Approved by the order of the Chairman of the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan

dated December 27, 2016

№326

### Methodology for constructing a composite leading indicator

### Chapter 1. General provisions

1. The methodology for constructing a composite leading indicator
(hereinafter - Methodology) refers to a statistical methodology formed in accordance with international standards and approved in accordance with [the Law](http://adilet.zan.kz/rus/docs/Z100000257_#z0) of the Republic of Kazakhstan dated March 19, 2010 "On State Statistics" (hereinafter - Law).
2. This Methodology is intended for use by the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan (hereinafter - the Committee) to build a composite leading indicator, in accordance with international standards.
3. The purpose of this Methodology is to describe the algorithm for constructing a composite leading indicator, which is used solely to obtain information about the direction of change in the business activity cycles of the economy and assess the likely trajectory of economic development ahead of several periods (years, quarters, months).
4. The Methodology describes the stages of building a composite leading indicator, which, along with other forecasting methods, allows monitoring and analyzing business cycles of the economy, determining the likely future direction of economic development, foreshadowing a possible change in the business activity of the economy, making a short-term forecast and obtaining information important for adoption. solutions to smooth adverse economic cycles.
5. The following definitions are used in this Methodology:
6. business surveys - surveys of large and medium-sized enterprises by industry conducted by the Committee. Based on the results of surveys, short-term economic indicators are formed that allow assessing the current and future financial and economic condition of enterprises;
7. a leading indicator-indicator that allows you to assess the likely trajectory of the economy and predict a possible change in the business activity of the economy ahead of several periods. A decrease in the level of the leading indicator is an early signal of a halt in growth or a decline in the level of the economy. The composite leading indicator is formed from indicators that in the group create leading signals;
8. the Hodrick-Prescott method is a [time series smoothing method](https://university.prognoz.ru/biu/ru/%D0%92%D1%80%D0%B5%D0%BC%D0%B5%D0%BD%D0%BD%D1%8B%D0%B5_%D1%80%D1%8F%D0%B4%D1%8B%2C_%D1%81%D0%BE%D1%81%D1%82%D0%B0%D0%B2%D0%BB%D1%8F%D1%8E%D1%89%D0%B8%D0%B5_%D0%B2%D1%80%D0%B5%D0%BC%D0%B5%D0%BD%D0%BD%D0%BE%D0%B3%D0%BE_%D1%80%D1%8F%D0%B4%D0%B0) that is used to highlight long-term trends in a time series - seasonal fluctuations and trends.
9. economic cycles are fluctuations in production or business activity in the economy as a whole. These fluctuations are periodic in nature and are measured by the level of output, unemployment, investment, consumption, prices and other economic indicators;
10. benchmark indicator - an indicator that reflects fluctuations in economic activity and its value is a benchmark for using leading indicators for forecasting purposes.

### Chapter 2. Choosing economic indicators for building a composite leading indicator

1. The construction of a composite leading indicator begins with the selection of indicators that are similar in certain qualitative and statistical characteristics relative to the benchmark indicator. When choosing an indicator, the following criteria are observed:
2. economic characteristics: indicators have an economic explanation for leading, matching or lagging behind the reference indicator, reflect a wide range of economic activity and are formed from balanced results of market surveys, financial and economic indicators;
3. practical characteristic: when constructing a composite leading indicator, the selected data are available and have long historical series;
4. statistical characteristic: takes into account the magnitude and sequence of advance of the turning points of the indicator relative to the reference series. The correlation of the cyclicity of the reference series with the indicator is analyzed;
5. analysis of individual economic fluctuations: identifies indicators for inclusion in a composite leading indicator. Certain economic processes change the nature of the relationship between macroeconomic variables , the indicator, while well correlated with the reference series based on the analysis of recent data, is not correlated when analyzing past historical data.

### Chapter 3. Building a Composite Leading Indicator

1. The reference indicator is the dynamics of the gross domestic product (hereinafter - GDP).
2. The Committee monitors economic participants in order to identify early signals of a change in the direction of economic cycles. Questions of general observation consist in assessing the current economic situation and expectations of future changes.
3. To build a composite leading indicator, data from nationwide statistical observations of the market survey are used, consisting of the following indicators:
4. expected release of the main product;
5. demand for finished products;
6. the number of employed workers;
7. financial and economic situation.

In order to improve the results of the formation of a composite leading indicator, the calculation includes the indicator of labor statistics "number of vacancies". Appendix 1 to this Methodology presents indicators that form a composite leading indicator.

1. The main factor in choosing indicators for the formation of a composite leading indicator was the cyclical characteristic of an individual indicator relative to the reference series. The cyclical characteristics of the indicators were determined by graphical analysis, as well as by correlation analysis.
2. In the process of correlation analysis, indicators were selected that had leading qualities relative to the reference series.
3. When forming a list of indicators for building summary leading indicators, the data is processed, seasonality, trend and random (irregular) fluctuations are excluded. Time series components equation:

*Y = C × T × S × I,*

where:

*Y* - time series;

*C* – cycle;

*T -* trend;

*S* - seasonality;

*I* - irregular oscillations.

1. Smoothing is performed to bring all composite series of the composite leading indicator to the same smoothness. The seasonality of the indicators was smoothed using the X12 ARIMA method. The X12 ARIMA method is a complex procedure for separating the seasonality of a time series. Features have been added to the method, such as types of seasonality, types of seasonal filters (moving average), unloading series containing corrections for holidays and containing a seasonal component, unloading series of spectral frequencies SP1 and SP2, spectral densities SP1 and SP2. The seasonally adjusted time series is given in Appendix 2 to this Methodology.
2. The trend of time series extracted by the Hodrick-Prescott method is presented in Appendix 3 to this Methodology.
3. The next step is to normalize the time series. Time series are normalized in order to obtain series with the same amplitudes. Normalized time series are presented in Appendix 4 to this Methodology.
4. Weighting is carried out by assigning weights to each component included in the composite indicator. The same weights are used when compiling a composite indicator, or weights are used depending on the quality of the lead of individual indicators.
5. A summary of individual indicators is produced to obtain a composite leading indicator. The average value of the composite indicator is adjusted to one, and with a uniform distribution of weights, a coefficient of 0.2 is assigned to each composite indicator. The composite leading indicator is calculated using the following formula:

$CLI=0,2Emp+0,2Dfg+0,2Out+0,2Fin+0,2Vak$,

where:

$CLI$– consolidated leading indicator;

$Emp$– number of employed workers;

$Dfg$– demand for finished products;

$Out$– expected output of the main type of product;

$Fin$– financial and economic situation;

$Vak$- the number of vacancies.

**Chapter 4 Evaluation of the composite leading indicator**

1. The quality of the resulting composite leading indicator is evaluated. Quality is determined by the analysis of turning points, which implies the ability to predict the turning points of the benchmark indicator. The dynamics of the composite leading indicator and the reference series is given in Appendix 5 to this Methodology. The composite leading indicator leads the benchmark by an average of one quarter, the pivot points of the composite leading indicator signal future changes in the benchmark.
2. The analysis of turning points is carried out by calculating the average value and the median of the lead of the composite indicator relative to the benchmark indicator. Long series of data are used in the analysis to obtain statistically significant results.
3. Another method for assessing the quality of a composite leading indicator is correlation and regression analysis. Correlation analysis reflects the interdependence of several indicators. Regression analysis describes the relationships between dependent indicators, and describes the relationships in the equations. Regression analysis is determined by the least squares method with a deviation tending to a minimum.

Appendix 1

to the Methodology for constructing a composite leading indicator

**Indicators forming the composite leading indicator**

|  |  |  |  |
| --- | --- | --- | --- |
| Period | GDP | Business survey data | Number of vacancies, thousand units |
| Number of employed workers | Total demand for products | Release of the main product | Financial and economic situation |
| 2006q1 | 107.90 | 6.00 | 19.33 | 28.00 | 24.33 | 16.10 |
| 2006q2 | 109.70 | 8.67 | 22.00 | 28.00 | 25.67 | 17.70 |
| 2006q3 | 110.50 | 5.33 | 17.00 | 25.67 | 21.00 | 18.20 |
| 2006q4 | 110.70 | 1.67 | 12.33 | 15.33 | 17.33 | 16.60 |
| 2007q1 | 111.70 | 7.33 | 16.67 | 25.33 | 24.00 | 22.20 |
| 2007q2 | 110.80 | 7.33 | 18.00 | 24.33 | 25.33 | 22.10 |
| 2007q3 | 109.90 | 8.00 | 19.00 | 25.67 | 21.00 | 24.00 |
| 2007q4 | 108.90 | 1.67 | 12.33 | 17.00 | 17.67 | 20.10 |
| 2008q1 | 107.00 | 5.67 | 16.00 | 19.67 | 22.00 | 27.80 |
| 2008q2 | 106.00 | 5.33 | 15.67 | 20.33 | 23.00 | 26.80 |
| 2008q3 | 103.90 | 1.00 | 11.67 | 19.33 | 17.33 | 27.80 |
| 2008q4 | 103.30 | -7.33 | 1.00 | 4.67 | 6.67 | 23.20 |
| 2009q1 | 98.00 | -3.33 | -0.33 | 5.00 | 5.00 | 18.90 |
| 2009q2 | 97.50 | -2.67 | 4.67 | 6.00 | 6.33 | 18.20 |
| 2009q3 | 98.20 | -1.33 | 9.33 | 15.00 | 9.67 | 17.80 |
| 2009q4 | 101.20 | -0.67 | 2.33 | 6.00 | 6.00 | 15.70 |
| 2010q1 | 105.80 | 4.33 | 8.00 | 14.67 | 12.67 | 16.60 |
| 2010q2 | 107.20 | 4.67 | 12.33 | 15.67 | 14.67 | 18.10 |
| 2010q3 | 107.40 | 4.33 | 11.67 | 17.00 | 12.33 | 17.90 |
| 2010q4 | 107.30 | 0.00 | 6.33 | 7.67 | 9.00 | 16.40 |
| 2011q1 | 106.30 | 6.00 | 10.67 | 16.67 | 14.67 | 17.90 |
| 2011q2 | 107.40 | 6.33 | 15.67 | 19.00 | 14.33 | 18.70 |
| 2011q3 | 107.20 | 5.00 | 14.33 | 24.33 | 11.67 | 19.00 |
| 2011q4 | 107.50 | 0.33 | 6.67 | 7.33 | 3.67 | 19.20 |
| 2012q1 | 105.20 | 4.33 | 12.00 | 15.67 | 14.00 | 21.80 |
| 2012q2 | 105.10 | 7.67 | 14.33 | 20.00 | 16.33 | 22.70 |
| 2012q3 | 105.00 | 5.67 | 15.00 | 20.33 | 12.33 | 25.10 |
| 2012q4 | 105.00 | 2.00 | 6.67 | 10.33 | 5.00 | 25.60 |
| 2013q1 | 104.30 | 7.00 | 12.00 | 18.00 | 21.00 | 25.10 |
| 2013q2 | 105.00 | 6.00 | 10.00 | 13.00 | 15.00 | 24.30 |
| 2013q3 | 105.70 | 3.00 | 13.00 | 19.00 | 13.00 | 21.10 |
| 2013q4 | 106.00 | 0.00 | 2.00 | 4.00 | 8.00 | 22.50 |
| 2014q1 | 104.10 | 4.00 | 11.00 | 19.00 | 14.00 | 25.10 |
| 2014q2 | 103.90 | 4.00 | 15.00 | 21.00 | 10.00 | 23.10 |
| 2014q3 | 104.10 | 3.00 | 13.00 | 20.00 | 9.00 | 23.40 |
| 2014q4 | 104.40 | -1.00 | 1.00 | 7.00 | 0.00 | 25.20 |
| 2015q1 | 102.30 | 1.00 | 8.00 | 14.00 | 7.00 | 25.90 |
| 2015q2 | 101.70 | -1.00 | 10.00 | 17.00 | 7.00 | 25.30 |
| 2015q3 | 100.20 | -3.00 | 6.10 | 15.80 | 2.00 | 24.20 |
| 2015q4 | 102.00 | -4.20 | -1.90 | 1.50 | -4.80 | 22.10 |

Appendix 2

to the Methodology for constructing a composite leading indicator

**Seasonally adjusted time series**



Appendix 3

to the Methodology for constructing a composite leading indicator

**Time Series Trend Extracted by
the Hodrick-Prescott Method**

| Period | GDP | Business survey data | Number of vacancies |
| --- | --- | --- | --- |
| Number of employed workers | Total demand for products | Release of the main product | Financial and economic situation |
| 2006q1 | 108.3 | 105.3 | 120.2 | 128.7 | 123.7 | 115.9 |
| 2006q2 | 109.5 | 105.2 | 118.9 | 125.4 | 122.3 | 117.0 |
| 2006q3 | 110.3 | 105.1 | 117.5 | 122.1 | 121.1 | 117.5 |
| 2006q4 | 111.0 | 105.5 | 116.9 | 121.6 | 121.6 | 118.7 |
| 2007q1 | 111.4 | 105.8 | 116.6 | 123.1 | 122.8 | 120.9 |
| 2007q2 | 111.0 | 106.0 | 116.1 | 122.7 | 122.2 | 122.3 |
| 2007q3 | 109.8 | 106.4 | 116.3 | 122.1 | 121.3 | 123.0 |
| 2007q4 | 108.7 | 105.9 | 117.0 | 121.8 | 121.4 | 124.5 |
| 2008q1 | 107.3 | 104.6 | 116.2 | 120.6 | 121.4 | 126.0 |
| 2008q2 | 105.8 | 103.2 | 113.3 | 118.3 | 120.1 | 127.0 |
| 2008q3 | 104.0 | 100.1 | 109.3 | 115.1 | 116.6 | 126.7 |
| 2008q4 | 101.4 | 96.7 | 104.8 | 109.9 | 110.4 | 124.2 |
| 2009q1 | 98.7 | 95.2 | 101.7 | 105.4 | 104.9 | 120.4 |
| 2009q2 | 97.3 | 95.8 | 102.3 | 105.4 | 104.1 | 117.9 |
| 2009q3 | 98.3 | 98.2 | 104.9 | 109.3 | 107.2 | 117.1 |
| 2009q4 | 101.1 | 101.2 | 107.0 | 112.8 | 110.1 | 116.6 |
| 2010q1 | 104.8 | 102.8 | 108.5 | 114.2 | 111.5 | 116.8 |
| 2010q2 | 107.1 | 103.2 | 109.3 | 113.7 | 111.8 | 117.4 |
| 2010q3 | 107.4 | 103.5 | 109.9 | 113.0 | 112.4 | 117.5 |
| 2010q4 | 107.0 | 103.9 | 110.6 | 114.3 | 113.2 | 117.3 |
| 2011q1 | 106.9 | 104.4 | 111.7 | 116.1 | 113.0 | 117.7 |
| 2011q2 | 107.2 | 104.7 | 112.1 | 117.8 | 112.0 | 118.3 |
| 2011q3 | 107.3 | 104.4 | 112.2 | 117.9 | 110.5 | 118.9 |
| 2011q4 | 106.8 | 103.9 | 112.1 | 115.8 | 109.7 | 119.9 |
| 2012q1 | 105.9 | 104.0 | 111.8 | 115.3 | 111.5 | 121.3 |
| 2012q2 | 105.2 | 104.7 | 111.6 | 116.4 | 113.1 | 122.9 |
| 2012q3 | 104.8 | 105.3 | 112.3 | 117.1 | 112.7 | 124.9 |
| 2012q4 | 104.6 | 105.5 | 112.8 | 117.8 | 113.0 | 125.8 |
| 2013q1 | 104.8 | 105.3 | 111.4 | 116.2 | 113.6 | 125.1 |
| 2013q2 | 105.2 | 104.4 | 109.4 | 113.1 | 112.9 | 123.9 |
| 2013q3 | 105.5 | 103.2 | 108.2 | 112.1 | 112.9 | 123.0 |
| 2013q4 | 105.3 | 102.7 | 108.7 | 114.0 | 113.1 | 122.8 |
| 2014q1 | 104.7 | 102.6 | 110.2 | 116.7 | 111.0 | 123.2 |
| 2014q2 | 104.2 | 102.7 | 111.4 | 117.9 | 108.8 | 123.3 |
| 2014q3 | 103.9 | 102.8 | 110.2 | 116.5 | 107.5 | 123.9 |
| 2014q4 | 103.6 | 101.7 | 108.1 | 114.7 | 105.7 | 125.1 |
| 2015q1 | 102.9 | 99.6 | 107.1 | 113.7 | 104.6 | 125.5 |
| 2015q2 | 101.9 | 97.8 | 106.0 | 113.2 | 104.2 | 125.3 |
| 2015q3 | 101.1 | 97.4 | 104.7 | 112.0 | 102.2 | 124.2 |
| 2015q4 | 100.3 | 97.8 | 103.9 | 109.7 | 99.7 | 122.5 |
| Average | 105.3 | 102.7 | 110.8 | 116.1 | 112.8 | 121.6 |
| Standard deviation | 3.5 | 3.1 | 4.6 | 5.0 | 6.3 | 3.4 |

Appendix 4

to the Methodology for constructing a composite leading indicator

**Normalized Time Series**

| Period | GDP | Business survey data | Number of vacancies |
| --- | --- | --- | --- |
| Number of employed workers | Total demand for products | Release of the main product | Financial and economic situation |
| 2006q1 | 0.85 | 0.82 | 2.05 | 2.54 | 1.72 | -1.67 |
| 2006q2 | 1.21 | 0.80 | 1.78 | 1.88 | 1.51 | -1.33 |
| 2006q3 | 1.44 | 0.76 | 1.46 | 1.20 | 1.32 | -1.19 |
| 2006q4 | 1.63 | 0.90 | 1.32 | 1.10 | 1.39 | -0.83 |
| 2007q1 | 1.76 | 1.01 | 1.28 | 1.41 | 1.58 | -0.19 |
| 2007q2 | 1.64 | 1.06 | 1.16 | 1.33 | 1.49 | 0.22 |
| 2007q3 | 1.30 | 1.18 | 1.19 | 1.20 | 1.35 | 0.41 |
| 2007q4 | 0.97 | 1.01 | 1.36 | 1.15 | 1.36 | 0.86 |
| 2008q1 | 0.58 | 0.62 | 1.18 | 0.91 | 1.36 | 1.30 |
| 2008q2 | 0.15 | 0.15 | 0.55 | 0.44 | 1.15 | 1.58 |
| 2008q3 | -0.37 | -0.85 | -0.34 | -0.21 | 0.61 | 1.51 |
| 2008q4 | -1.13 | -1.94 | -1.32 | -1.24 | -0.37 | 0.78 |
| 2009q1 | -1.91 | -2.42 | -2.00 | -2.16 | -1.25 | -0.35 |
| 2009q2 | -2.29 | -2.23 | -1.88 | -2.15 | -1.38 | -1.08 |
| 2009q3 | -2.03 | -1.46 | -1.30 | -1.38 | -0.89 | -1.30 |
| 2009q4 | -1.20 | -0.48 | -0.85 | -0.67 | -0.43 | -1.46 |
| 2010q1 | -0.15 | 0.04 | -0.51 | -0.38 | -0.21 | -1.39 |
| 2010q2 | 0.50 | 0.17 | -0.34 | -0.47 | -0.16 | -1.20 |
| 2010q3 | 0.59 | 0.26 | -0.21 | -0.62 | -0.06 | -1.18 |
| 2010q4 | 0.48 | 0.39 | -0.04 | -0.36 | 0.07 | -1.25 |
| 2011q1 | 0.46 | 0.53 | 0.18 | 0.00 | 0.04 | -1.12 |
| 2011q2 | 0.54 | 0.65 | 0.27 | 0.35 | -0.12 | -0.94 |
| 2011q3 | 0.57 | 0.56 | 0.30 | 0.37 | -0.37 | -0.79 |
| 2011q4 | 0.43 | 0.39 | 0.28 | -0.05 | -0.50 | -0.48 |
| 2012q1 | 0.17 | 0.41 | 0.21 | -0.16 | -0.21 | -0.09 |
| 2012q2 | -0.04 | 0.65 | 0.17 | 0.06 | 0.05 | 0.41 |
| 2012q3 | -0.16 | 0.83 | 0.31 | 0.21 | -0.01 | 0.99 |
| 2012q4 | -0.20 | 0.89 | 0.43 | 0.35 | 0.04 | 1.23 |
| 2013q1 | -0.15 | 0.85 | 0.13 | 0.03 | 0.13 | 1.03 |
| 2013q2 | -0.02 | 0.53 | -0.31 | -0.59 | 0.02 | 0.68 |
| 2013q3 | 0.05 | 0.16 | -0.58 | -0.79 | 0.02 | 0.42 |
| 2013q4 | 0.00 | 0.01 | -0.47 | -0.41 | 0.05 | 0.37 |
| 2014q1 | -0.17 | -0.02 | -0.13 | 0.13 | -0.29 | 0.48 |
| 2014q2 | -0.32 | 0.00 | 0.13 | 0.36 | -0.63 | 0.50 |
| 2014q3 | -0.40 | 0.02 | -0.14 | 0.08 | -0.84 | 0.69 |
| 2014q4 | -0.48 | -0.32 | -0.59 | -0.28 | -1.11 | 1.03 |
| 2015q1 | -0.68 | -1.00 | -0.81 | -0.48 | -1.30 | 1.17 |
| 2015q2 | -0.97 | -1.60 | -1.05 | -0.58 | -1.37 | 1.11 |
| 2015q3 | -1.22 | -1.72 | -1.35 | -0.83 | -1.68 | 0.79 |
| 2015q4 | -1.43 | -1.59 | -1.51 | -1.29 | -2.07 | 0.28 |
| Average | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Standard deviation | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |

Appendix 5

to the Methodology for constructing a composite leading indicator

**Dynamics of the composite leading indicator and reference series**