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DEVELOPMENT AND EVALUATION OF A MULTIFACTOR ECONOMETRIC MODEL OF FACTORS AFFECTING THE NET ASSETS OF INVESTMENT FUNDS IN UZBEKISTAN

Khamraev Kuvvat Iskandarovich
PhD student of Urgench State University
E-mail: quvvatb@mail.ru

Аннотация: Ушбу мақолада мамлакатимизда фаолият юритаётган инвестиция фондлари "Камалак" ва "Даромад-плюс" АЖнинг соф активларига таъсир қилувчи омилларнинг регрессион ва корреляцион модели тузилган, ҳамда ушбу модел асосида инвестиция фондларининг соф активлари ўсишига таъсир қилувчи омиллар 3 та сценарий бўйича прогноз қилинган.

Калит сўзлар: инвестиция фонди, соф активлар, эконометрик модел, прогноз, гипотеза, регрессион ва корреляцион таҳлил, гетероскедастик тест,сценарий.

Резюме: В данной статье разработана регрессионно-корреляционная модель факторов, влияющих на чистые активы инвестиционных фондов, действующих в стране «Камалак» и «Даромад-Плюс» АО, и на основе этой модели прогнозируются факторы, влияющие на рост чистых активов инвестиционных фондов в 3 сценариях.

Ключевые слова: инвестиционный фонд, чистые активы, эконометрическая модель, прогноз, гипотеза, регрессионно-корреляционный анализ, гетероскедастический тест, сценарий.

Abstract: In this paper developed a regression and correlation model of factors affecting the net assets of investment funds of "Kamalak" and "Daromad-plus" JSC operating in the country and on the basis of this model, the factors influencing the growth of net assets of investment funds are forecasted in 3 scenarios.

Key words: investment fund, net assets, econometric model, forecast, hypothesis, regression and correlation analysis, heteroscedastic test, scenario.

Introduction: The subjects of econometric modelling net assets of investment funds and their effective use in the context of modernization of the national economy have not been studied as a separate, independent object of scientific research.

Today, researches conducted on the activity of investment funds in the world economy, their new innovative forms and the widespread use of elements of the digital economy. At the same time, one of the most important issues is the assessment of factors influencing the net assets of index funds, as well as mutual funds, which are becoming more active in the securities market [1].

Investment funds, which are considered attractive in the global financial market, are losing their position in the Uzbek securities market. In this regard, one of our important tasks in attracting public funds to the securities market with the help of investment intermediaries is to "mobilize the funds accumulated in the hands of the

population in the development of the economy, to strengthen the entrepreneurial spirit of the people" [2].

Literature review: Foreign economists Engle and Granger studied the dependence of variables using the OLS (Ordinary least squares) method to avoid creating a spurious model [3].

The Johansen cointegration method was formulated because there were a number of shortcomings in determining the short- and long-term relationship of variables using the Engl and Granger's method. The Johansen cointegration process is the maximum likelihood estimates (MLE) approach. In this method, the time series vector autocorrelation determines the cointegration of the vectors, taking into account the constraints placed on the non-stationary variables [4].

In his scientific study, Johansen showed the determination of cointegration through two statistical tests. The first is the Maximum Eigenvalue Test and the second is the Trace Test [5].

In statistics, the Breusch–Godfrey test is used to assess the validity of some of the modelling assumptions inherent in applying regression-like models to observed data series. In particular, it tests for the presence of serial correlation that has not been included in a proposed model structure and which, if present, would mean that incorrect conclusions would be drawn from other tests or those sub-optimal estimates of model parameters would be obtained.

The regression models, those the test can be applied include cases where lagged values of the dependent variables are used as independent variables in the model's representation for later observations. This type of structure is common in econometric models [6].

In recent years increasing the number of researchers conducting a research on the development of Investment funds in Uzbekistan. In particular, many researches have done efforts to develop the activity of investment funds and their organizational models [7]. Also, I.Abdullaev, K.Khamraev studied modelling factors affecting net assets of investment funds using autoregressive distributed lag (ARDL) model [8]. Sultanbaeva [9] elaborated on the conceptual aspects of the development of investment funds.

Although the authors mentioned above conducted researches on the subject, issues of econometric modelling of assessment of net assets of investment funds and their effective use were not analysed in detailed. This, in turn, indicates that research in this area is a key issue today.

Methodology: Correlation and regression analysis methods used to find out solution of the research questions.

Analysis and results: The purpose of our study is to develop a model of regression and correlation of factors affecting the net assets of investment funds of "Kamalak" and JSC "Daromad-Plus" and make a forecast based on this model. In the research developed a multifactor regression and correlation econometric model based on the data for 2009-2018. In creating these models, we use the program Eviews 9, which is widely used in Econometrics. Before creating an econometric model, we select the variables. For the multifactor regression and correlation econometric model net assets (*nav*) of investment funds in the country were taken as an dependent

variable and receivable accounts of investment fund (*ar*), payable accounts of investment fund (*cd*), total income of investment fund (*tr*) and total cost of investment fund (*te*) were defined as independent variables. Based on the above-developed following research hypotheses:

H1 - The volume of receivable accounts of an investment fund depends on the growth of its net assets and has a high impact;

H2 - The amount of payable accounts of an investment fund depends on the growth of its net assets and has a high impact;

H3 - The total income of an investment fund depends on the growth of its net assets and has a high impact;

H4 - The total cost of an investment fund depends on the growth of its net assets and has a high impact;

Based on the above hypothesis, formed following mathematical function:

$$N_{nav} = \alpha + \beta_0 A_{ar} + \beta_1 C_{cd} + \beta_2 T_{tr} + \beta_3 T_{te} + \varepsilon_i \qquad \beta{>}0 \qquad (1)$$

Here:

N_{nav}- Growth of net assets of the investment fund;

A_{ar}- Growth of the investment fund's receivable accounts;

C_{cd}- Growth of the investment fund's payable accounts;

T_{tr}- Growth of total income of the investment fund;

T_{te}- Increase in the total cost of the investment fund.

In the construction multi-factor regression and correlation econometric model (1) the methods of OLS.

Before constructing a multifactor regression and correlation econometric model, we perform the analysis by bringing the selected variables to the natural logarithm to bring selected variables into the same index system.

Based on the hypothesis formed a multi-factor regression model considering net assets (types) of investment funds as a dependent variable and defining receivable accounts of investment fund (*ar*), payable accounts of investment fund (*cd*), total income of investment fund (*tr*) and total cost of investment fund (*te*) as independent variables. Taking into account the long-term influence of factors in formation of the multifactor regression model, effects of receivable accounts of investment fund (*ar*), payable accounts of investment fund (*cd*), total cost of investment fund (*te*) to net asset (*nav*) of the investment fund were estimated (Table 1).

Table 1

"Results of the multifactor regression analysis of the factors affecting the net assets of the investment fund "Daromad-plus"

Related variables: *lnnav*				
Method: The smallest squares				
Number of observations : 37				
Variable	Coefficients	Standard errors	t-statistics	P-value
lntr	0.236178	0.055279	4.272504	0.0002
lnte	-0.137818	0.111994	-3.15967	0.0000

lncd	0.082141	0.064940	1.264870	0.0148
C	3.238356	0.189493	17.08957	0.0000
Determination coefficient	0.991380	The average value of the dependent variables		10.53662
Adjusted determination coefficient	0.990597	Standard deviation of dependent variables		4.297114
Standard error of regression	0.416690	Akaike criterion		1.188860
The square sum of the remains	5.729822	Schwartz criterion		1.363013
The value of the maximum similarity function	-17.99391	Hannah-Quinn criterion		1.250257
F-statistics	1265.168	Durbin-Watson statistics		2.148700
Probability (F-statistics)	0.000000			

Based on the results of the calculations, the following multifactor regression model was formed.

$$ln\widehat{nav} = 3.238356 + 0.082141\,lncd + 0.236178\,lntr - 1.137818\,lnte + \varepsilon$$

The results of regression analysis given in Table 1 shows that the net asset (*nav*) of the investment fund, which is a dependent variable of the investment fund "Daromad-plus", is effected by receivable accounts of investment fund (*ar*), payable accounts of investment fund (*cd*), total cost of investment fund (*te*). The adjusted determination coefficient showed how well the constructed model fit the data. This is because the closer the adjusted determination coefficient to one, the more likely independent variables: receivable accounts of investment fund (*ar*), payable accounts of investment fund (*cd*), total cost of investment fund (*te*) will substantiates the impact of the investment fund on changes in net assets. Which, allows to forecast accurately the value of the net assets of the investment fund. We perform a diagnostic analysis to determine forecasting accuracy of constructed model. First of all, we check that there is an autocorrelation problem in the residuals in the constructed model. Residual autocorrelation is determined by the Breush-Godfrey test (Table 2).

Table 2

Breush-Godfrey autocorrelation test result

F-statistics	4.472462	Probability F(2,4)	0.5197
Tracking * R-square	8.285463	Probability chi-square (2)	0.4159

There is no autocorrelation between the residuals based on the results of the Breush-Godfree test, which is a diagnostic test in Table 2. Because the Chi-square probability level is greater than 0.10, the null hypothesis suggests there is no autocorrelation of the residuals. In conclusion, it is obvious that there is no autocorrelation between the net assets of the investment fund: payable accounts, total income and total expenses, which are the data collected. The diagnostic test shows that the formed econometric model can predict. After the Breush-Godfrey

autocorrelation test, we perform a heteroscedastic test of the residuals. Heteroscedastic test is determined by Breush-Pagan-Godfrey test (Table 3).

Table 3

Breush-Pagan-Godfrey heteroskedastic test result [1]

F-statistics	1.343230	Probability F(1,7)	0.2772
Observation*R-square	4.026459	Probability. CHi-square(1)	0.2586
Explained sum of the total squares	2.072092	Probability. Chi-square(2)	0.5576

From data given in Table 3, there is no heteroscedasticity between the residuals due to the Breush-Pagan-Godfrey heteroscedastic result. Because the Chi-square probability level is 0.5576 and greater than 0.10, null hypothesis suggests there is no heteroscedasticity the residuals. That is, the residuals of the structured model is homoscedastic. Diagnostic tests mean that if there is no autocorrelation in the residual of the constructed model, as well as homoscedasticity of the residual allows the model to use for forecast.

In summary, a percent increase in the total income of the investment fund leads to an increase in the value of net assets by 0.08 percent, and one percent increase in payable accounts of the investment fund leads to an increase in the value of net assets of the investment fund by 0.23 percent. However, an increase of one percent in the total cost of the investment fund leads to a decrease in the value of the net assets of the investment fund by 0.13. Excluding other factors (ceteris paribus), the payable accounts of investment fund, total income and total expenses together increase by 1 percent, resulting in an increase in the value of net assets by 0.18 percent. Using the above multi-factor regression analysis, we forecast the growth value of the net assets of the investment fund "Daromad-Plus" over the years in 3 scenarios, using polynomial, linear and exponential models, depending on the amount of payable accounts, total income and total expenses of the investment fund (Figure 1).
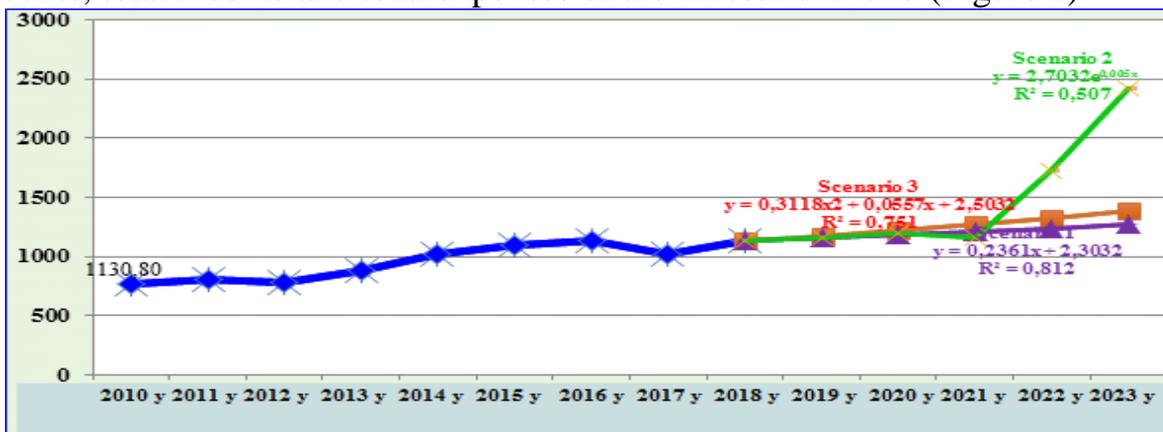

Figure 1. Forecast of growth of net assets of "Daromad-Plus" investment fund for 2020-2023 (billion soums).

Based on the factors influencing the growth of net assets of the investment fund of "Earnings-Plus" as well as impact payable accounts, total income and total expenses of investment fund and interdependence of their growth rate forecasted growth of net assets of the investment fund for 2019-2023 in three cases (Table 4).

Table 4

The forecast of growth of the value of net assets of the investment fund "Daromad-plus" in 2020-2023 (million soums).

Years	Scenario 1 Linear $y = 0{,}2361x + 2{,}3032$ $R^2 = 0{,}812$	Scenario 2 Exponential $y = 2{,}7032e^{0{,}005x}$ $R^2 = 0{,}507$	Scenario 3 Polyminal $y = 0{,}3118x2 + 0{,}0557x + 2{,}5032$ $R^2 = 0{,}751$
2020 y	1183,1	1192,4	1225,1
2021 y	1210,3	1161,0	1275,3
2022 y	1238,1	1730,8	1327,6
2023 y	1266,6	2413,6	1382,1

The data in Table 4 shows the linear analysis of Scenario 1, the value of the net assets of the investment fund is expected to reach 1266.6 million soums by 2023. According to the exponential analysis of Scenario 2, net assets of the investment fund of "Daromad-Plus" is expected to reach 2413.6 million soums by 2023. According to the semi-final analysis of Scenario 3, the value of net assets of the investment fund expected to reach 1382.1 million soums by 2023.

The study based on the factors affecting the growth of net assets of the investment fund "Kamalak" in country. The forecast indicators for the growth of net assets of the investment fund for 2020-2023 in three cases were determined based on the impact and interdependence of the growth of the payable accounts investment fund, total income and total cost (Table 5).

Table 5

Forecast of growth of net assets of Kamalak Investment Fund in 2020-2023, million soums

Years	Scenario 1 Linear $y = 0{,}2161x + 2{,}2032$ $R^2 = 0{,}852$	Scenario 2 Exponential $y = 2{,}7032e^{0{,}005x}$ $R^2 = 0{,}537$	Scenario 3 Polyminal $y = 0{,}3819x2 + 0{,}1909x + 2{,}6032$ $R^2 = 0{,}781$
2020 y	430,2	433,6	445,5
2021 y	440,1	422,2	463,8
2022 y	450,2	629,4	482,8
2023 y	460,6	877,7	502,6

The data in the table shows that based on the linear analysis of Scenario 1, the value of the net assets of the investment fund is expected to reach 460.6 million soums by 2023. According to the exponential analysis of Scenario 2, studying the impact of the increase in the value of net assets of the investment fund "Kamalak", the value of net assets of the investment fund expected to reach 877.7 million soums by 2023. According to the semi-final analysis of Scenario 3, the value of the net assets of the investment fund is expected to reach 502.6 million soums by 2023.

Conclusion: Changes in the value of net assets of investment funds in Uzbekistan are affected by long-term fluctuations in the payable accounts of these funds.

A percent increase in the total income of the "Daromad-Plus" investment fund will increase the value of net assets by 0.08 percent, and a percent increase in the payable accounts of the investment fund will increase the value of net assets of the investment fund by 0.23 percent. However, if the total cost of the investment fund increases by one percent, the value of net assets of the investment fund decreases by 0.13 percent, and the value of net assets increases by 1 percent. Excluding other factors (ceteris paribus), the payable accounts of investment fund, total income and total expenses together increase by one percent, resulting in an increase in the value of net assets by 0.18 percent.

A percent of increase in the total income of the "Kamalak" Investment fund will increase the value of net assets by 0.16 percent. An increase in payable accounts by one percent will increase net assets of the investment fund by 0.19 percent, but an increase in total cost of the investment fund by a percent leads to a decrease in the value of the fund's net assets by 0,25 percent. Excluding other factors (ceteris paribus), the value of net assets can be increased by 0,10 percent by increasing the payable accounts, total income and total cost of the investment fund by a percent at the same time.

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