The Scientific Journal of Cahul State University "Bogdan Petriceicu Hasdeu"
Economic and Engineering Studies
№. 1 (5), 2019
http://jees.usch.md/ e-mail: journal.ees@usch.md

ECONOMIC AND MATHEMATICAL MODELLING OF THE LEVEL OF FINANCIAL SUPPORT OF INNOVATIVE ACTIVITY IN UKRAINE

Soroka Larisa,
PhD in Economics, Associate Professor,
Izmail State University of Humanities, Ukraine
e-mail: soroka.lara55555@gmail.com

Ivanenko Iryna,
lecturer,
Izmail State University of Humanities, Ukraine
e-mail: iryna.ivanenko.123@gmail.com

Abstract. *The article presents the results of the correlation-regression analysis of the obtained statistical data for constructing an economic and mathematical model, establishing the closeness and quality of the correlation relations between the selected factor values that affect the level of financial support of innovation activity in Ukraine. The influence of each of the investigated component figures on the resultant criterion and on each other by checking the obtained correlation-regression model for the presence of the phenomenon of multicollinearity is presented.*

Key words*: economic and mathematical modelling, correlation-regression analysis, multicollinearity, sources of financial resources, investments, innovative activity of enterprises.*

JEL Classification: C50, C60, G32, O39
UDC: 330.45:330.341.1(477)

Introduction. The current stage of the development of the market economy in Ukraine requires the use of scientifically grounded management decisions that increase the efficiency and competitiveness of industrial enterprises. It is possible to estimate the influence of various factors on the final result using economic and statistical methods. Their application makes it possible to conduct an analysis of the studied statistical indicators and develop a mathematical model on the basis of the data.

In the market economy conditions, a number of external and internal factors influence the performance of enterprise innovation activities. Particularly significant influence is made by financial factors, namely, the factors of adequacy of financing innovative activity; it becomes possible to evaluate the results of them using economic and statistical methods. The application of these methods consists in carrying out a deep analysis of the studied statistical indicators as well as on the basis of the results of constructing a mathematical model.

A large number of factor values necessitate the use of the methods of multiple correlation-regression analysis, which allow to distinguish the most statistically significant factors and evaluate the connection between them and the resultant criterion, which as a result is presented in the form of a certain numerical expression.

Thus, only one indicator of the effectiveness of innovation activity is already a significant statistical aggregate, which, if not to use the appropriate economic and mathematical methods and software complexes will lead to the probability of obtaining not only inaccurate results, but also an inadequate mathematical model.

Thus, there is an objective need for conducting correlation-regression analysis as one of the most effective economic and statistical methods for revealing the influence of the most significant factors on the resultant criterion and constructing an adequate mathematical model.

Analysis of recent research and publications. Nowadays, in the works of many domestic and foreign scientists, the issue of the influence of financial factors on the performance of innovation activity of enterprises is investigated. The research interest of such Ukrainian scientists as A.S. Pyatigina, T.V. Gryn'ko, O.A. Gavrylova, P.V. Gudzhya, R.P. Naumenko is in carrying out research in the context of analysis of the main indicators of the efficiency of innovation activity, the interest of O.I. Marchenko is in the context of substantiation of key financial factors influencing innovation

activity, of V.F. Kolisnichenko – in the context of research of the sufficient level of financial support of innovation activity in Ukraine.

It should be noted that the overwhelming majority of scientific achievements on this issue are connected with the exclusive consideration of the state of innovation activity in Ukraine and the factors influencing it. However, in the works of scientists, certain questions devoted to a more in-depth analysis and defining of the level of adequacy of financing innovation activities in Ukraine remain controversial and are not adequately investigated.

Thus, there is an objective precondition for detailing the issues of optimal financial support of innovation activity in Ukraine. Given the long-term perspective, identifying sources and instruments for funding innovation activities in Ukraine and assessing their impact on the effectiveness of innovation activity is of paramount importance.

The objective of the article: to analyze and summarize the influence of sources and tools of financing innovative activity as selected component figures on the scope of implemented innovation activity as one of the key indicators of the effectiveness of innovation activities in Ukraine.

Research results. At present, an effective method of study of laws and regularities of economic development is economic and mathematical modelling. Therefore, we consider it appropriate to use this methodology to model the level of financial support of innovation activity in Ukraine.

A large number of operative factors necessitate the use of multiple correlation-regression analysis for the quantitative assessment of the relations between statistical characteristics that characterize individual socio-economic processes. During the analysis, it is necessary to establish the theoretical form of connection between factor and performance characteristics (regression analysis) and determine the closeness of this connection (correlation analysis), i.e. to quantitatively measure and evaluate the mechanism of interaction of factor characteristics. Parameters of correlation analysis are used for purposeful adjustment of levels of resultant criteria.

The task of correlation-regression analysis is the construction and analysis of the economic and mathematical model of the regression equation (correlation communication equation), which reflects the dependence of the resultant criterion on several factor characteristics and gives an estimate of the degree of communication density [1, p. 54].

The results of innovation activity in the market economy conditions are shaped by the influence of many factors, the impact of which can be expressed through economic and statistical methods.

Meanwhile, the current state of information security creates the preconditions for the widespread use of multi-factor models in order to establish the relations between the resultant criterion and the main factors.

In order to study the qualitative and quantitative assessment of internal and external relations between the resultant criterion and selected factors, it is appropriate to apply the correlation-regression analysis, the main task of which is to analyze the available statistical data on the investigated features and subsequently to determine the density of the relations with the help of calculated coefficients of correlation.

At the moment, we observe the insufficient financial support of innovation activity of domestic enterprises. Accordingly, there is a need to find additional financial resources, which today, in an unstable economic situation in the country, requires particularly clear calculations that would allow us to assess adequately the financial capabilities of enterprises that carry out innovation activities.

Consider the sources and tools of financial revenues to provide innovation activities of enterprises in Figure 1.

Innovative activities require the diversion of financial resources in large volumes and with a fairly long payback period. This, in turn, leads to a decrease in the indicators of liquidity and solvency of enterprises, and under critical conditions - even to bankruptcy. In this regard, when creating the optimal portfolio of sources of funding for innovation, there appears an objective precondition for in-depth analysis and implementation of the simulation of the level of financial security of innovation activity in Ukraine.

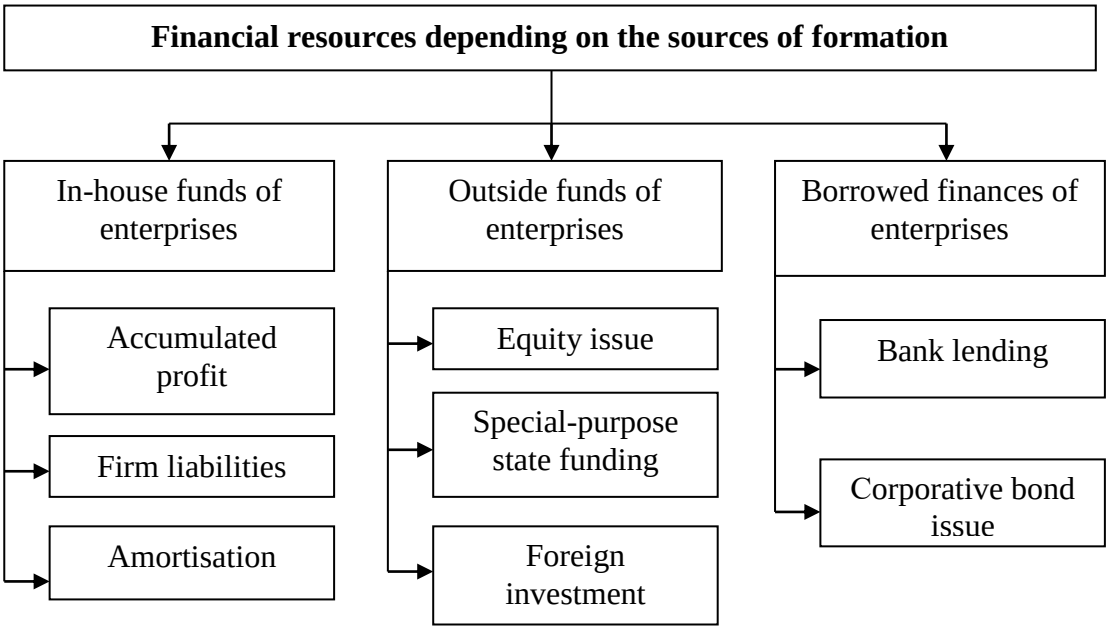

Figure 1. Sources of financing of innovation activity of domestic enterprises
Source: in-house development of the authors.

One of the main indicators of the effectiveness of innovation activity in Ukraine is the scope of implemented innovation activity.

In order to take into account all available sources and tools for funding innovation activities that affect the scope of implemented innovation, we will conduct a correlation analysis of a number of financial indicators to determine the closeness of the relations between the resultant criterion and factor figures and constructing an economic and mathematical model.

The analysis of the influence of these factors on the scope of realized innovation activity allows us to assess the situation that we have as a result of innovation activity of enterprises during 2005-2017.

In order to avoid lengthy calculations and avoid mechanical errors, we will use the Data Analysis package in the Microsoft Office Excel program that provides quick, cost-effective mathematical calculations, and allows developing multi-factor linear as well as nonlinear models.

When conducting a correlation-regression analysis the volume of realized innovation products was chosen as the resultant indicator Y, while the factor values were determined as following:

X1 – amount of undistributed profit, million UAH;
X2 – volume of stable liabilities, million UAH;
X3 – amount of depreciation deductions, million UAH;
X4 – amount of funds received from the capital stock issues, million UAH;
X5 – amount of funds received from targeted state financing, million UAH;
X6 – volume of foreign investments, million UAH;
X7 – volume of bank lending, million UAH;
X8 – amount of funds received from the issue of corporate securities, million UAH.

In Table 1 we present the initial data for carrying out correlation-regression analysis and revealing the influence of volumes of financial revenues from different sources on the volume of realized innovative products.

Table 1

Initial data for carrying out correlation-regression analysis

Year	Y	X1	X2	X3	X4	X5	X6	X7	X8
2005	1457,80	167,92	1335,84	0,92	0,22	2,87	1859,28	132,96	8,39
2006	1243,85	198,48	1586,76	6,70	0,31	0,41	2630,57	161,88	83,32
2007	1512,68	256,99	2013,48	5,35	0,31	0,82	1535,48	283,32	512,95
2008	1545,85	257,81	2883,72	11,16	0,37	0,41	2162,60	525,72	509,03
2009	2254,08	420,18	4123,80	7,61	0,19	1,99	3400,34	980,64	492,79
2010	2991,05	605,45	6117,12	3,37	1,79	4,09	2977,80	2686,08	1529,80
2011	3707,12	625,37	7873,68	13,73	1,68	4,24	5224,80	5997,00	2648,50
2012	4822,56	956,36	10356,96	17,38	0,88	2,17	6000,00	5184,60	5337,66
2013	5499,62	871,68	12708,84	40,43	1,90	1,60	5536,80	10143,00	3761,56
2014	3771,88	620,33	9897,24	15,24	0,89	1,66	12128,40	10614,72	1212,89
2015	4043,71	573,02	12258,36	10,44	0,68	2,02	4870,80	10230,60	1139,27
2016	5086,40	910,26	16218,60	17,90	1,48	1,09	6979,20	10956,36	4309,73
2017	4338,92	729,41	17530,81	26,92	2,76	1,24	5625,82	9796,56	5847,14
Total:	42275,53	7193,26	104905,21	177,14	13,45	24,59	60931,90	67693,44	27393,01

Source: compiled by the authors on the basis of [2, 3, 4].

We will analyze the dynamics of changes in volumes of innovative products sold by Ukrainian enterprises in Figure 2.

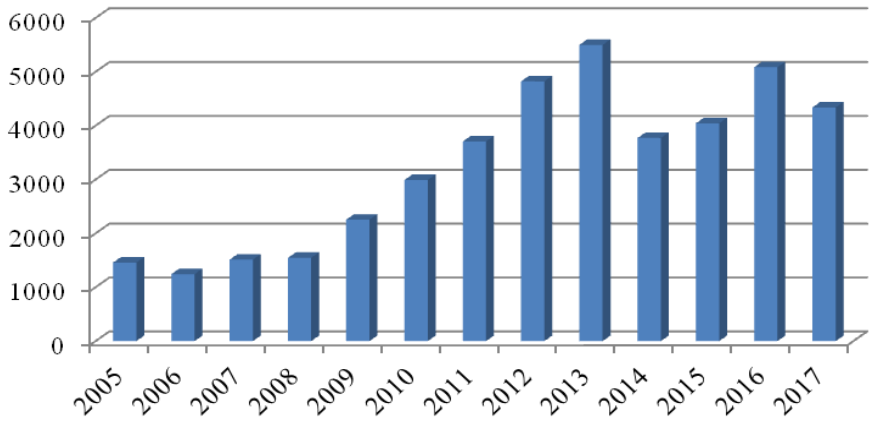

Fig. 2 Analysis of changes in volumes of sales of innovative products by domestic enterprises for 2005-2017, mln UAH.

Source: compiled by the authors on the basis of Table 1.

As we can see, in 2012, 2013 and 2016 there was a significant revival of innovation activity in Ukraine. While from 2005 to 2009 we have record-low indicators of innovation activity in the state. In general, we note the positive dynamics, which manifests itself in increasing the volume of sales of innovative products by domestic enterprises.

Using the Microsoft Office Excel toolkit and the built-in «Correlation» and «Data Analysis» functions allows us to quickly construct a correlation matrix to identify relations that exist between the resulting index (Y) and the factors that affect it (X), and actually between the factors themselves. The results of program calculations are presented in Table 2.

The need to construct a correlation matrix is due to the fact that it is an effective tool for identifying the factors which have the most significant impact on the resultant indicator. However, before doing this, we must identify the factors united by a multicollinearity phenomenon.

Table 2. Results of the correlation matrix construction

	Y	X1	X2	X3	X4	X5	X6	X7	X8
Y	1								
X1	0,969	1							
X2	0,912	0,861	1						
X3	0,779	0,706	0,728	1					
X4	0,696	0,686	0,763	0,659	1				
X5	0,161	0,193	-0,015	-0,205	0,277	1			
X6	0,661	0,630	0,638	0,464	0,356	0,017	1		
X7	0,889	0,788	0,927	0,701	0,640	0,014	0,793	1	
X8	0,833	0,872	0,838	0,726	0,773	0,039	0,426	0,644	1

Source: compiled by the authors on the basis of Table 1.

That is, from the correlation matrix, we exclude the factors whose magnitude of the absolute correlation coefficients is greater than 0,7. This is due to the fact that between such factors there is a strong correrelation and their subsequent use as part of the model will lead to getting uncertain inference [5, p. 315].

Consequently, we must exclude the following factors from the model: X2, X3, X7 and X8. Let us present an updated source for conducting a correlation-regression analysis in order to identify the impact of financial resources on the innovation activity of domestic enterprises in Table 3.

Table 3. Updated initial data for correlation-regression analysis

Year	Y	X1	X4	X5	X6
2005	1457,79	167,91	0,21	2,86	1859,28
2006	1243,848	198,48	0,32	0,40	2630,56
2007	1512,68	256,99	0,31	0,81	1535,48
2008	1545,85	257,80	0,37	0,40	2162,60
2009	2254,08	420,18	0,19	1,99	3400,34
2010	2991,04	605,44	1,78	4,09	2977,80
2011	3707,12	625,36	1,68	4,23	5224,80
2012	4822,56	956,36	0,87	2,17	6270,00
2013	5499,62	871,68	1,89	1,59	5536,80
2014	3771,87	620,32	0,88	1,65	12128,40
2015	4043,71	573,02	0,68	2,01	4870,80
2016	5086,40	910,26	1,476	1,09	6979,20
2017	4338,92	729,40	2,76	1,23	5625,81
Total:	42275,53	7193,25	13,45	24,58	60931,89

Source: compiled by the authors on the basis of [2, 3, 4].

Now we will construct a correlation matrix for the updated initial data, the results are given in Table 4.

Table 4. Results of the correlation matrix construction

	Y	X1	X4	X5	X6
Y	1				
X1	0,969	1			
X4	0,696	0,686	1		
X5	0,161	0,193	0,277	1	
X6	0,661	0,630	0,356	0,017	1

Source: compiled by the authors on the basis of Table 3.

As we can see from Table 4, in this correlation matrix there is no strong correrelation between the factors of the model. Now it is appropriate to use the Microsoft Office Excel toolkit and the «Data Analysis" and "Regression» functions to conduct a correlation-regression analysis. In the proposed model parameters, we choose the reliability level at 95%, that is, the probability of error in model construction is 5% (see Table 5).

Table 5. Results of calculations of regression statistics

Indicators of regression statistics	Indicators Value
Multiple R	0,973197703
R-square	0,94711377
Normalized R-square	0,920670655
Standard error	425,7636181
Number of observations	13

Source: compiled by the authors on the basis of Table 3.

Data from Table 5 indicate that we have a tight correlation between the performance indicator and the factors influencing it. This confirms the value of the multiplier R, which is at 0,973. The value of the R-square indicator at 0,947 indicates that the volume of production of innovative products at 94,70% depends on the sources of financing innovative activity of domestic enterprises and 5,30% – depends on the influence of other factors. The higher is the determination coefficient, the better is the model.

This fact is also confirmed in practice, since the development, testing and implementation of innovations at enterprises require a significant amount of financial resources.

For the analysis of the general quality of the linear multiple-factor regression equation, a multiple determination coefficient is used which is called the square of the coefficient of multiple correlation R and determines the share of the variation of the resultant criterion due to the change of the factor characteristics included in the multi-factor regression model.

The value of the R-square, which is called the degree of certainty, characterizes the quality of the resulting regression line. This quality is expressed by the degree of correspondence between the initial data and the regression model (estimated data). The degree of certainty is always within the interval [0; 1].

If the R-square is close to one, this means that the constructed model explains almost all the variability of the corresponding variables. Vice versa, the value of the R-square, close to zero, indicates the low quality of the constructed regression model.

Multiple R – Multiple Correlation R – indicates the degree of dependence of independent variables (X) and the dependent variable (Y). Multiple R is square root of the determination factor, this value is in the range from zero to one [6 s. 145].

Because in most cases the regression equation has to be built on the basis of sample data, there is a need to prove the adequacy of the constructed equation with the data of the general population. For this purpose, the test of the statistical significance of the determination coefficient based on Fisher LSD is carried out.

For values it is assumed that the variation of the resultant sign Y is mainly dependent on the influence of the factors included in the regression model of factors X. We summarize the results of the dispersion analysis and analyze the significance of the indicators that characterize the reliability of the obtained regression model in Table 6.

Table 6. Analysis of indicators of the reliability of the regression model

Index	df	SS	MS	F	F Value
Regression	4	25970878	6492719,4	35,817027	3,746E-05
Balance	8	1450197,3	181274,66	-	-
Total	12	27421075	-	-	-

Source: compiled by the authors on the basis of Table 3.

From the table above, we see that the indicator df in the line «Regression», that is, the number of degrees of freedom, is equal to the number of given factors of the regression model, in our case - 4 factors. The indicator df in the line «Balance» calculates the number of observations minus the number of factors plus one, in our case, is 13- (4 + 1) = 8. The line «Total» shows the sum of the indicators «df regression» and «df balance» and equals 12.

The SS column shows the sum of the squares of deviations. The MS column shows the calculated index of dispersion. Column F shows the calculated Fisher LSD. The «F Value» column shows the level of significance, which corresponds to the calculated value of Fisher LSD. As it can be seen from Table 6, we have the high values of the coefficients of multiple regression and determination, this dependence is sufficiently regular. The index of dispersion, the F value and the F-statistic score indicate a sufficient level of reliability of the evaluation results.

The critical value of t CRIT for the established level of significance is £ = 0.05, it is determined using the function TINV of the MS Excel program. The result of the calculation of the critical value is t CRIT = 2,228. Since the condition t K> t CRIT is executed only for the coefficient of regression of factor X6 (additional issue of shares), which, accordingly, for this model is statistically significant.

We analyze the obtained values of the correlation coefficients, the results are presented in Table 7.

Table 7. Analysis of correlation coefficients

Indices	Coefficients	Standard error	t-statistics	P-value	Lower 95%	Top 95%
Y-index	309,908	322,613	0,961	0,365	-434,038	1053,854
Variable X1	4,763	0,750	6,353	0,000	3,034	6,491
Variable X4	148,525	213,445	0,696	0,506	-343,681	640,730
Variable X5	36,313	104,636	0,147	0,738	-277,604	204,978
Variable X6	0,047	0,056	0,839	0,426	-0,083	0,177

Source: compiled by the authors on the basis of Table 3.

The Y-index shows what the resulting index (Y) will be if all variables in this model are equal to 0. In our case, the volume of realized innovation products will be 309.908 million UAH, however, we should take into account the influence of factors not included in the regression model (5,30%).

Critical value of Student's t-test by the established level of significance is 0,05, determined using the function TINV of the MS Excel Program. The result of the calculation of the critical value is equal to Student's t-test = 0,334. This means that the factors that are more than 0,334 are statistically significant. These factors are: X1, X4 and X6. The value of the factor X5 is at the level of 0.147, which is less than the estimated value of Student's t-test, and therefore this factor is statistically insignificant. The Top 95% and Lower 95% columns show the upper and lower confidence intervals for the regression model coefficients.

By the results of calculations in Table 7, we can construct a 4-factor economic and mathematical model that will become the goal of conducting correlation-regression analysis:

$$Y = 309{,}908 + 4{,}763 \times X1 + 148{,}525 \times X4 + 36{,}313 \times X5 + 0{,}047 \times X6;$$

Thus, the results of the correlation-regression analysis can be used to substantiate managerial decisions on forecasting and planning in the short-term future period.

From the obtained equation we can draw the conclusion that the factors that have the most significant impact on the resultant indicator Y, that is, the determinants, are:

- X4 – with an increase in the issue of shares at 1 million UAH the volume of innovative products will rise by 148,525 million UAH;
- X5 – with an increase in the volume of foreign investment by 1 million UAH the volume of realized innovative products will rise by 36,313 million UAH.

Less influential on the results of correlation-regression analysis were the following factors:

- X1 – with the growth of profitability of the company by 1 million UAH, we will have an increase in the volume of realized innovative products by 4,763 million UAH;
- X6 – with an increase in the volume of state financing by 1 million UAH, we will observe the growth of the volume of realized innovative products by 0,047 million UAH.

We will analyze the dynamic pattern of the changes of the revealed determinants for 2005-2017. The results of the diagnostics of changes in the profitability of domestic enterprises will be reflected in Figure 3.

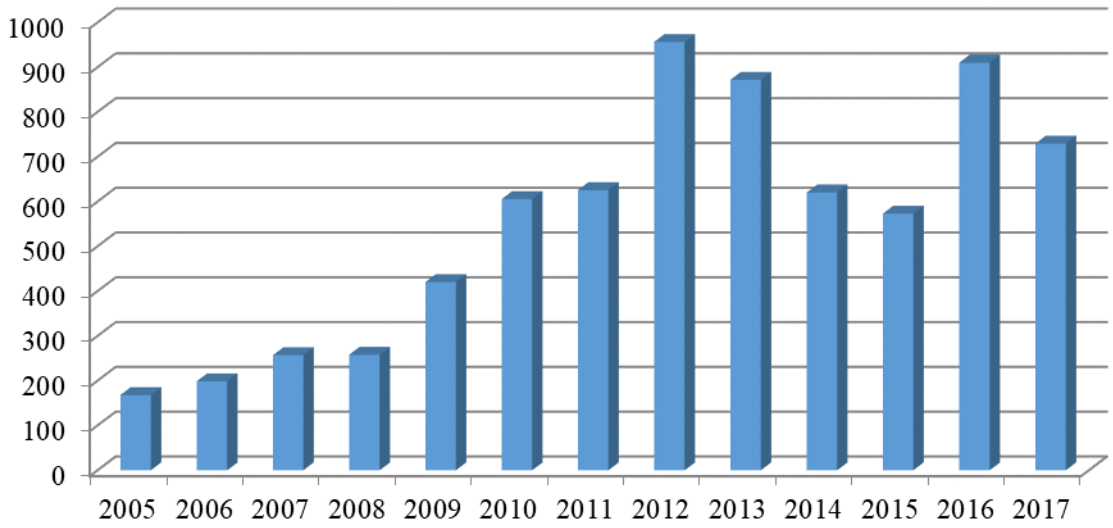

Fig. 3 Diagnostics of changes in the profitability of Ukrainian enterprises for 2005-2017, mln UAH.

Source: compiled by the authors on the basis of Table 1.

The data presented in Figure 3 show that the largest volumes of profitability were observed in 2012 (at the level of 956,36 million UAH), 2013 (at the level of 871,68 million UAH), 2016 (at the level of 910,26 million UAH) and 2017 (at the level of 729,40 million UAH). However, Ukrainian enterprises had the smallest amount of profit in the period from 2005 to 2008. We observe the growth of profitability, but not a stable one. This is confirmed by the fact that after high levels of profitability in 2012 and 2013 there was a significant decrease in profitability levels in 2014 and 2015.

We will analyze the stability of financial revenues from additional issue of shares during 2005-2017, the results are shown in Figure 4.

The data show that from 2005 to 2009 the volume of cash proceeds from emission activities was insignificant: we had 0.216 million UAH in 2005, 0.312 million UAH in 2006, and 0.312 million UAH in 2007 , 0,372 million UAH in 2008 , 0,192 million UAH in 2009.

We have seen a strong recovery since 2010, the proceeds from the issue of shares amount to 1,788 million UAH. We see high levels of financial revenues from the issue of shares during 2010-2017, but there are sharp fluctuations in 2012 and 2015. Domestic enterprises had the largest amount of financial proceeds from the issue of securities in 2017 at the level of 2.76 million UAH.

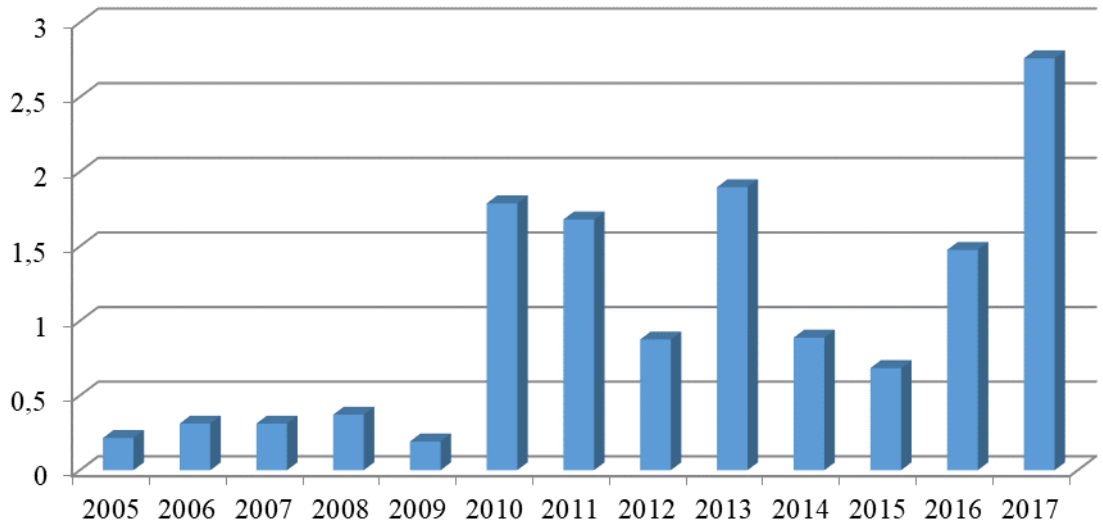

Fig. 4. Diagnostics of changes in the volume of financial revenues from the issue of shares of enterprises for 2005-2017, million UAH.

Source: compiled by the authors on the basis of Table 1.

It should be noted that only enterprises registered in the form of public or private joint-stock companies may have financial income from the issue of shares. There are 33.48% such enetrprises of the total number of operating enterprises in Ukraine in 2017.

According to the results of work in 2017, representatives of processing industry, trade, financial sector and real estate sector, information and telecommunication sector are investment attractive in Ukraine. The largest amount of foreign investment in 2017 came from such countries as Cyprus, the Netherlands, the United Kingdom, Germany and Switzerland [7].

We will analyze the changes in financial revenues from foreign investors, the results of the study are presented in Figure 5.

As it can be seen from Figure 5, the volume of foreign investment is not stable. In 2005, we have a significant amount of financial revenues from foreign investors at the level of 2,868 million UAH, while in 2006 this figure is down to 0,408 million UAH. Significant revival took place in 2009, the volume of foreign investment increased from 0.408 million UAH up to 1,992 million UAH. In 2010 and 2012, we observe high rates of foreign investment at the level of 4,092 million UAH and 4,236 million UAH. Since 2012, the volume of foreign investment is quite stable: in 2012 the figure is

2,172 million UAH, in 2013 – 1,596 million UAH, in 2014 – 1,656 million UAH, in 2015 – 2,016 million UAH, in 2016 – 1,092 million UAH, in 2017 – 1,236 million UAH.

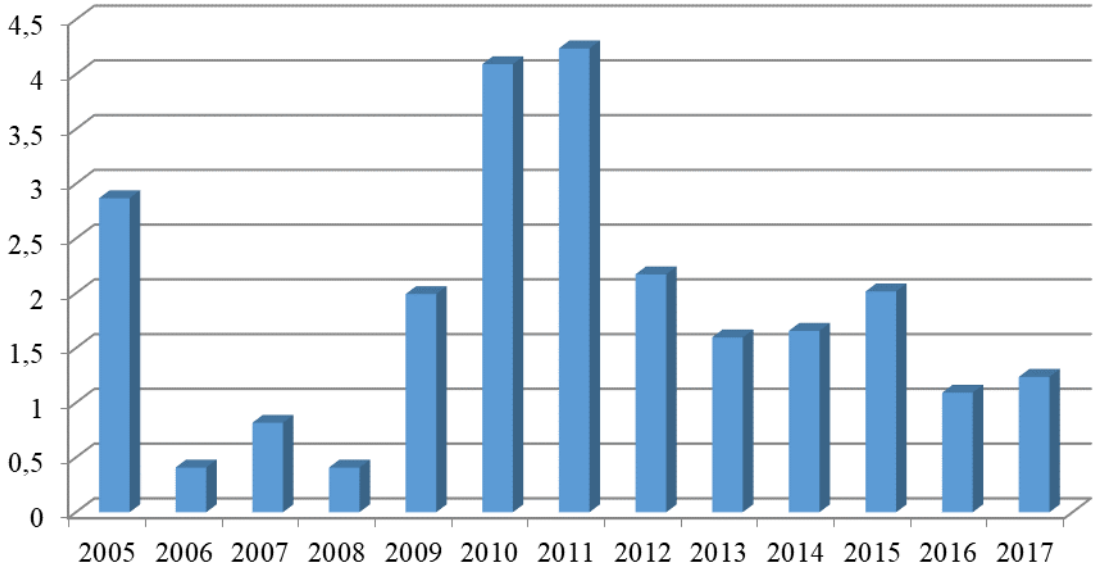

Fig. 5. Diagnostics of changes in volume of financial revenues from foreign investors for 2005-2017, million UAH.

Source: compiled by the authors on the basis of Table 1.

According to many experts, a significant reduction in the volume of investment income from abroad since 2012 has been the result of the military conflict in eastern Ukraine and the temporary annexation of the Crimea.

Consider the dynamics of changes in the volume of cash revenues from the state in the form of targeted financing of innovation activity in Figure 6.

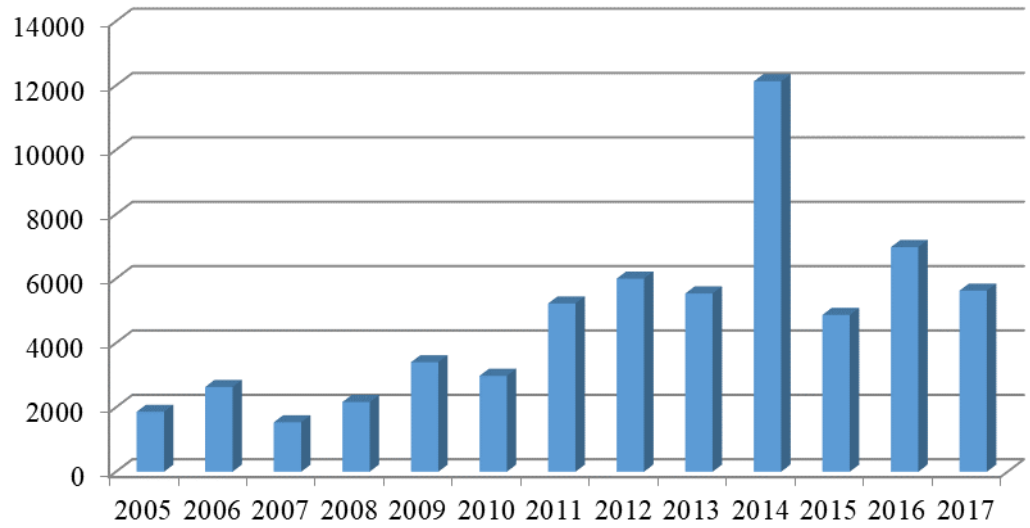

Fig. 6. Diagnostics of changes in volumes of financial revenues from state targeted financing for 2005-2017, UAH million.

Source: compiled by authors on the basis of Table 1.

Thus, in the period from 2005 to 2010, we have quite low levels of financial revenues in the form of state-targeted financing, namely: in 2005 – 1859,28 million UAH, in 2006 – 2630,56 million UAH, in 2007 – 1535,48 million UAH, in 2008 – 2162,60 million UAH, in 2009 – 3400,34 million UAH, in 2010 – 2977,80 million UAH. Since 2011, there has been a significant increase in cash revenues from state financing and in 2011 it amounts to 5224,80 million UAH. In 2012, state investments amounted to 6270,00, in 2013 – to 5536,80 million UAH. In 2014, the largest amount of state investments in the development of innovation activity of domestic enterprises amounts to 12128,40 million UAH. In 2015, revenues from state financing are 4870.80 million UAH, in 2016 – 6979,20 million UAH, in 2017 – 5625,81 million UAH.

Thus, in order to enhance the innovation activity of Ukrainian enterprises, it makes economic sense to increase the volume of financial revenues from the following sources:

- inhouse profit;
- issue of securities;
- foreign investments;
- government investments.

Conclusions. The diagnosis of the dependence of the volume of sales of innovative products on the level of financial security of innovation activities during 2005-2017 made it possible to draw the following conclusions. It has been revealed that innovative activity of enterprises of Ukraine to a large extent depends on the amount of financing. This conclusion is confirmed by the development of a correlation matrix and a regression model whose reliability indicators are high.

The correlation-regression analysis made it possible to reveal the sources of financial resources, changes in volumes of which greatly influence the efficiency of innovation activity of domestic enterprises. Consequently, the determinants were: the volume of issue of shares, foreign investments, corporate profits and state financing. The increase in these factors leads to a significant increase in the volume of sales of innovative products.

Therefore, in order to ensure a stable increase in the volume of implemented innovative products as the main indicator of the effectiveness of innovation activities, it is necessary to create favourable conditions for attracting investments by issuing shares and financial receipts from foreign investors. We consider it efficient to establish a mechanism for state-targeted financing of innovation projects.

REFERENCES:

1. Вітлінський В.В., Терещенко Т. О., Савіна С. С. Економіко-математичні методи та моделі: оптимізація: навч. посіб. Київ : КНЕУ, 2016. 303 с.
2. Звіти Державної комісії з цінних паперів з 2005 по 2017 роки. URL: https://www.nssmc.gov.ua/reports/ (дата звернення 15.04.2018 р.)
3. Каталог Бюлетенів Національного банку України з 2005 по 2017 роки. URL: http://www.irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv/cgiirbis_64.exe?C21COM=S&I21DBN=JRN&P21DBN=JRN&S21FMT=JwU_B&S21ALL=%28%3C.%3EU%3D%D0%A39%284%D0%A3%D0%9A%D0%A0%29262.100%3C.%3E%29&Z21ID=&S21SRW=GOD&S21SRD=&S21STN=1&S21REF=10&S21CNR=20 (дата звернення 20.04.2018 р.)
4. Офіційний сайт Державної служби статистики України. URL: www.ukrstat.gov.ua (дата звернення 22.04.2018 р.)
5. Пятигін А.С. Використання аналітичних моделей для оцінювання середовища прийняття управлінських рішень у сфері фінансової діяльності підприємств. Актуальні проблеми економіки. 2017. Вип. 11. С. 308-321.
6. Ґудзь П.В., Науменко Р.П. Аналіз бюджетного управління на підприємстві. Бізнесінформ. 2016. Вип. №12. С. 144-149.
7. Хто і як інвестує в Україну? http://razumkov.org.ua/statti/khto-i-iak-investuie-v-ukrainu URL: (дата звернення 30.04.2018 р.)

REFERENCES:
(translated)

1. Vitlinsky V.V., Tereshchenko T.O., Savina S.S. Economics and Mathematical Methods and Models: Optimization: Teaching. manual Kyiv: KNEU, 2016. 303 p.
2. Reports of the State Commission on Securities from 2005 to 2017. URL: https://www.nssmc.gov.ua/reports/ (Accessed date 15.04.2018)
3. Catalog of Bulletins of the National Bank of Ukraine from 2005 to 2017. URL: http://www.irbis-nbuv.gov.ua/cgi-bin/irbis_nbuv/cgiirbis_64.exe?C21COM=S&I21DBN=JRN&P21DBN=JRN&S21FMT=JwU_B&S21ALL=%28%3C.%3EU%3D%D0%A39% 284% D0% A3% D0% 9A% D0% A0% 29262.100% 3C.% 3E% 29 & Z21ID = & S21SRW = GOD & S21SRD = & S21STN = 1 & S21REF = 10 & S21CNR = 20 (Accessed date 20.04.2018)
4. Official site of the State Statistics Service of Ukraine. URL: www.ukrstat.gov.ua (Accessed date 22.04.2018)
5. Pyatigin A.S. Use of analytical models to assess the environment for making managerial decisions in the field of financial activity of enterprises. Actual problems of the economy. 2017. Issue 11. pp. 308-321.
6. Gudz P.V., Naumenko R.P. Analysis of budget management at the enterprise. Biznesinform. 2016. No. 12 Pp. 144-149.
7. Who and how does he invest in Ukraine? http://razumkov.org.ua/statti/khto-i-iak-investuie-v-ukrainu URL: (Accessed date April 30, 2018)

Received: 12.06.2019
Reviewed: 24.06.2019
Accepted to publishing: 27.06.2019