Approved by the order of the Chairman of the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan on December 6, 2016

no. 303

**Methodology for measuring multifactorial performance**

**Chapter 1. General provisions**

1. Methodology for measuring multifactor productivity (hereinafter - Methodology) was developed in accordance with the Law of the Republic of Kazakhstan dated March 19, 2010 " On State Statistics".

2. This Methodology is intended to be used by the Statistics Committee of the Ministry of National Economy of the Republic of Kazakhstan (hereinafter - the Committee) to measure multi-factor productivity.

3. The purpose of this Method is to describe the algorithm for experimental calculations of multifactorial productivity.

4. This Methodology uses definitions consistent with the System of National Accounts 2008 methodology prepared by the International Monetary Fund, the Organization for Economic Co-operation and Development, the Statistical Office of the European Communities, the United Nations and the World Bank.

5. The following definitions are used in this Methodology :

1) price index - a relative indicator of the price level for any product (service) from one period of time to another;

2) wages of employees - the total amount of remuneration in cash or in kind, payable by the enterprise to the employee for the work done by him during the reporting period;

3) gross value added (GVA) - characterizes the final result of production activity and represents the value added by processing in this production process. Calculated at the level of sectors as the difference between the output of goods and services and intermediate consumption, includes the cost of fixed capital consumed in the production process;

4) gross fixed capital formation (GFCF) - the cost of acquisition by producers of new and existing fixed assets, less the cost of disposal of fixed assets used in production to create new income in the future;

5) taxes on production - mandatory grants that include taxes on products produced as output, as well as other taxes on production in connection with the use of labor, machinery, equipment and other assets in production.

**Chapter 2 Theoretical aspects of determining multifactorial productivity**

6. Various performance indicators are formed. The choice of metric depends on the purpose of the performance measurement and, in many cases, the availability of data. Performance measures are categorized as either single factor productivity (linking output to a single cost measure) or multi-factor productivity (linking output to a set of inputs of different ingredients). Another difference, especially significant at the industry or firm level, is the difference in productivity indicators that relate some measure of gross output to one or more factors that use the concept of value added to detect changes in output.

7. Labor productivity is the main indicator of the economic efficiency of the production of the industry and each enterprise. The identification of reserves and ways to increase labor productivity is based on a comprehensive technical and economic analysis of the enterprise. Analysis of labor productivity allows you to determine the effectiveness of the use of labor resources and working time by the enterprise .

Labor productivity characterizes the fruitfulness of useful labor, which determines the degree of efficiency of production activities over a certain period of time.

8. The indicator of labor productivity correlates the result of activity with only one type of cost. The release is the result of a combination of interrelated influences:

changes in technology;

capital-labor ratio;

degree of use of production capacity;

quality of managerial decisions;

qualifications and diligence of employees.

Various private indicators give conflicting estimates of productivity dynamics.

9. To generalize the assessment of efficiency and the use of production factors, multifactorial methods for measuring productivity are used. The output is related to all resources used.

In the world practice of calculations, the following conditions are accepted:

the cost of raw materials, materials, services purchased from the outside is taken into account when producing products, estimated at full cost and as part of costs;

when output is calculated according to one of the value added options, only labor costs and fixed capital costs are taken into account in the cost structure.

10. An increase in labor and capital costs, productivity growth (efficiency in the use of labor and capital) are considered as factors determining the increase in output.

A multi-factor productivity indicator characterizes the growth rate of output in addition to the growth due to extensive factors (an increase in the amount of resources involved in production). This indicator represents the output index divided by the input index (in base year prices). Changes in labor and capital inputs affect output in different ways (the elasticity of output with respect to the factor of labor and capital is not the same). The weighting method is used to calculate the overall cost index. As weights, the shares of labor and fixed capital costs in total costs are taken.

11. Labor and capital multi-factor productivity indices (hereinafter - MFPI) show the dynamics of how productively the combined labor and capital inputs are used to create added value. The productivity of the "labor and capital" factor is not an accurate measure of technological progress. The MFPI is an indicator of an industry's ability to contribute to economy-wide income growth per unit of primary cost. In practice, the MFPI reflects the combined effects of untapped technological progress, economies of scale, efficiency changes, changes in capacity utilization, and measurement errors. The cost of capital measure is an aggregate of different types of assets, each weighted by the respective cost of capital to the user and based on the prices of capital goods reflecting quality change, the effects of embodied technical progress are reflected in the capital factor, and only non-embodied technical progress affects the MFPI.

**Chapter 3. Sources of information for measuring multifactorial performance**

12. To measure multi-factor productivity , long time series of GFCF indicators by asset types, price indices for the respective asset types, other taxes on production, gross profit, wages are used. The data sources are official statistics on nationwide statistical surveys . The dynamics of indicators for calculating the MFPI has been formed since 1993 on the basis of available official statistical data on nationwide statistical observations. In the absence of direct data, an indirect estimate is made using additional data sources.

The GFCF is generated by economy, and statistics on the acquisition of fixed assets by asset type are used to drill down the GFCF by asset type.

**Chapter 4 Algorithm for calculating multifactorial performance**

13. The calculation of multifactorial productivity consists of several successive stages.

1) Recalculation of GFCF from current prices to constant prices of the base year (base year - 1994) by deflation by the corresponding price indices for each category of assets.

$$I^{k,t,1994}=\frac{I^{k,t}}{P^{k,t,1994}},$$

where:

$I^{k,t,1994}$– GFCF of asset type k in period t at constant 1994 prices;

$I^{k,t}$- GFCF of asset type k at current prices in period t;

$P^{k,t,1994}$- price index of asset type k in period t (1994 = 100).

2) The calculation of the average annual growth rate $"θ"$of GFCF for each category of assets from 1994 to 2014 is made according to the following formula:

$$θ=\left(\frac{I\_{2014 }^{1994}}{I\_{1994}}\right)^{\frac{1}{21}},$$

where:

$I\_{2014 }^{1994}$– GFCF for 2014 at constant 1994 prices;

$I\_{1994}$– GFCF for 1994 at constant prices.

3) Calculation of the initial stock of capital at the end of 1993 is made with the assumption of geometric depreciation and constant annual growth.

$$W^{1993}=\frac{I^{1994}}{\left(δ+ θ\right)},$$

where:

$W^{1993}$ - initial net capital stock at the end of 1994;

$I^{1994}$ - GFCF for 1994 at constant prices ;

$δ$ - depreciation rate;

$θ$ - projected annual growth rate until 1994.

The estimated annual growth rate is obtained by calculating the average annual growth rate from 1994 to 2014 and adjusting based on the assumption that GFCF growth has accelerated or slowed since 1993.

4) Determination of the net stock of capital at constant prices since 1994 was carried out according to the following formula (assuming capital accumulation occurs from the middle of the year):

$W^{tE}= W^{tB}+ I^{t}- δ \left(\frac{I^{t}}{2}+ W^{tB}\right)$,

where:

$W^{tE}$ - the net stock of capital at constant prices;

$W^{tB}$ - the net capital stock of the previous year ;

$I^{t}$ – GFCF at constant prices;

$δ$ - depreciation rate .

5) Recalculation of the obtained net capital stocks from constant prices to current prices is made by multiplying by the corresponding price indices (1994=100).

$$W^{tC}= W^{tE}\* P^{t,1994},$$

where:

$W^{tC}$– net stock of capital at current prices;

$W^{tE}$ - net stock of capital at constant prices;

$P^{t,1994}$– price index (1994=100).

6) Calculation of user costs for each category of GFCF assets is made according to the following formula:

$$c^{k,t}= p^{k,t} \left[r^{t}- i^{k,t}+ δ^{k}\right],$$

where:

$c^{k,t}$– user costs of asset type k in period t;

$p^{k,t}$– net capital stock of asset type k in period t ( $p^{k,t}$= $W^{tC}$);

$r^{t}$is the real rate of return in period t;

$i^{k,t}$– real expected change in the price of the asset k;

$δ^{k}$- depreciation rate .

To determine the real rate of return$(r^{t})$ In international practice, two methods are used :

ex post (actual);

ex ante (assumed).

When applying the ex post approach, the rate of return is obtained by calculation, with the ex ante approach $r^{t}$it is set equal to a certain interest rate. In international practice, a profit margin of about 4% is accepted.

Real expected changes in the price of an asset are calculated by determining the average changes over the previous few years or the actual changes in the real price index for each type of asset, adjusted for the general inflation rate.

The ex ante approach is used in the current calculations, 4% is taken as the real rate of return, the expected price change is calculated as the actual change in the real price index.

7) The productive capital stock is calculated by averaging the net capital stock at constant prices of two consecutive years.

8) Calculation of the capital services index (geometric function).

$$\frac{U^{t}}{U^{t-1 }}= \prod\_{}^{}\left[\frac{K^{k,t}}{K^{k,t-1}}\right]\begin{matrix}w^{k,t}\\\end{matrix},$$

where:

|  |  |
| --- | --- |
| $$\frac{U^{t}}{U^{t-1 }}$$ | – index of capital services ; |

$K$– productive capital stock;

$w^{k,t}$– average user costs calculated using the following formula:

$$w^{k,t}= \left[\frac{c^{k,t}}{\sum\_{}^{}c^{t}}+ \frac{c^{k,t-1}}{\sum\_{}^{}c^{t-1}}\right] / 2,$$

where:

$c^{k,t}$– user costs of asset type k in period t, t-1.

9) Calculation of capital and labor costs .

To estimate capital and labor costs, weights (shares) of capital and labor are used, which are calculated using ex post or ex ante approaches. To determine the weights, the components of the Gross Domestic Product (hereinafter - GDP) are used using the income method:

GDP - calculated as Compensation ( $CoE$), Gross operating profit ( $GOS$), Gross mixed income ( $GMI$), Taxes minus production subsidies ( $TSPI$).

Gross mixed income ( $GMI$) and Taxes less subsidies on production ( $TSPI$) include labor and capital components. To distinguish between them, additional data on the number of self-employed (paid and unpaid) and average wages, detailing taxes and subsidies on products are used.

When using the ex post approach, the formula looks like this:

$$Labor share S\_{L}= \frac{CoE+GMI(L)}{CoE+GOS+GMI+TSPI},$$

$$Capital share S\_{K}= \frac{GOS+GMI\left(K\right)+TSPI(K)}{CoE+GOS+GMI+TSPI},$$

The second ex ante approach replaces $GOS$both $GMI\left(K\right)$the numerator and denominator with the amount of user costs for each type of asset.

$$Labor share S\_{L}= \frac{CoE+GMI(L)}{CoE+c^{k,t}+GMI+TSPI},$$

$$Capital share S\_{K}= \frac{c^{k,t}+TSPI(K)}{CoE+c^{k,t}+TSPI},$$

Labor cost index ( $\frac{L^{t}}{L^{t-1} }$) - calculated as the ratio of the number of hours worked in the current year to the number of hours worked in the previous year.

cost index is obtained by multiplying the labor cost index by the capital cost index (geometric function).

$$ \frac{I^{t}}{I^{t-1}}= \left[\frac{U^{t}}{U^{t-1} }\right]\frac{(s\_{K}^{t} +s\_{K}^{t-1})/2}{} \left[\frac{L^{t}}{L^{t-1} }\right]\frac{(s\_{L}^{t} +s\_{L}^{t-1})/2}{},$$

where:

$U^{t}$- flows of capital services;

$L^{t}$- labor flows.

11) The MFPI "capital-labor" index (year-on-year) is calculated by dividing the index of physical volume of GDP according to the Laspeyres formula by the resulting combined index of capital and labor costs . Obtaining the chain index MFPI "capital-labor" by sequentially multiplying the obtained indices.

$$\frac{A^{t}}{A^{t-1}}= \frac{\frac{V^{t}}{V^{t-1}}}{\frac{I^{t}}{I^{t-1}}},$$

where:

$A^{t}$– Index MFPI "capital-labor" ;

$V^{t}$– index of physical volume of GDP according to the Laspeyres formula in period t;

$I^{t}$- the combined index of capital and labor costs in period t .

14. Experimental calculations of MFPI were carried out on the basis of official statistical information. Work to improve the calculations and data used is carried out in terms of filling gaps in missing data in the amount of capital.

At the first stage, the consumption of fixed capital for certain types of assets is calculated by the method of continuous inventory in the presence of an appropriate time series. The volume of capital, in addition to fixed assets, includes inventories and non-produced assets, such as land, natural resources. Work is underway on the valuation of non-produced assets.

At the second stage, producer price indices and import receipts indices are prepared, taking into account constant quality for all types of assets, which are used when converting from current prices to constant prices.