MODELLING OF EVOLUTIONARY POTENTIAL OF PASSIVE INVESTMENT

Salih A. Bayzulayev, Elmira G. Shurdumova, Rimma M. Azamatova, Rita H. Kushbokova, Larisa S. Chechenova
Kabardino-Balkarian State University named after Kh.M. Berbekov
Chernyshevskogo st., 173, 360004, Nalchik, Kabardino-Balkarian Republic, Russia

ABSTRACT
In work the research of questions of modeling of evolutionary potential of passive investment is conducted. The aprioristic, current and a posteriori purposes of investment defining creation of conceptual model of a control system of investment activities of the organization are allocated. The essence is investigated, characteristics and potential of active use of passive investment are defined. The model of assessment of investment attractiveness and stability of economy of the region on the basis of the generalized production function of type of Kobba-Douglas with twenty variables (basic investment parameters) is developed. The offered integrated model can be used as for assessment of investment attractiveness of separately taken region, but also for taxonomy and ranging of the organizations, regions on the level of investment activity. Quantitative and qualitative levels of classification of conditions of investment attractiveness of an economic unit are determined. On the basis of application of information and entropy approach the analysis and modeling of an index variety of ETF in processes of diversification of a portfolio and realization of investment strategy with the reduced risk is carried out.

Keywords: passive investment, evolutionary potential, modeling, ETF, region, function of Kobba-Douglas, management, system, factors, entropy

INTRODUCTION
The control system of investment activities of economic subjects (it is presented in fig. 1) is directed to achievement of a number of the purposes – aprioristic, current and a posteriori.

![Conceptual model of a control system of investment activities of the organization](image-url)

Figure 1. Conceptual model of a control system of investment activities of the organization
The aprioristic purposes are connected with planning of investment activities (function (1) of fig. 1). It:
- to define the priority directions of investment development and to prove investment strategy and policy;
- to prove acceptable risk levels and profitability of investment projects and tools;
- to prove optimum sources of financing of investment activities from positions of minimization of their cost.

The current purposes are connected directly with realization of investments (functions (2), (3), (5) of fig. 1). It is possible to carry to such purposes:
- definition of profitability, optimum on indicators, and to liquidity of assets of the structure of the investment portfolio consistent with tactical and strategic objectives of the subject;
- the organization of regular monitoring of external and internal factors of the investment environment and adoption of the correcting investment decisions.

The posteriori purposes are connected with results of investment activities (functions (4) and (6) of fig. 1), it is necessary to carry to them:
- to develop the system of indicators for accounting of results of investment activities of the organization;
- to develop the control system of results of implementation of investment decisions and assessment of their efficiency.

Achievement of the aprioristic, current and a posteriori purposes is possible with use of various techniques and approaches which can be classified by subject to investment as active and passive.

Active methods are used for management of the investment assets which are highly profitable, high-risk and at the same time short-term financial instruments. These methods are based on systematic monitoring of the financial market, search of irrelevantly estimated papers, forecasting (modeling), expert assessment of changes of their cost and profitability in the future. Art consists in right identification of points of an entrance exit, definition of tendencies (creation of trends), quick reaction on change of market conditions.

Passive methods are applied to management of the investment assets having the following characteristics: low level of profitability, riskiness and usually long circulation period. The investor applying passive methods is guided at adoption of administrative decisions by indicators of profitability of the market index, the structure of the built investment portfolio has permanetny character and changes only for adaptive approach to the chosen profitability trajectory.

The merits and demerits, relevant tools determined by features of functioning of the market and qualification of the investor (expert) have both active, and passive management of investments. So, "experts" prefer to carry out the technical analysis of the financial market, and "fundamentalists" use for this purpose static ways [1]. Institutional investors choose "middle": a part of the capital is actively operated, the rest – "in a passive", the investment portfolio is diversified.

**MAIN PART**

**Active use of passive investment**

The traditional strategy of the "passive" investor consists in the analysis of the financial market on the basis of studying of dynamics of market indexes and indicators, acquisition of shares of investment funds (for example, exchange fund Exchange Traded Fund - ETF or mutual fund). In essence ETF is a portfolio
of securities (investment assets), some market index which is freely addressing at the exchange and repeating. Separate unit of such investment portfolio is called ETF share.

Structures of ETF and mutual fund in general are similar and have the following characteristics - professional management, high liquidity and diversifiability, availability on volumes of necessary investments. However, for the Russian investors there are distinctions:

- ETF are foreign securities and the funds which are their cornerstone are in foreign jurisdiction (for example, at the Moscow Exchange ETF which issuers are the Irish organizations, managing directors - the English companies, and administrators and custodians – the American banks address);

- ETF "are passive", i.e. are tied to indexes whereas also active strategy can choose mutual fund;

- acquisition by the Russian investors of ETF at the foreign exchanges will be difficult and connected with performance of a number of additional procedures and also existence of the status of the qualified financial analyst confirmed with the certificate of FFMS or CFA;

- the price mutual fund share is calculated at the end of the day whereas ETF bargains all trading session (as actions), usually speculatively, with an opportunity in need of commission of transactions and use of leverage by the trader;

- cumulative costs for operations with ETF are much lower, than on mutual fund, transactions at the counter application – instant, and profitability miscalculates quickly.

The market of ETF happens primary and secondary type. Primary market – is more for representatives (authorized) fund participants (initiation of a share issue, exchange of the index focused baskets of securities or money on the stock ETF, for example, blocks on 50000, repayment of actions). The secondary market – is more for the exchange (off-exchange) address, available to all persons as actions.

The first half of 2017 showed, according to data of ETFGI, the record growth of volume of world index products (4.17 trillion dollars, the rate of a gain in a year was 17.5%). According to ETFGI analytics, now about 5% of world assets, 15% - actions and 30% of volume of mutual funds of the USA are the share of index funds, ETF. In total in the world more than 7 thousand passive funds functioning at 70 exchanges of 56 countries.

Experts of ETFGI explain growth of popularity of passive investments with aggravation of problems of geopolitics (Brexit, DPRK, an internal political conflict in the USA, etc.) – risks of active investment grow. For the first half of the year 2017 the S&P 500 index increased by 9.34%, the stock markets (outside the USA) showed profitability of 14.27%, in emerging markets – 16.69%. In favor of "passive" investment also the low index commissions promote. For example, the average annual value for the stocks ETF is 0.25%, bonds of ETF – 0.21% that there is much less payment in 1-3% raised mutual fund, hedge funds, etc.

At the Moscow Exchange the number of the investors focused on ETF grows quicker, then the relative share of their brokerage accounts (2.2%), is even less than growth of share invested in OPIF (from 0.01 to 0.03%). ETF trading volumes at the exchange in a year (since July the 2016th) grew to 8.2 billion rub (for 17.1%), OPIF turn – to 43 million rubles (for 940%) [2]. The most liquid ETF at the Moscow Exchange are FinEx Rus Eurobonds (investment into corporate eurobonds of the Russian issuers), FinEx Cash Equivalents (in indexes of short-term state bonds of the USA). Low trade indicators on operations with ETF on the Russian securities market are caused, in particular, by bad knowledge of investors of passive tools, their interest in other, specialized segments of securities market and a priority of active forms of investment.
But the potential of appeal of ETF, according to some expert estimates above, then at opened mutual fund on the index, thanking, first of all, to the low threshold of an entrance on the market for the investor and the acceptable commission. Repayment of shares of exchange funds is impossible – only sale to other participant at the exchange, with withdrawal of funds (with the commission) on the settlement account of the broker. Payments for ETF portfolio (dividends, coupon yield) come to fund, then are reinvested or distributed among shareholders. For management mutual fund the investor at the Moscow Exchange annually pays 2-3% (without the commission of the broker), for service of exchange fund – only 0,45-0,9%. Some brokers determine the minimum sum of funds which are originally deposited into the brokerage account, the commission to the intermediary.

The feature of the financial market becoming system is important: the average level the managing director loses to predictability of the market, the investor prefers big safety to bigger income. Where and how to invest – always the compromise choice taking into account risks, liquidity and the cost of the contents of a position. Skilled exchange expert’s financiers recommend to invest in ETF on the bond if the purpose puts the fixed income, to put in ETF on an action – if participation in growth of the stock market is important or to adhere to American "golden mean" for the balanced investment portfolio: 60% of bonds, 40% of

**Modeling of evolutionary potential of investment activities in the conditions of problem regional economies**

In it is information the society sated, founded on knowledge and competences, the innovative investment potential of development of economy is defined more by the investments of the ideas, knowledge, technologies, competences, information resources providing achievement of the goals of investors with the minimum risks, quickly and reliably. In these conditions of category "potential", "risk", "knowledge", "innovations", "investments", "purposes" will have system, emerzhentny character [3]. They are difficult formalizable, difficult estimated (quantitatively) and if are estimated, then it is frequent with subjective "imposing of noise".

Development the infologischeskikh, mathematical models with identification of integrated indicators (indicators of investment attractiveness) and the subsequent their use in the forecast of indexes of passive investment will be the solution of this problem. Such parameters implicitly reflect both risks, and potential of investment [4,5], but, the main thing, help to carry out taxonomy of subjects to investment on the level of their investment attractiveness and activity ("activity/passivity"). Taxons are limited to categories of "demand" which is understood as the investment capacity and "offers", i.e. investment potential. Investment potential defines the need for investments and a possibility of investment of potential investors, and investment capacity is defined by investment attractiveness of a concrete market niche (an object, an asset). The ratio of investment potential and capacity defines category "coverabilities" of investment requirements. For example, if at an object insufficient investment attractiveness, then it does not attract, most likely, the volume of investment, sufficient for its potential, or will lose on the commission, raising funds of high cost.

Its decomposition on subsystems, allocation of the operating subsystem providing not only development of decisions, but also structural activity, growth of a role of passive mechanisms of controllability is important for modeling of system. Procedures of modeling have to consider integrated communications of structures of system, its subsystems.

Let's consider i-uyu a system S subsystem, a vector of $x^{(i)} = (x_1^{(i)}, x_2^{(i)}, ..., x_n^{(i)})$ the basic factors (which are relevantly describing, influencing functioning of a subsystem) and functionality of $f^{(i)} = f(x^{(i)})$ activity (passivity) of a subsystem. For system S similarly, we enter a vector of its state $x$, system activity of $f(x)$ and potential of $P$.

If to consider the operating subsystem, then as in technical systems, it makes sense to speak not about activity of system, and about her "fatigue", emphasizing that it is only figurative comparison as investment
processes have more difficult character. It is important to identify functionality of activity, its parameters (for example, the integrated parameter of self-control).

Let's show in a one-dimensional case \((n=1, \ x=x(t), \ 0<t<T, \ 0<x<X)\) how to determine the evolutionary potential of investment activities in the conditions of problem regional economy.

On condition of renewability of the investment environment whose speed will be determined by the law \(v=v(t),\) and the coefficient of investment attractiveness (activity) is equal to \(p=p(t),\) evolutionary potential can be determined in a look:

\[
P = \int_{0}^{T} v(\tau) \exp \left( \int_{0}^{T} p(\omega) d\omega \right) d\tau.
\]

At the same time, the rate of renewal is higher, the evolutionary potential and vice versa is higher. If evolutionary potential is less than unit, then irrespective of investments into the initial moment, sizes of investment investments will decrease.

It is important to identify relevantly quantitatively factors of increase in investment attractiveness, their admissible (expected) boundary and optimum sizes. Especially in the conditions of the "problem" region where arrangement of priorities, development and implementation of anti-recessionary programs strongly influences the evolutionary potential of investment.

Let's offer the following system of basic parameters for situational modeling of evolutionary investment potential of regional economy. We classify them as follows:

- natural (volume, ratio and efficiency of investments into land, water, raw material, recreational resources, etc. region);
- financial and economic (dynamics and efficiency of investments in the industrial and nonindustrial sector of economy, investment into infrastructure security of the region and so forth);
- demographic (dynamics, structure and efficiency of the investments directed to improvement of a demographic situation – increase in indicators of birth rate and decrease in indicators of mortality of the population, growth of duration and quality of his life, optimization of indicators of pension loading, etc.);
- production (the volume and efficiency of investments into the fixed and working production capital, in professional development and productivities of industrial and production personnel, in automation and rationalization of productions and so forth);
- public and social (the size and dynamics of the investments connected with work intellectualization, approach to individual and public installations of wellbeing, information and public openness, decline in unemployment, poverty and uncontrollable migration, efficiency of social service, improvement of a criminogenic situation in the region, etc.);
- educational (the volume, structure and efficiency of the investments connected with modernization of educational system, expansion of a range of educational services and increase in their quality, development and deployment of modern systems and techniques of training and so forth);
- scientific and technical (the volume, structure and efficiency of the investments connected with introduction of achievements of scientific and technical progress in the region, support of the innovation-active organizations, commercialization of scientific and technical and innovative developments, etc.);
- ecological (the volume, dynamics and structure of investments into the projects directed to decrease in ecological threats, risks of pollution, increase in efficiency of ecological actions and so forth).

The main objective consists in formation of system of the most informative, quantitatively measured indicators by means of which it is possible to describe the listed parameters of investment potential of problem regional economy. The examples of indicators describing financial and economic criteria are expenses in research and development, investment into fixed capital, cost of contracts of financial leasing, etc. Public and social investments characterize such indicators as number of computers on 1000 inhabitants, the number of students, number of Internet users and so forth. Demographic parameters of investment activities can be estimated by means of indicators of birth rate and mortality, average life expectancy, age of survival, a migration flow, etc. It is necessary to consider that there are investment factors which are difficult for describing quantitatively, and in this case, it is necessary to apply methods of expert estimates, polls, the linguistic and indistinct systems of their updating.

After formation of system of indicators (taking into account their ranks) evolutionary modeling of investment potential of the studied object is carried out, its integrated assessment is given and the elasticity of indicators of investment activity is defined. For example, thus, as it is made in [6].

In the course of modeling of investment potential of Kabardino-Balkar Republic it is necessary to consider as the general for all regions key factors of sustainable development (general economic, institutional, policy risks, a condition of the financial and credit and taxation system, demographic potential, purchasing power of the population, etc.), and regional (the tourist flows conducting branches of regional economy, a transport and social infrastructure, dependence on subsidies of the budget, etc.).

Let's offer model of assessment of investment attractiveness and stability of economy of the region on the basis of the generalized production function of type of Kobba-Douglas:

\[
F = F_0 \prod_{t=1}^{n} \left( \frac{x_{i}(t) - x_{i}^{\text{max}}}{x_{i}^{\text{opt}} - x_{i}^{\text{min}}} \right)^{\beta_i(t)} \left( \frac{x_{i}^{\text{max}} - x_{i}(t)}{x_{i}^{\text{opt}} - x_{i}^{\text{min}}} \right)^{\beta_i(t)} \left( \frac{\beta_i(t)x_{i}^{\text{opt}} - x_{i}^{\text{opt}}}{x_{i}^{\text{opt}} - x_{i}^{\text{min}}} \right),
\]

where \( F_0 \) – the initial level (initial assessment) of investment attractiveness, \( n \) – quantity of the considered major factors of model, \( x_{i}(t) \), \( x_{i}^{\text{max}}, \) \( x_{i}^{\text{min}}, \) \( x_{i}^{\text{opt}} \) – i a factor and its the values, maximum, minimum and optimum for investment stability, \( t \) – time (the settlement period), \( \beta_i(t) \) – importance of i-go of a factor, the parameter defining it a contribution to ensuring investment attractiveness and stability. Parameter \( \beta_i(t) \) reflects self-regulatory opportunities on i to a factor.

In model the region type by means of selection of relevant system of basic investment parameters can be accentuated. For example, for economy of Kabardino-Balkarian Republic it is possible to offer the following system of variables \( x_{i} \) (\( t = 1, 2, \ldots, 20 \)):

1) the volume of the involved internal investments (million rubles);
2) volume of external investments (million rubles);
3) number of able-bodied population (one thousand people);
4) average annual rate of a gain of VRP (%);
5) volume of home shopping service per capita (million rubles);
6) rates of updating of fixed assets (%);
7) the volume of the put into operation construction objects (one thousand buildings);
8) growth rate of real income of the population (%);
9) power consumption of VRP (knot / 10 thousand rubles);
10) crime rate (crimes/one thousand of the people);
11) growth rate of number of high-performance jobs (%);
12) population with income below the living level (one thousand people);
13) migration of able-bodied population (one thousand people);
14) expenses for education (million rubles);
15) expenses on health care (million rubles);
16) the volume of the information services (million rubles) provided to society;
17) gross value added of the tourist industry (million rubles);
18) expenses on environmental protection, ecology (million rubles);
19) dependence on subsidies of the regional budget (%);
20) volume of innovative goods, works, services (million rubles).

In model for each factor coefficient (speed) $\dot{\beta}_i(t)$ as a rule, is unknown and is subject to identification or on set of the chosen factors, or on their clusters (by means of consideration of submodels, for example, of a general economic or tourist cluster). In work [7] the forecasting model of bankruptcy of economic entity and also the procedure of identification on the basis of a method of the smallest squares was offered. It is adapted also for our task.

At short-term forecasting of investment potential, it is possible to consider all parameters constants. Then, using functionality

$$\Phi(\beta_1, \beta_2, \ldots, \beta_m) = \sum_{i=1}^{m} (\ln F(t_i) - f_i)^2 \rightarrow \min,$$

(3)

where $m$ – quantity of the considered factors (above $m=21$), $F_i$ – statistical (monitoring) data, it is possible to identify values of parameters $\beta_i$ from the following system of the equations:

$$\frac{\partial \Phi}{\partial \beta_i} = 0, \quad i = 1, 2, \ldots, m.$$  \hspace{1cm} (4)

After identification of model it is suitable for preparation short-term (if conditions are stable – and for medium-term) the forecast of investment potential of the region, on the basis of use of the following model (formula):
where $A(t) = \sum_{i=1}^{m} \beta_i \ln A_i(t)$.

The offered integrated model is suitable not only for assessment of investment attractiveness of separately taken region, but also for taxonomy and ranging of the organizations, regions on the level of investment activity. Besides, it considers that the consecutive growth of the sum of investments is insufficiently inefficient, and factors (submodels) are limited by opportunities. The efficiency is defined by interaction and coherence of factors, in model it is necessary to consider synergetic effect of such interaction and self-control of investment processes.

Distribution of points is set expertly, for example, by the Delfi method (brainstorming, the commission, court). It is insufficiently informative, does not classify fully group. Therefore, we will enter into a research of a concept of amplitude and importance.

Amplitude – a measure of investment readiness of system for this factor, importance – a measure of the importance of each factor in model. It is required to separate actual data (amplitudes) from value judgment (importance), for the purpose of receiving the most objective assessment (rather independent of experts). The dimension problem (more precisely, measurements) is allowed by rationing and scaling.

It is possible to consider simply classes: absolute unattractiveness (crisis), relative appeal (on separate major factors), appeal (on all key factors), full appeal (on all factors). In work [4] to Krasnoyarsk Krai the system "positive – negative indicators" and scales (similar to the entered importance) investment attractiveness, for example, is applied to VRP per capita – the weight 0,4, to the volume of paid services per capita – 0,6, to a share of an economically active population – 0,3, to the specific weight of pensioners – 0,05, to the average per capita income – 0,4.

For the offered model we will determine quantitative and qualitative levels of classification (in brackets rating estimates on nine-mark system are specified):

1) full (unconditional, absolute) unattractiveness (0);
2) strongly expressed unattractiveness, on all factors (1);
3) the expressed unattractiveness, on all key factors (2);
4) unattractiveness, on some key factors (3);
5) poorly expressed unattractiveness, on non-key factors (4);
6) poorly expressed appeal, on non-key factors (5);
7) appeal, on some key factors (6);
8) the expressed appeal, on all key factors (7);
9) strongly expressed appeal, on all factors (8);
10) full appeal (9).
Thus, investment potential is defined by a small amount of factors for which it is possible to execute group by criteria of investment activity (passivity) and appeal, investment risks, efficiency of investment (the activity relation to potential) and uses (the activity attitude towards appeal).

The only possibility of integrated accounting of all these diverse criteria – through self-control measures \( \beta_i(t), i = 1, 2, ..., m \) and modeling of investment potential.

**Estimation of risks and variety ETF**

The risks always reducing dynamism of the capital are considered also at passive investment. The maximum risks at the low commission, profitability, small dynamism, infrequent changes of the built investment portfolio and frequent tracking of dynamics of market indexes are characteristic of it.

A variety of ETF provides the potential for diversification of a portfolio (globally or locally), realization of investment strategy with the reduced risk. There are highly liquid ETF with the big daily average trading volume realizing speculative trade strategy. For example, in TOP-5 "twenty" of the most liquid ETF enter: SPY (S&P500) with an average annual capacity of $101,5 million, XLF - $46 million, QQQ (NASDAQ) – $38,11 million, UNG – $16,7 million, XLE – $11,95 million, XLU – $11,37 million. On a share of other of "twenty" – $40,92 million.

Advantage of ETF – diversifiability for the benefit of effective management of risks, decrease in their probability, mathematico-statistical predictability of results of strategy, adaptability by results of projections of deviations from a target trajectory (curve profitability) and the potential of an investment and speculative portfolio, increase in investment and speculative income at the set risk level. For example, conservative strategy (classical briefcase) from ETF shares in 30-40%, a standard deviation in 5-10% and risks of the speculative capital is not higher than 10-15% and criterion: decrease in the risk capital no more than for 40-50%. The portfolio can be an example of an investment and speculative portfolio: ETF – 20%, 16% - SPY, VEU, AGG, UEM with an average standard deviation of 7,9% and the expected profitability of 27,5%.

The speculative component is subject to news reactions, clients can "go over" in more profitable funds.

The integrated average risk of investment can be defined in a look:

\[
R = \left( \sum_{i=1}^{n} \left( \frac{\sum_{j=1}^{m} Z_j R_{ij}}{nm} \right) \right)
\]

(6)

where \( Z_j \) – the weight (importance) of j of investment process (stage) in risk situation, \( R_{ij} \) – risk of j of an event of i of a class (taxon).

In a dynamic case, at differentiation of investments on a temporary number of \( Y_t \), \( t = 1, 2, ..., T \) (for example, by years), it is possible to carry out the factorial analysis of dynamics, having defined a multiplicative ratio (an analog of function of usefulness of type of Kobba-Douglas):

\[
y_t(t) = \delta_t Y_t^{\max} I_t^P(t) I_t^P(t)
\]

(7)

where \( Y_t(t) \) – the volume of investment, \( I_t^P(t), I_t^P(t) \) – indexes of the volume of investment and the prices, respectively, \( \delta_t \) – the parameter of importance (scaling).
It is possible to carry out the correlation and regression analysis of influence of a share of passive investments, to identify parametrical dependence, for example, square:

$$f = \alpha_2 m^2 + \alpha_1 m + \alpha_0,$$  \hspace{0.5cm} (8)

where $f$ – a gain of passive investments, $m$ – their share in a portfolio, $\alpha_0, \alpha_1, \alpha_2$ – the identified parameters.

If we want to achieve a gain 0.4 (40%) passive investments, then it will occur at a share:

$$m_{1,2} = \frac{-\alpha_1 \pm \sqrt{\alpha_1^2 - 4\alpha_2(\alpha_0 - 0.4)}}{2\alpha_2}.$$ \hspace{0.5cm} (9)

But the choice of $m$ depends on the mechanism of investment, the competition, ability of diversification.

What measures of assessment of an index variety of ETF? The category "variety" (a variety of investment tools, schemes of investment, diversifications of the investment portfolio is meant) defines development of portfolio investment and investment risks arising in this regard (credit, market, currency, operational, losses of liquidity, legal, invlyatsionny and so forth). The choice of the relevant tool – by the principle "from simple tools – to difficult", for example, "a deposit – state bonds – mutual fund – ETF".

There are various approaches to understanding of measures (criteria) of a variety. In our case we will adhere to information and entropy approach, information – itself reflection of a variety, and amount of information – a measure of a variety of an outcome of a situation, definiteness of the choice. At information and entropy approach a variety is attribute of information transfer, and the obtained information is considered a measure of removal of uncertainty in system at the choice of the operating influence (for example, at diversification of the investment portfolio). As a result of decision-making there has to be only one choice.

The amount of information of $H$, entropy (measure of a disorder, disorder) $S$, number of elections of $N$, probability of removal of uncertainty of $p_i$, $i = 1, 2, ..., N$ and thermodynamic coefficient of Boltzmann of $k$ are connected by formulas:

$$H = -\sum_{i=0}^{N-1} p_i \log_2 p_i,$$ \hspace{0.5cm} (10)

$$\frac{dH}{dt} = -\frac{\log_2 e}{k} S.$$ \hspace{0.5cm} (11)

Increase (reduction) in $H$ leads to reduction (increase) of entropy (structure) of diversifiable system: from full uncertainty, chaos ($H = H^{\text{min}}$, $S = S^{\text{max}}$) to full definiteness, an order ($H = H^{\text{max}}$, $S = S^{\text{min}}$).

If to consider investment system as thermodynamic, $H_0, H_1$ – entropy of system in initial and final conditions of process of diversification, then the measure of entropy can be estimated as $H = H_0 - H_1$. Reduction of $N$ demonstrates proximity of system to balance of effective diversification, increase – remoteness.

If "a specific variety" – the scaled size is accented, then as the index (measure) of a variety in such systems it is possible to use:
a) Shannon-Uivera index –

\[ H_1 = -\sum_{i=1}^{n} \frac{u_i}{S} \log_2 \left( \frac{u_i}{S} \right) \]  

(12)

b) Margalefa index –

\[ H_2 = -\frac{1}{S} \log_2 \left( \frac{S!}{u_1! u_2! \ldots u_n!} \right) \]  

(13)

в) Simpsona index –

\[ H_3 = \sum_{i=1}^{n} \left( \frac{u_i}{S} \right)^2 \]  

(14)

g) Makintosha index (mean square) –

\[ H_4 = \sqrt{\sum_{i=1}^{n} u_i^2} \]  

(15)

d) Ren’i-Rao index –

\[ H_5 = -\log_2 \sum_{i=1}^{n} \left( \frac{u_i}{S} \right)^2 = -\log_2 H_3 . \]  

(15)

Here \( u_i \) – the attracted investment resources (ETF indexes) of type \( i \); \( n \) – total number of their types, \( S \) – their sum.

It is possible to identify associativity type between kinds of indexes:

\[ R = Re^{ax^2+bx+c}, \]  

(16)

where \( a, b, c, Re \) – const, \( x \) – the operating factor and also to estimate distinction measures that will allow to carry out taxonomy.

Estimation and accounting of investment risks, measures of uncertainty for the enterprise was made in work [8].

**CONCLUSION**

Attraction, placement, diversification of investments, management of the investment portfolio – process multidimensional which demands use of relevant methods, narrowings of a strip "underinvestment – reinvestment". It is important to have the corresponding tools allowing to predict and adapt to changes of investment conditions. Here passive investment of ETF has advantage for effective management of risks, diversification, minimization of deviations from the target curve yield and maximizing evolutionary potential of the investment portfolio.

**REFERENCES**

Appel J. Effective investments (the lane with English) / Under the editorship of V.V. Ilyin. – SPb.: St. Petersburg, 2009. – 416 P.
Income for lazy: what it is necessary to know about passive investment. URL: http://www.rbc.ru/money/27/07/2017/5979de0f9a79470064d7e98f?from=center_23 (access 10.08.2017).