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Tendencies in Evaluation of Portfolio Investment

Investment and related activities have considerable importance for assurance of sustained economic growth, institutional and structural modernization of the economy. Because of the pressures coming from current economic performance of Ukraine, caused by various kinds of risks, portfolio and venture investment still remain preferable options of financing. Foreign practices of joint investment show that the tools involved in joint investment institutes have been quite popular form used by potential investors.

The objective of the study is to analyze methods involved in evaluation of portfolio investment with consideration to operative practices at the Ukrainian domestic market and respective international standards.

Models for formation of optimal investment portfolio, their specifics and types are discussed. The review covers groups of models for investment portfolio formation, types of linear models for formation of optimal investment portfolio, methods used in multi-criteria model for investment portfolio formation, methodology for evaluation of investment portfolio by Global Investment Performance Standards.

The conclusion is made that the analyzed methods for evaluation of investment portfolio performance allow for taking the final investment decision either by foreign investors or by the government, and for solving the problem of risk minimization in transactions related to long-term investment in optimal portfolios.

Keywords: *investment portfolio, models for investment portfolio formation, Global Investment Performance Standards, investment portfolio evaluation.*

Introduction. Investment and related activities have considerable importance for the assurance of sustained economic growth, institutional and structural modernization of the economy, stabilization of the currency rate and the securities' values. This raises the importance of essential problems related with identification of "real" investors, expansion of investment portfolios, structuring of investment types and evaluation of the investment performance etc., which solutions can foster positive investment climate in a country.

Because of the pressures coming from the current economic performance of Ukraine, political and military crises, high financial risks, imperfections in the national banking system, portfolio and venture investment still remain preferable options of financing in Ukraine. Foreign practices of joint investment show that the tools involved in joint investment institutes have been quite popular form used by potential investors for performing high-risk financial transactions. Nomenclatures and prices of investment services rendered by asset management companies take account of the investor's segmentation and a fixed investment margin (limit), whereas the economic compensation of an investment company has to be proportional to the profit from an investment portfolio. Yet, attraction of investment should always be preceded by analysis of methods for evaluation of portfolio investment.

Analysis of recent studies and publications. Portfolio investment principles and evaluation algorithms were elaborated in works of H. Daly, H. Markowitz, F. J. Fabozzi, W. Sharp, J. M. Hartwig, J. Hicks and others. Theoretical studies of portfolio investment and its evaluation practices have been made by Ukrainian scientists: T. Vasyliyeva, Z. Herasimchuk, V. Hrynyova, B. Danylyshyn, M. Zgurovsky, S. Kozmenko, S. Leonov, T. Mayorova, L. Maslovska, L. Melnik, A. Peresada, V. Tsaryov and others.

The objective of the study is to analyze methods and tendencies in evaluation of portfolio investment in view of operative practices at the Ukrainian domestic market and international standards for investment performance evaluation.

Results. Investment refers to all the categories of tangible and intangible assets invested in business entities to create economic (profit) or social effects. Portfolio investment, related with portfolio formation, involves acquisitions of securities and other financial assets. Yet, prior to taking decision on investing in a portfolio, evaluation of its performance and payback needs to be made. Various methods, models and indicators measuring the portfolio investment performance in terms of investment attraction and investment portfolio implementation can be used for this purpose, which are going to be subject of this study.

The first step in selecting indicators for evaluation of the investment portfolio performance is model-based study of portfolio formation. There are two groups of models for investment portfolio formation:

- one-criterion (linear) modes;
- multi-criteria models.

One-criterion models for investment portfolio formation define the portfolio selection criterion (with account to uncertainty, risk, econometric grounding of decision making). Also, numerical values of the criteria for comparative options are derived. The option with the best value of the criterion is recommended for selection and practical use. When high uncertainty or high risk is involved in investment portfolio formation, the level of costs needs to be forecasted by economic components. A classification of models for formation of the optimal investment portfolio is given on Figure 1.

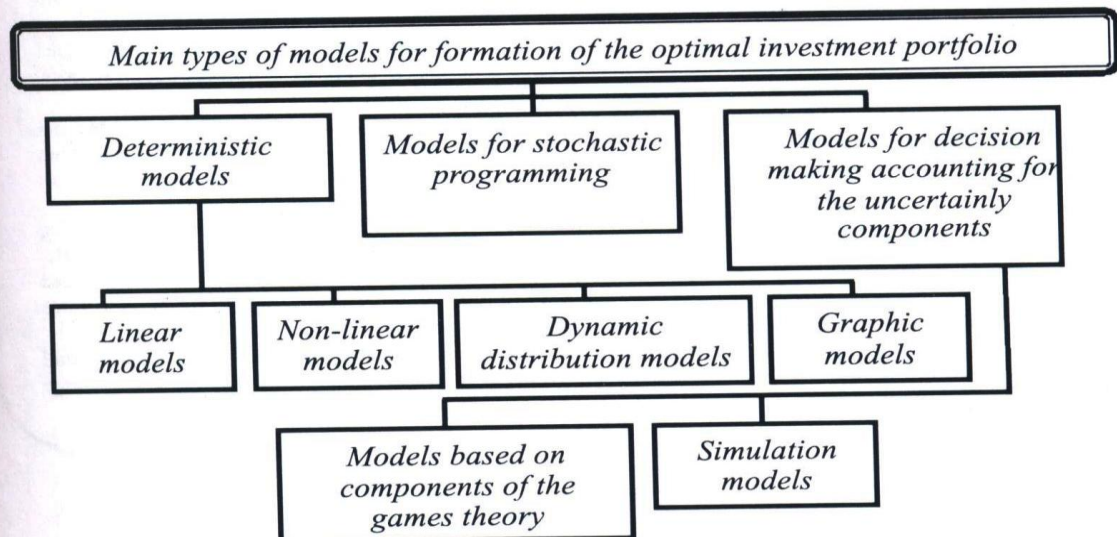


Figure 1. Types of Models for Formation of the Optimal Investment Portfolio

Source: constructed by the authors

One of the most effective types of the models shown above is linear models where the target function and limits are parallel to management variables. The portfolio target, say, the expected profit rate, can be achieved by changing the variables' values. Types of linear models for formation of the optimal investment portfolio are given on Figure 2.

Essential forms of multipurpose and multi-criteria approach to solving optimization problems in investment planning, financing and management are:

- generation of alternative solutions by use of one-purpose model with various criteria and selecting the most optimal solution (by maximization of profit);
- building and substantiation of the absolutely dominant criterion (investment advantage);
- use of the vector optimization method.

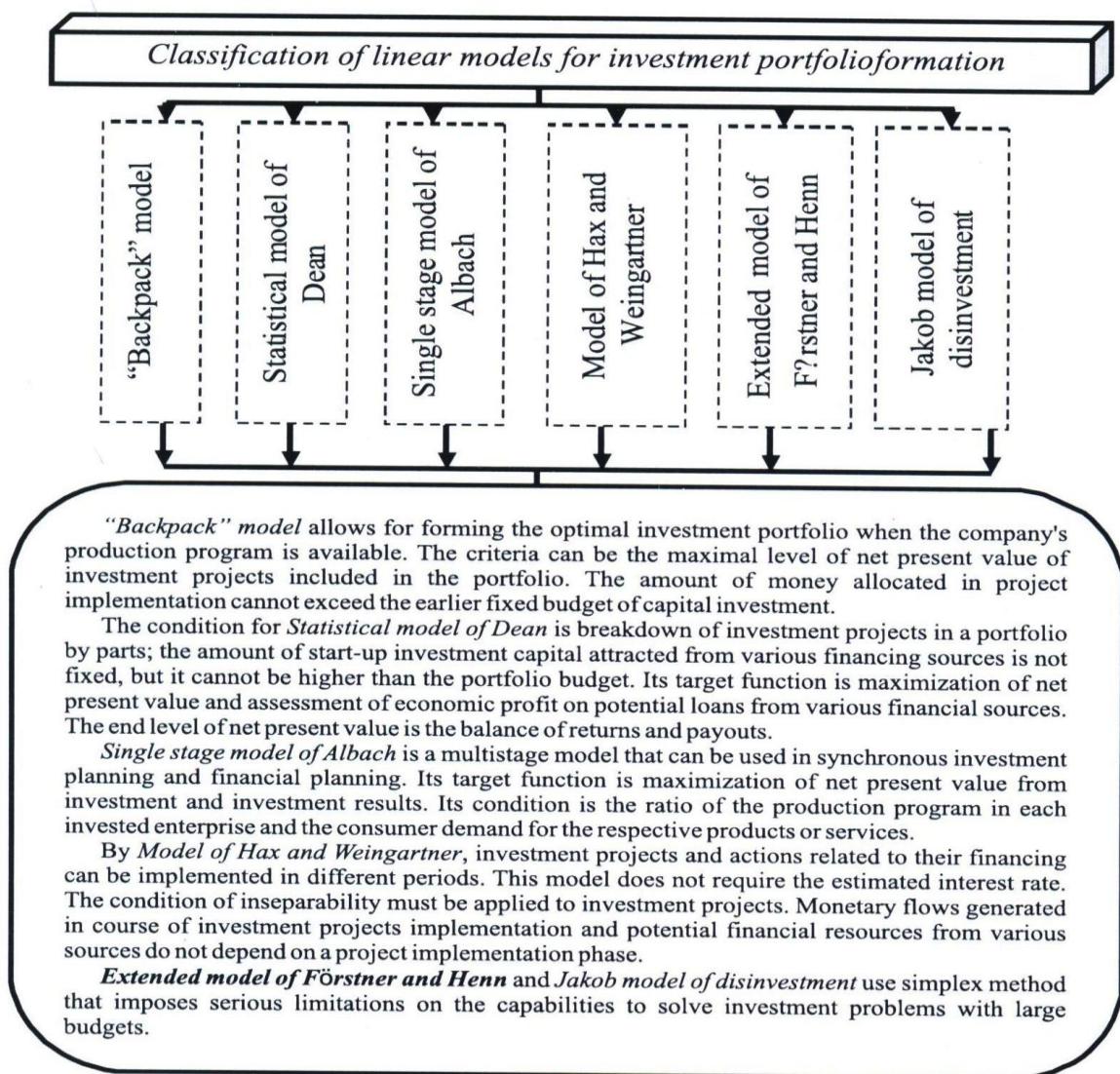


Figure 2. Types of Linear Models for Formation of Optimal Investment Portfolio

Source: constructed by the authors

Methods used in multi-criteria model for investment portfolio formation are shown in Table 1.

The first specific of both the methods and the multipurpose model for investment portfolio formation is that the same conditions (requirements) for the optimal investment portfolio can take form of limitations (on the investment costs or the interest rate). The second specific of this model is the need to select the criteria that have direct impact on the profitability of an investment portfolio.

Apart from the mechanism for formation of the optimal investment portfolio, its evaluation can be made by Global Investment Performance Standards (GIPS) (see Table 2).

GIPS significance is that the investment portfolio evaluation can be made by calculating the profitability that does not include added funds and payouts [2]. This involves consolidation of the security portfolios that have quite similar or identical investment strategies with the single composite. Composite refers to consolidation of the financial instruments of a portfolio by similarity of the investment strategy. Each set of such financial instruments in a portfolio

has the formation and evaluation pattern. The pattern criterion is deviation of reported measures of the portfolio investment performance from the planned ones.

Table 1

Methods used in Multi-Criteria Model for Investment Portfolio Formation [1]

Method	Main formula	Comments
Uniform optimization method	$f(x) = \prod_{j=1}^n f_j(x) \rightarrow \max_{x \in M}$	Used when the portfolio criteria have nearly equal economic significance
Fair compromise method	$f(x) = \prod_{j=1}^n f_j(x) \rightarrow \max_{x \in M}$	Recommended for use when an investment decision is linked to non-corporate games of a portfolio
Main criterion method	$f_{j=1}(x) \rightarrow \max_{x \in M}$ $f_{j=1}(x) \geq b_{j=1}, \dots, n$	$f_{j=1}(x)$ – principal criterion; $b_{j=1}$ – the lowest numerical value of the criterion
Method of successive concessions	$[\max_{j=1, \dots, m} f_j(x) - \Delta j] \rightarrow \max$	Δj – concession by j criterion
Criteria convolution method	$f(x) = \sum_{j=1}^n f_j(x) \times \alpha_j \rightarrow \max$ $\sum_{j=1}^n \alpha_j = 1, \alpha_j > 0$	α_j – ratio of significance, determining the advantage of one criterion over another, or the advantage of an investment portfolio

Source: [1]

Table 2

Evaluation of Investment Portfolio by Global Investment Performance Standards

Evaluation object	Evaluation method	Evaluation periodicity
Composite	Market (fair) value	Dates of beginning and end of the period for annual evaluation of the value need to be agreed
Portfolio of financial instruments	Market value	Evaluation is made not rarer than on monthly basis (on the last calendar date of a month or the last business day of a month) and on the date of each large monetary flow
Securities with fixed income and any other assets with accrued interest income	Accrual method	Evaluation is recommended on the last calendar date of a month or the last business day of a month. The market value must include the accrued income
Dividends		
Private investments	Fair value	Evaluation is made on quarterly basis, or, at least, once in a year

Source: [3]

Investment portfolio evaluation by GIPS refers to formation of individual managerial assets that can also be part of other portfolios (credit portfolio, currency portfolio). The profitability is calculated on the beginning of the period and measures the initial value and the external flows of assets.

GIPS contain the following requirements to investment portfolio evaluation:

- investment results need to cover the period of five years or longer, or retrospective performance over the period of existence of the investment entity;
- annual profitability for all the year needs to be measured;
- investment portfolios with composite assets are subject to evaluation;
- profitability dispersion for selected portfolios or parts of one portfolio for each reporting period are to be measured.

GIPS distinguish private investments, which refer to investments in high-risk venture capital assets, but without partnerships or funds. For private investments, the internal profitability rate (SI-IRR) should be calculated beginning with the period of initial capital investment till the end period, with counting daily, monthly and annual flows.

A GIPS advantage from the perspective of portfolio investment performance is the enhanced quality of portfolio investment management, detailed analysis of its components and the need to evaluate its volatility.

Existing models and standards for investment portfolio evaluation involve the following important indexes:

- integral effect (net discounted income);
- internal rate of return;
- investment profitability;
- payback period.

Integral effect is calculated as the total of net effects over the estimated period, adjusted to the reference year, or as the excess of integral results over the integral costs. Integral effect is also referred to as the present value reflecting the overall absolute result of an investment portfolio:

$$NPV = \sum_{t=1}^{Tp} \frac{B_t - C_t}{(1+i)^t}, \quad (1)$$

where *NPV* – net present value;

B_t – project income in year t ;

C_t – project expenditures in year t ;

i – discount rate;

t – years of the portfolio life cycle.

Internal rate of return is the estimated interest rate allowing the returns from an investment portfolio to be equal to the portfolio costs, or the maximal interest that can be paid to have an investment portfolio formed. The investment portfolios should be selected where the internal rate of return is not lower than 15–20%.

Profitability rate is the ratio of the effect from portfolio implementation to the portfolio costs. In evaluation practices, the benefit / cost ratio is used. It is calculated by the formula:

$$JR = \frac{\sum_{j=0}^{Tp} IN_j r^j}{\sum_{t=0}^{Tp} K_{trt}}, \quad (2)$$

де IN_j – income in period j ;

K_{trt} – amount of portfolio investment in period t .

In the numerator is the income, adjusted to the date when the investment started, in the denominator is the portfolio investment discounted to the beginning of investment process, meaning that the two parts of the payment flow, profit part and investment part, are compared.

Profitability index is closely related with integral effect. When integral effect is positive, profitability index will be $JR > 1$, and vice versa, when $JR < 1$, an investment portfolio is supposed to be ineffective.

Rate o return shows the period in which the portfolio investment will payback. It is calculated on the basis of non-discounted incomes. In international practices the measure of payback period is used.

Payback period refers to the duration of the period in which the total net income discounted at the date of investment completion will be equal to the total investment. It is the period required for reimbursement of initial capital investment by the profit from a portfolio (net profit after taxation + costs + depreciation). Payback period can be calculated as follows:

$$T = \frac{I}{NP_t + P_t + D_t}, \quad (3)$$

where T – payback period;

I – total investment;

NP_t – net profit in the period t ;

D_t – depreciation;

P_t – interest on loan.

For all the measures of investment portfolio performance the performance coefficient (K_e) is calculated by the formulas:

$$K_e = \frac{E}{B} \text{ (прямий показник),} \quad (4)$$

$$K_e = \frac{B}{E} \text{ (зворотний показник),}$$

where E – the effect from implementation of a portfolio;

B – costs related with portfolio implementation.

When selecting an investment option, the estimated payback period is compared with its normative one: $T_n = I/E$. The option will be effective when $T_{est} < T_n$. The reciprocal of payback period is called *the coefficient of additional portfolio investment performance*, or *the comparative performance coefficient* (E). It is calculated by the formula:

$$E = \frac{\Delta C}{\Delta K}. \quad (5)$$

The estimate coefficient is compared with the normative one, E_n . When $E_{est} < E_n$, the additional portfolio investment will be effective.

The indexes of investments performance, which also measure the performance of an investment portfolio, are as follows:

– *Performance rate*, calculated as the ratio of the total returns (in the current price) to the total portfolio investment. When the performance rate is lower than 1, a portfolio will be put away as one incapable to bring additional profit to an investor. The following algorithm for annual performance rate is used:

$$PR = \frac{\overline{AR}}{\sum I}, \quad (6)$$

where \overline{PR} – annual performance rate;

\overline{AR} – average annual returns;

I – investment.

Net profitability of investment:

$$PI_a = \frac{\overline{AI} - T}{\sum I}, \quad (7)$$

where \overline{PI}_a – net profitability of investment;

\overline{AI} – average annual income of a company (profit);

I – investment;

T – tax and interest payments.

– *Profitability index (coefficient of net discounted income)* is the ratio of net discounted income and discounted investment (discounted profit rate), used for comparisons of alternative portfolios:

$$PI = NDI : DVI, \quad (8)$$

where PI – profitability index;

NDI – net discounted income;

DVI – discounted value of investment.

– *Capital-labor ratio (CL)* is the ratio of initial investment to employment. It measures the intensity of work and closely related with other measure, the technical capacity of work, measured as the value of assets in business per employee.

$$CL = II : EM; \quad (9)$$

$$TC = AB : EM, \quad (10)$$

where, CL – capital-labor ratio;

II – initial investment;

EM – employment;

TC – technical capacity of work;

AB – assets in business.

– The resulting measure of sensitivity analysis is *portfolio breakeven*, determined by the balance of sales and costs (investment costs and production costs). This balance, called “breakeven point”, can be derived by the formula:

$$(PU - CVC) \cdot PO = FC_{an} \quad \text{or} \quad PO = \frac{FC_{an}}{PU - CVC}, \quad (11)$$

where PU – price of a product unit, in our case it’s price of a security;

CVC – current variable costs;

PO – production output;

FC_{an} – annual fixed costs.

Conclusions. The proposed methods for evaluation of investment portfolio performance allow for taking the final decision on its financing by foreign investors or the government, and for solving the problem of risk minimization in transactions related to long-term investment in optimal portfolios.

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Тенденції оцінювання портфельних інвестицій

У статті проаналізовано основні моделі формування оптимального портфелю інвестицій, їх особливості та види. Зроблено докладний огляд Глобальних стандартів оцінювання результативності інвестування. Узагальнено і наведено основні показники залучення портфельних інвестицій, які характеризують результативність їх використання та діяльності об'єкта інвестування в цілому.

Ключові слова: *портфельні інвестиції, моделі формування інвестиційного портфеля, Глобальні стандарти оцінювання результативності інвестування.*

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Тенденции оценивания портфельных инвестиций

В статье проанализированы основные модели формирования оптимального портфеля инвестиций, их особенности и виды. Сделан подробный обзор Глобальных стандартов результативности инвестирования. Обобщены и приведены основные показатели привлечения портфельных инвестиций, характеризующие результативность их использования и деятельности объекта инвестирования в целом.

Ключевые слова: *портфельные инвестиции, модели формирования инвестиционного портфеля, Глобальные стандарты оценивания результативности инвестирования.*