant correlation coefficients (with p-value < 0.05) occur in each row of the correlation matrix, the studied variables are suitable for factor analysis.

The variables and the generalities are shown is Table 3. The values of the initial generalities equal 1.

Table 3

Generalities

	Initial	Excluded
VAR1	1.000	0.764
VAR2	1.000	0.799
VAR3	1.000	0.605
VAR4	1.000	0.035
VAR5	1.000	0.514

3.3. Evaluate the possibility to apply one factor by use of the value of full explained dispersion

The columns of Table 5 contain the characteristics of the factors: their sequence numbers, sums of the square loads of exclusion, the share of overall dispersion caused by a factor, and the respective cumulative (accumulated) share.

Table 4

Full explained dispersion

Component	Initial values			Sums of the square loads of exclusion		
	Total	% dispersion	cumulative %	Total	% dispersion	cumulative %
1	2.717	54.334	54.334	2.717	54.334	54.334
2	1.233	24.653	78.988	–	–	–
3	0.635	12.708	91.696	–	–	–
4	0.239	4.778	96.474	–	–	–
5	0.176	3.526	100.000	–	–	–

The higher is the share of dispersion caused by a factor, the higher is this factor's significance. The higher is the cumulative share accumulated to the last factor, the more significant is the factor solution. If this accumulated share is less than 50%, then either the number of variables needs to be decreased or the number of factors needs to be increased. In our case, the accumulated share of dispersion is quite acceptable for use of one factor.

3.4. Compute matrix components and matrix of estimates coefficients to derive business climate indicator

The matrix of components for one factor is shown in Table 5.

Table 5

Matrix of components

	Component 1
VAR1	0.874
VAR2	0.894
VAR3	0.778
VAR4	–0.186
VAR5	0.717

The matrix of the coefficients of estimated components (matrix of standardized scoring coefficients), shown in Table 6, is used for computation of the standardized values of the computed component.

Table 6

Matrix of the coefficients of estimated components

	Component 1
VAR1	0.322
VAR2	0.329
VAR3	0.286
VAR4	–0.069
VAR5	0.264

As a result, the business climate indicator is derived, summing up the opinions and estimates of large numbers of economic agents. It can be compared with values of an aggregated statistical indicator (such as GDP; seasonally adjusted rates of GDP growth). Comparison of the business climate indicator and seasonally adjusted rates of GDP growth is shown Figure 2.

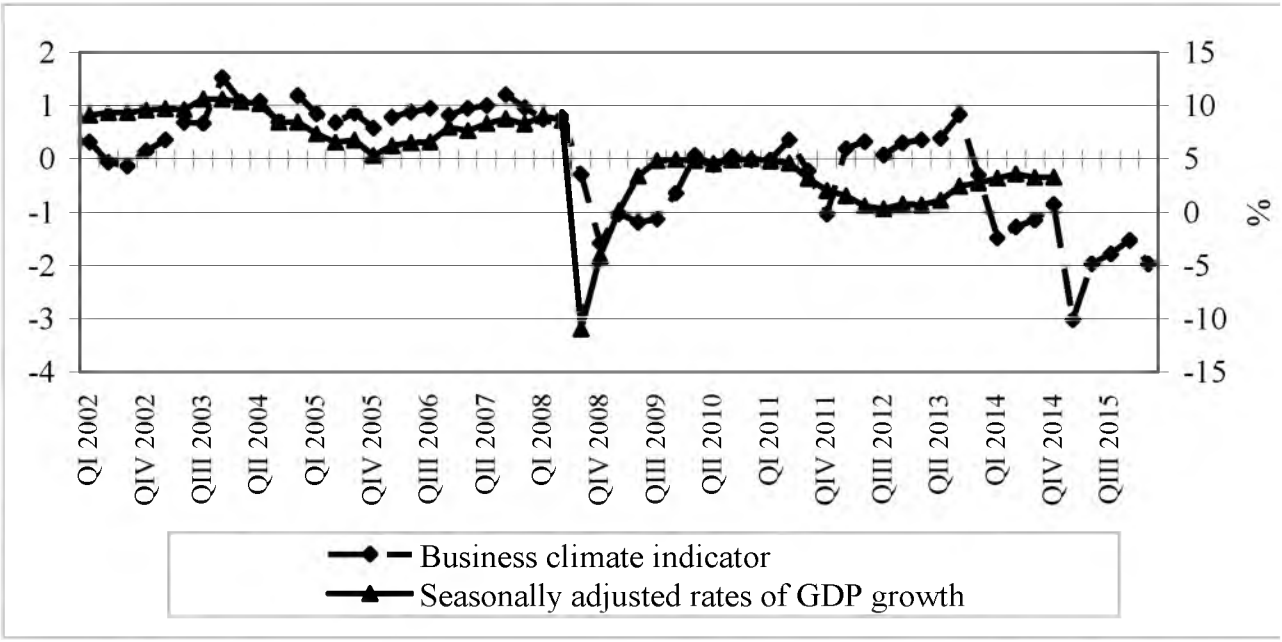

Fig. 2. Comparison of the business climate indicator and seasonally adjusted rates of GDP growth

The coefficient of correlation between business climate indicator and seasonally adjusted rates of GDP growth for Ukraine is 0.56, which evidences on medium correlation between these indicators. Basically, GDP recession is predicted for II quarter 2015 – II quarter 2016, with a slight upward trend in III and IV quarters 2015 p. and I quarter 2016.

Business climate indicator can be computed in Ukraine now by the procedure adapted to the European standards. BTSE has been fully harmonized with the Eurostat methodology since I quarter 2015, thus allowing for comparisons of business climate indicators for Ukraine and EU. Seasonal adjustment of the variables used for computation of business climate indicator can be made at the end of 2018, when the length of the time series will cover 4 years, following international recommendations.

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