



# ECONOMETRIC MODELING OF THE EFFECTIVENESS OF POTENTIAL GROSS FACTORS IN THE ECONOMY OF UZBEKISTAN

Djalilov Dostonbek Abdazizovich<sup>1</sup>

<sup>1</sup>Senior Teacher at National University of Uzbekistan, Tashkent, Uzbekistan

## ABSTRACT

DOI No: 10.36713/epra12730

Article DOI: <https://doi.org/10.36713/epra12730>

*In this study, the influence of factors affecting the efficiency of gross factors was quantitatively evaluated. Binary variables were used for the existence of a shift in the trend of gross factor efficiency in the national economy. The fully optimized ordinary least squares (FMOLS) method was used because the gross factor efficiency and its activating factors were non-stationary with respect to time. According to the results of the research, it was found that increasing the index of economic freedom by 1 point can increase the efficiency of gross factors by 0.8%.*

**KEY WORDS:** Solow residual, binary variables, index of economic freedom, technological development.

## INTRODUCTION

Gross factor efficiency is an indicator of labor and capital efficiency, and represents technological development in the country. technological development can be represented by the Solow residual. In this case, the Solow residual shows the gross efficiency of capital and labor.

Determining the factors affecting the efficiency of the aggregate factors will determine the actual and potential economic growth on the basis of which factors can be activated. In studies, the efficiency of gross factors is modeled on the basis of factors affecting it. In particular, the impact of investments in information technologies <sup>1</sup>, scientific research and the level of education <sup>2</sup>, the quality of the labor force was studied <sup>3</sup>. At the same time, the

<sup>1</sup> Edquist H., Henrekson M. Do R&D and ICT affect total factor productivity growth differently? //Telecommunications Policy. - 2017. - T. 41. - no. 2. - S. 106-119.

<sup>2</sup> Liu J., Bi C. Effects of higher education levels on total factor productivity growth //Sustainability. - 2019. - T. 11. - no. 6. - S. 1790.

<sup>3</sup> Cubas G., Ravikumar B., Ventura G. Talent, labor quality, and economic development //Review of Economic Dynamics. - 2016. - T. 21. - S. 160-181.

influence of institutional factors on the efficiency of economic freedom index, entrepreneurship <sup>4</sup>, income distribution <sup>5</sup>, and logistics development index on the efficiency of gross factors was studied <sup>6</sup>.

Gross factor efficiency in Uzbekistan had an increasing trend in 1997-2014. In 1997-2014, the share of capital in GDP was equaled to 0.30 and in 2015-2021 to 0.48. This led to a shift in the trend of gross factor efficiency from 2015. In addition, as a result of the high growth rate of investments in fixed capital and the fact that the economy will take some time to fully absorb new technologies, the gross factor efficiency has a tendency to decrease until 2020. In 2021, it can be seen that the value of gross factor efficiency has a tendency to grow at a lower rate than in 2020 (Figure 1).

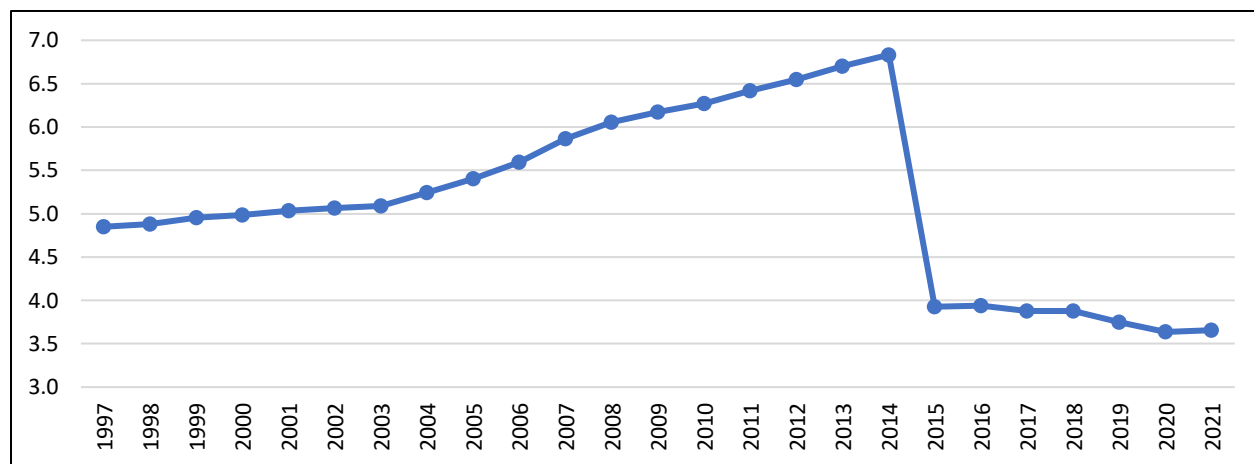


Figure 1. dynamics of gross factor efficiency<sup>7</sup>

An increase in the share of capital in GDP cannot be the reason for a decrease in the efficiency of aggregate factors. Therefore, based on foreign experience and research conducted on the example of other countries, it is assumed that the number of people employed in scientific research, the volume of foreign investments and loans, investments in information and communication, and the index of economic freedom affect the efficiency of gross factors for the economy of Uzbekistan (Figure 2 ).

Aggregate factor efficiency is classified as technological development in the neoclassical model of production. Therefore, most of the factors listed above are one of the main factors that activate production technology in the economy.

<sup>4</sup> Bjørnskov C., Foss NJ Do economic freedom and entrepreneurship impact total factor productivity?. - 2010.

<sup>5</sup> Sequeira TN, Santos M., Ferreira-Lopes A. Income inequality, TFP , and human capital //Economic Record. - 2017. - T. 93. – no. 300. - S. 89-111.

<sup>6</sup> Sobieraj J., Metelski D. Economic determinants of total factor productivity growth: The Bayesian modeling averaging approach //Entrepreneurial Business and Economics Review. - 2021. - T. 9. – no. 4. – S. 147-171.

<sup>7</sup> www.stat.uz Uzbekistan Republic president of the Statistics Agency official information .



**Figure 2. Factors Affecting Gross Factor Efficiency<sup>8</sup>**

The number of people employed in the field of scientific research affects the introduction of new technologies in the economy or the introduction of new technologies into the economy and the adoption of new technologies, resulting in an increase in the efficiency of aggregate factors.

As foreign investments and loans introduce new tools and technologies into the economy, the economy begins to adopt new technologies and, as a result, affects the volume of production. In this case, foreign investments and loans bring new production technologies, especially in countries with developing economies.

Investments in information and communication also affect aggregate factor efficiency by increasing efficiency in sectors of the economy.

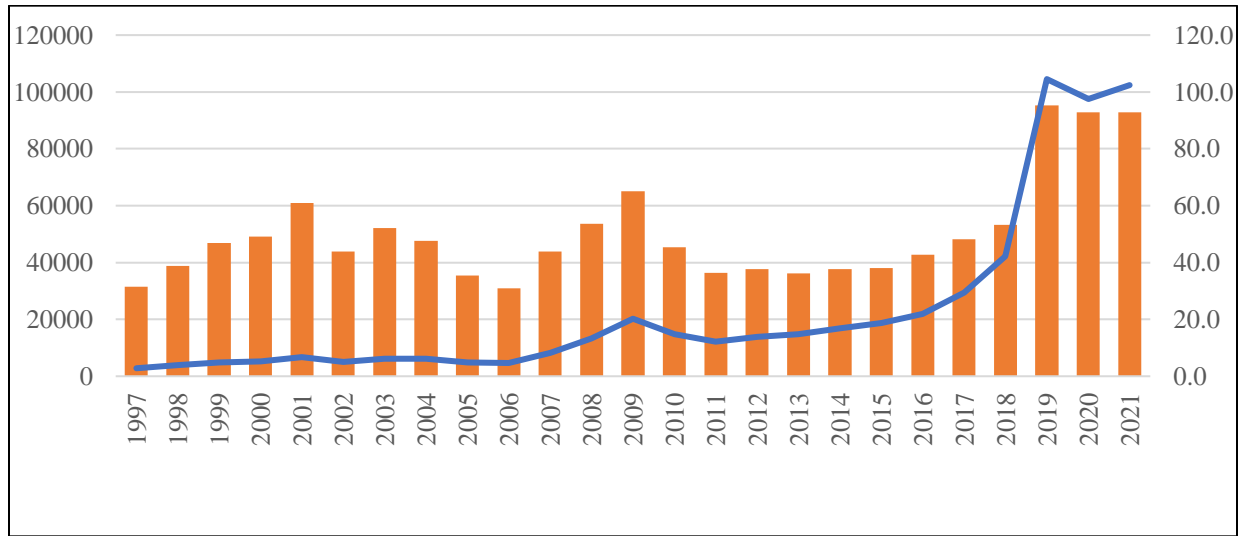
In this dissertation work, it is assumed that the above-mentioned factors can affect the efficiency of gross factors technically and technologically, and the economic freedom index is assumed to be influenced by the reforms carried out by the state. This indicator is used as an index expressing uncertainties in the economy and the openness of the economy. By assessing the impact of the index of economic freedom on overall efficiency, it is possible to determine which reforms should be carried out by the state in order to increase the efficiency of gross factors. The index of economic freedom is determined by the property rights, fiscal freedom, government spending, business freedom, labor resources, monetary freedom, trade freedom, investment freedom, state integration, judicial system and tax burden. The economic freedom index is the arithmetic mean value of the given values, and this index has been evaluated by the Heritage Foundation and The Wall Street Journal for 184 countries since 1995 .

**Analysis and results.** In this study, investments in information and communication were excluded from the composition of foreign direct investments and loans in fixed capital to determine the effect of individual gross factors on efficiency. This eliminates to a certain extent the linear relationship between independent variables in econometric modeling of gross factor efficiency.

It was observed that the dynamics of foreign investments and loans was stable in 1997-2006 and had a certain growth trend in the next three years. In 2009-2016, there was no high volatility in the dynamics of foreign investments and loans, and their average volume during this period was 16 trillion 664.0 billion. organized soum. In 2017-2019 , high growth trends were observed in the dynamics of foreign investments and loans, which amounted to 104 trillion 517.3 billion soums in 2019, which showed an increase of 4.7 times the volume of 2016. In 2021, it was found that the volume of foreign investments and loans again had growth dynamics after the COVID-19 pandemic (Figure 3).

<sup>8</sup> The author development

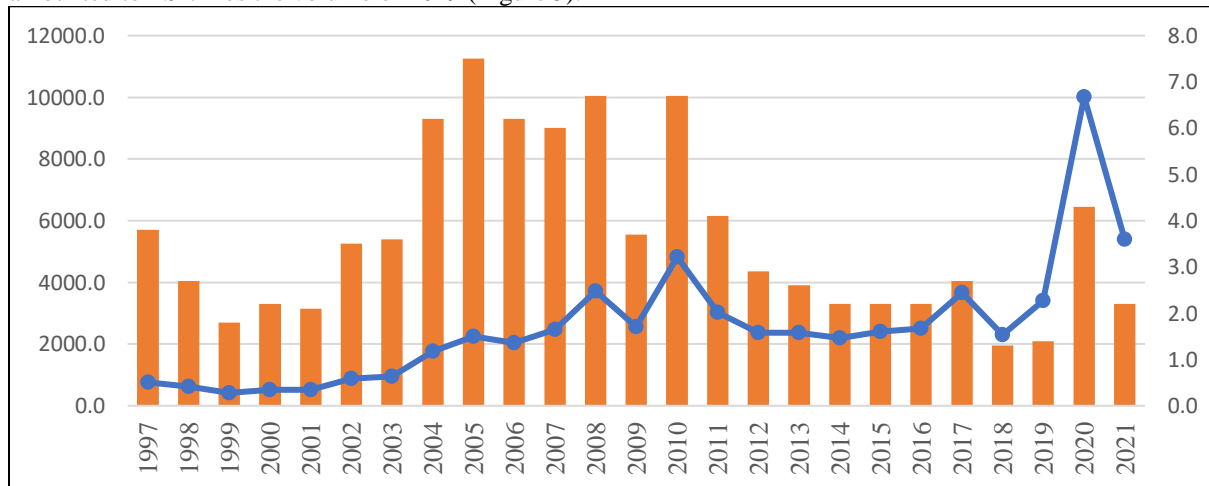
It was observed that the share of foreign investments and loans in total investments changed in the range of 13.9-29.3% in 1997-2009. It was found that in 2006, this indicator was 13.9%, and by 2009, its value reached 29.3%. In 2010, the share of foreign direct investment and loans in total investment fell to 20.5%, and in 2011-2015,



**Figure 3. The volume of foreign investments and loans allocated to fixed capital (in billion soums, at 2021 prices) and their share (in percent)<sup>9</sup>**

this indicator decreased to an average of 16.8%. In 2016, the share of foreign direct investment and loans in total investment was 2.1 percent compared to 2015. increased to 19.2%. As a result of active investment policy in the national economy in 2017-2019, it was observed that this indicator reached 42.9% in 2019 (Figure 3).

In 1997-2005, the volume of investments in information and communication had growth dynamics, and in 2005 this indicator reached 2 trillion 252.2 billion. It was found that it increased by 3 times from the value in 1997, amounting to soums. In 2006-2010, it was found that investments in information and communication had a growing trend, but in 2009, this indicator was found to decrease. In the following years, there was no significant change in the dynamics of this indicator, only during the COVID-19 pandemic, investments in information and communication showed a high growth rate. In 2020, the amount of investments in this field is 10 trillion. 12.7 billion amounted to 2.9 times the volume of 2019 (Figure 3).



**4 - picture. Capitalized investments in information and communication (billion soums, at 2021 prices) and its share (in percent)<sup>10</sup>**

<sup>9</sup> www.stat.uz Uzbekistan Republic president of the Statistics Agency official based on the data of the author account - book

The share of investments in information and communication in total investments reached its highest value in 2005, and the share of investments in this sector was 7.5%. It can be seen that this indicator has decreased in the following periods. Even in 2020, this indicator was found to be 4.3% ( Figure 4).

It was observed that the number of researchers engaged in scientific research and experimental design work did not have a tendency to change in a specific direction in 2000-2021. In 2000, it was 25,100, and the following year, the number of researchers decreased by 400. A significant decrease in the number of researchers was observed in 2007, reaching 22,800 people. In the next two years, it was found that the number of researchers increased significantly. In 2010-2018, there was no significant change in the dynamics of this indicator. Although the number of researchers decreased again in 2019-2020, the decrease in 2021 significantly increased the number of researchers to 30,300 people. It can be seen that the share of researchers in the economically employed population is similar to the dynamics of the number of researchers. In 2000, the share of researchers in the economically employed population was 0.28%, and in 2021 it was 0.22%.

We can see that both indicators have almost the same dynamics according to the researchers employed in scientific research and their share in the economically employed population.

It is important to create a favorable business environment and investment attractiveness as a result of reforms in our country. We can see the results of economic reforms in our country through the index of economic freedom. The economic freedom index for Uzbekistan has been calculated since 1998. In 1998, Uzbekistan scored 31.5 points on the economic freedom index, which was 25.7 points lower than the average economic index for the countries of the world. In 2005-2007, the score given for Uzbekistan in the economic freedom index was significantly increased, and in 2007 it was equal to 52.3, and the difference in the average score for the countries of the world was 8.6 points. From 2017, as a result of economic liberalization and economic reforms, we can see that the economic freedom index is 52.3 points, which is 6.3 points higher than the value of 2016. In recent years, it can be observed that the index of economic freedom of our country is increasing. In 2022, the economic freedom index for Uzbekistan was 55.7, which is 4.3 points lower than the average for the countries of the world. If we pay attention to the dynamics of the assessment of economic freedom in Uzbekistan, it was found that the difference between the 2022 score and the world average score in 1997 has decreased by 6 times, and by 3.5 times compared to the difference in 2016 (Figure 5).

In 2022, Uzbekistan was ranked 117th out of 177 countries in the economic freedom index. According to the economic freedom index, Uzbekistan ranked higher than Saudi Arabia (118), India (131), Belarus (135), Tajikistan (147), and Turkmenistan (165)<sup>11</sup>.

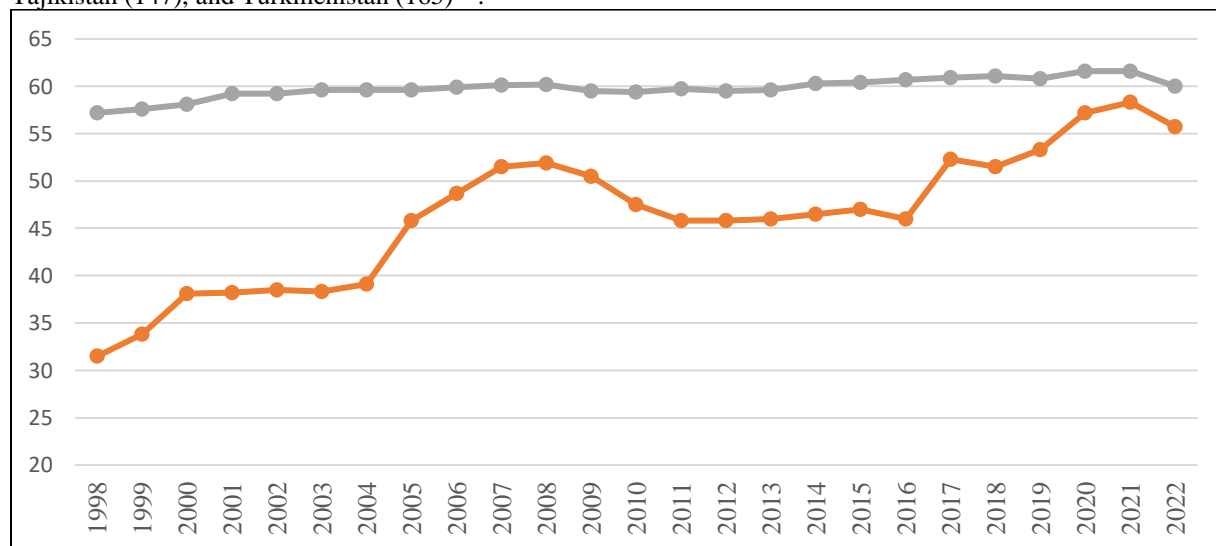


Figure 5. Dynamics of the index of economic freedom<sup>12</sup>

<sup>10</sup> www . stat . en Uzbekistan Republic president of the Statistics Agency official based on the data of the author account - book

<sup>11</sup> www . heritage . org " Meros " ( Heritage Foundation ) of the fund official site

<sup>12</sup> www . heritage . org " Heritage " ( Heritage Foundation ) of the fund official site

According to the result of the correlation matrix between the efficiency of the gross factors and the factors affecting it, it was found that the efficiency of the gross factors has a weak relationship with the factors affecting it. We can see that the linear relationship between the independent variables is higher (Table 1).

**Table 1**  
**Correlation matrix**

Variables	(1)	(2)	(3)	(4)	(5)
(1) TFP	1.000				
(2) employment	0.231	1.000			
(3) IEF	0.036	0.205	1.000		
(4) ICT	0.146	0.316	0.862	1.000	
(5) FDI	-0.239	0.413	0.752	0.684	1.000

The fact that gross factor efficiency has a weak correlation with the factors affecting it may cause a shift in the trend of gross factor efficiency in 2015. Therefore, it is necessary to use a fictitious variable in econometric modeling of general efficiency based on the factors affecting it, taking into account the trend of gross factor efficiency. In addition, since there is a shift in the gross factor efficiency trend from 2015, the correlation coefficients cannot provide information about whether there is a real relationship between the independent variables affecting gross factor efficiency and gross factor efficiency.

Since the effectiveness of the gross factors is estimated based on the time series data of the factors affecting it, initially, the variables were checked for stationary with respect to time by Dickey-Fuller's single root test. The results of the one-root test of the variables revealed that foreign investment and investment in credit, information and communication are stationary at the 5% level of significance. The remaining variables were found to be non-stationary with respect to time even at the 10% significance level. The hypothesis of non-stationarity of the first difference of variables was rejected at the 1% significance level (table 2).

Dickey - Fuller's one-root stationarity test showed that the results of ordinary least squares estimation of the influence of factors affecting gross

**Table 2**  
**Results of one-root test of variables stationarity with respect to time**

variables	$H_0$ unit root:			
	Test statistics	1% Critical value	5% Critical value	10% Critical value
$tfp_t$	-0.286	-2.665	-1.956	-1.609
$ief_t$	2.057	-2.669	-1.956	-1.608
$employment_t$	0.315	-2.680	-1.958	-1.608
$FDI_t$	2.537	-2.669	-1.956	-1.608
$ICT_t$	0.825	-2.665	-1.956	-1.609
$\Delta tfp_t$	-4.650	-2.669	-1.956	-1.608
$\Delta ief_t$	-3.335	-2.674	-1.957	-1.608
$\Delta employment_t$	-4.274	-2.692	-1.960	-1.607
$\Delta FDI_t$	-3.343	-2.674	-1.957	-1.608
$\Delta ICT_t$	-5.729	-2.669	-1.956	-1.608

factor efficiency are not reliable. Therefore, it is necessary to estimate the effect of the factors affecting the overall efficiency using the fully refined ordinary least squares method.

2 models are constructed, in model (1) fictitious variable is not used. According to the results of model (1), it can be seen that foreign investments and loans do not have the expected value. In addition, despite other independent variables having the expected value, they were found to be statistically insignificant at the 10% level of

significance. We can see that the estimated coefficients according to the results of model (2) give the expected result. This means that all variables affecting the gross factor efficiency should have a correct relationship with the gross factor efficiency, and the estimated coefficients of the model also give such a result. In addition, according to the effect of the fictitious variable in model (2), the shift in the trend of gross factor efficiency from 2015 was found to be statistically significant. It was found that the influence of those employed in the field of scientific research and the economic freedom index on the efficiency of gross factors is statistically significant even at the 5% level of insignificance. Foreign investment and credit, and investment in information and communication are shown to be statistically insignificant at the 10% significance level. So, increasing the number of people employed in the field of scientific research by one thousand people leads to an average increase in gross factor efficiency by 2.4%, and an increase in the index of economic freedom by 1 grade increases gross factor efficiency by 0.8% on average ( Table 3).

**Table 3**  
**Results of the regression model**

VARIABLES	(1) model	t-statistic	(2) model	t-statistic
dummy	-	-	-0.587 ***	-19,867
employment	0.012	1.401	0.024 ***	7.368
IEF	0.004	0.439	0.008 **	2.368
FDI	-0.112	-2.831	0.027	1.385
ICT	0.089	1.319	0.017	0.628
C	1.339	4.587	0.415 **	2.873
Observation	25	-	25	-
R-squared	0.904	-	0.96	-
F-statistics	28.165	-	-	-

Standard errors are given in parentheses

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1

According to the results of the above-mentioned model (2), the influence of independent variables on the efficiency of the gross factors was determined. (2) factors from the model whose effects are statistically insignificant are not excluded from the model. The main reason for this is the shift in the index of economic freedom and the number of researchers on the efficiency of aggregate factors.

## SUMMARY

According to the effect of gross factor efficiency on potential GDP, as a result of institutional changes in the economy, an increase in the index of economic freedom by 1 point leads to an increase in economic real and potential GDP by 0.8%. This means that the continuation of reforms in the economy by the state can ensure high economic growth rates.

The estimated coefficient that increases the number of researchers by 1000 increases the effect on gross factor efficiency by 2.4% may have shifted. For this reason, in further studies, the effect of the number of researchers on the efficiency of gross factors will be investigated based on panel data.

The above-mentioned model (2) can be used to determine the potential level of gross factor efficiency. In this case, the potential level of independent variables in the model (2) is determined based on time series methods. In this case, it was estimated that the fluctuation of independent variables from the potential level will cause the efficiency of gross factors to be interrupted to the potential level.

## REFERENCES

1. Edquist H., Henrekson M. Do R&D and ICT affect total factor productivity growth differently? //Telecommunications Policy. - 2017. - T. 41. - no. 2. - S. 106-119.
2. Liu J., Bi C. Effects of higher education levels on total factor productivity growth //Sustainability. - 2019. - T. 11. - no. 6. - S. 1790.
3. Cubas G., Ravikumar B., Ventura G. Talent, labor quality, and economic development //Review of Economic Dynamics. - 2016. - T. 21. - S. 160-181.
4. Bjørnskov C., Foss NJ Do economic freedom and entrepreneurship impact total factor productivity?. - 2010.

5. *Sequeira TN, Santos M., Ferreira-Lopes A. Income inequality, TFP , and human capital //Economic Record. - 2017. - T. 93. – no. 300. - S. 89-111.*
6. *Sobieraj J., Metelski D. Economic determinants of total factor productivity growth: The Bayesian modeling averaging approach //Entrepreneurial Business and Economics Review. - 2021. - T. 9. – no. 4. – S. 147-171.*
7. *www . stat . en Statistics Agency under the President of the Republic of Uzbekistan*