Features of evaluating the effectiveness of investment projects in emerging markets

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Abstract The article deals with features of evaluating the effectiveness of investment projects in emerging markets, the hallmark of which are, high inflation, political and general economic risks. The peculiarity of the analysis is the rationale for the approach in the formation of the initial data of investment, the forecast which should be carried out on all the expensive items and revenue in future prices, taking into account the principles of adequacy of cash flows. Important role in the analysis is ordering options for the relationship the investment process, based on the objective function - the maximum return on invested capital.

Index Terms: investment project, evaluation of efficiency, growing market, members of the investment process, the yield on invested capital.

JEL: G11, G24

I.Introduction

The hallmark of emerging markets are high inflation rates, political and general economic risks. In respect of project evaluation this leads to the rise in the desired and required yield fund holders get. An important role for the evaluation of project efficiency in emerging markets play the cross interests of different fund holders, which results in the increase of investment risks leading to financial restraints on the growth of capital. To avoid this, one will have to implement targeted control of the economic efficiency of an investment project. The existing mathematical methods used currently for risks analysis have some limitations that do not allow us to be 100% certain about the desired return on investment. In this paper, upon a detailed review of the technique of applying the known mathematical methods to economics, and of their properties, the author suggests a solution to the task of management of investment project efficiency. To substantiate the solution to the problem, the paper analyses methods used for investment risk assessment and offers the author's own ideas to this end based on the methodology of managing the target economic efficiency of an investment project (Blank, 2003).

II. Methodology for managing target economic efficiency of an investment project

All mathematical methods used in the economics for risk analysis can be categorized as direct or inverse problems. In direct problems, risk analysis related to the assessment of risk rates is carried out on the basis of the apriori known data. In inverse problems, limitations for one or several initial variable parameters are to be defined with the purpose of attaining a reasonable return rate for an investment project (Blank, 2003). While analyzing risks for an investment project at each of its implementation stages, both direct and inverse problems are used, with the management process being a closed loop. This approach underlies the methodology and principles of managing the target economic efficiency of an investment. The widely adopted practice of investment risks assessment allows for categorization of these methods and of related models by the types listed below (Bocharov, 2008).

1. By the use of probability distributions: methods taking account of probability distributions; methods not taking account of probability distributions.

2. By taking account of the probability of each individual value for a variable, and by doing the whole analysis with regard for probability distributions: probabilistic methods, sampling methods.

3. By the use of specific techniques to calculate resulting parameters on a constructed model: analytical methods, simulation methods.

The hallmark of Approach 1 is that for each stochastic variable only one of its values is used. The purpose of such "condensation" of the exogenous variable risk is to make possible the use of methods developed for certainty situation analysis without the need for any alterations. The results of calculations according to a model built for Approach 2 will be not an individual value for the resulting variable but its probability distributions. Probabilistic methods imply that construction and calculation on the model are based upon the probability theory principles, while in the case of sampling analysis all calculations are made by sample.

The main feature of Approach 2 is that it relies upon decision-making simulation methods. Within this approach we can single out such techniques as the target, optimization and systematic ones. The target technique is characterized by setting very clear goals for the construction of a model, with their refinement leading to the reconstruction of the model and new analysis. Application of this approach is most reasonable when it is necessary to constantly made new decisions in similar situations with very specific goals for each of them.

Approach 3 that implies calculation of resulting parameters according on a constructed model, contains the analytical and the simulation methods. The analytical method allows for getting results directly from the values of exogenous variables. Among its advantages is that solutions are found very fast. Its deficiency lies in the necessity to adjust a set goal to mathematical techniques at hand.

The simulation technique relies upon step-by-step calculation of the value of a resulting parameter. Among its key advantages is the transparency of all calculations, easy perception/assessment by all participants of the process,
easy planning and obtaining the results of an investment project analysis. In order to develop a methodology for the management of economic efficiency in investment, the system approach has been used allowing for building a technique for management of investment risks that is focused solely upon the reflection of the management realities, i.e. such a model a forecast which proceeds not on the basis of a formulated set of goals, but proceeds from the analyzed aspect of a real situation. As a result, such a model describes the behavior of a real system and not the action strategy as is implied by traditional methods. Then selection of a system of goals is done, after which decision-taking becomes possible on the basis of the forecasted system behavior. Individual changes of goals due to investment projecting do not result in the change of the model and require no additional calculations.

Now, while developing a methodology for the management of investment economic efficiency, we have to choose the type of categorization of management methods for the developed model and of a method for investment project risk assessment. In the breakdown structure this is Classification Type 2, subject to the probability of each individual value of a variable, and to doing the whole analysis with regard for distribution of probabilities containing sample-based methods. It should be noted here that sampling methods have only limited application to the developed approach and to the model of management of investment process risks. Therefore, with this paper an opportunity arises to supplement the existing mathematical methods for the management of economic efficiency of investment in a risky environment. Let us consider how the above described approach is applied to the analysis of investment risks.

Mathematical methods used for the assessment of investment efficiency under risky conditions can be broken down into two categories: qualitative and quantitative.

At the same time in the present paper we have considered the following issues:

**Qualitative methods for risk assessment**
- expert methods for risk analysis, SWOT-analysis
- Delphi method

**Quantitative methods for risk assessment**
- discounting method
- capital asset pricing model (CAMP)
- cumulative discount rate method
- country risk assessment method
- sensitivity analysis method
- investment project sustainability method
- scenario analysis.

For the review and analysis we have chosen only those mathematical methods in the economics that have to be applied if the methodology of management of economic efficiency of investment projects in emerging markets from Paragraph 2 is used, which resulted in certain changes of the risk analysis procedure. The study presented below defines a technique for the analysis of the assessment of economic efficiency of investment projects in emerging markets.

### 2.1. Investment risk assessment: qualitative methods

The methodology for qualitative assessment of risks associated with a project at first sight seems to be a very simple descriptive procedure, but essentially it leads to the quantitative analysis (Metodicheskie..., 2000). The main goal for the qualitative approach is to reveal and identify all possible types of project risks associated with the project under consideration. In addition it is necessary:

a) to identify and describe causes and factors contributing to the rate of this type of risk;

b) to describe and provide the cost estimate of a possible damage from the risk;

c) to suggest a system of counter-risk measures and estimate their cost equivalent.

The qualitative analysis of investment project risks is done at the stage of investment feasibility study; a mandatory comprehensive examination of the investment project helps accumulate a lot of necessary information for the subsequent analysis of its risks. In the process of qualitative assessment of project risks it is crucial to examine the causes for these risks and factors influencing their dynamics. This has to do with the next stage of a qualitative approach procedure – i.e. description of potential damage from these risks and their cost estimate. Since project efficiency estimates are based on simulation of its cash flows whose volume can change due to realization of any of such risks, than at this stage it is important for a project analyst to carry out the quantitative evaluation of consequences expressed in cost values, and in addition to this – the assessment of counter-risk measures to be suggested at the next step of the process. Risk countermeasures can be called "methods that allow for managing the risks of an investment project". It is important to choose the right methods for project risk reduction, because it is the correct and effective risk management that helps reduce the damage that may arise during the project implementation, and in addition to this it allows us to reduce the general risk of the project.

The main advantage of the expert evaluation method is that we can draw upon experts’ expertise during the process of project assessment and take account of various qualitative factors. The method of expert evaluation has for itself a package of logical and mathematical statistical techniques and procedures related to the work of an expert-analyst who processes the data necessary for decisions analysis and decisions-making, and also for taking account of various qualitative factors. In practice, a number of formalized procedures for the expert assessment of risks are used (Mitroff, 2000).
One of the simplest practical expert methods for risk analysis is the SWOT standing for "Strength, Weakness, Opportunity, Threat". This is a qualitative approach based upon comparison ("weighing") of opposite characteristics of the project, which allows for a vivid demonstration of the project’s strengths and weaknesses, its perspectives and risks.

Upon examining the project's documentation and business-plan experts carry out the assessment of those of its factors (e.g. on a 10-point scale) that can be controlled for risk. The higher the rate, the stronger the risk. Like a number of other expert methods, this approach can not be called quantitatively precise, but still it allows for a comparison of various project factors. The risk zone of the project being assessed points to deficiencies in the project concept in what concerns its management and financing. Further development of this technique is achieved via graphical construction of the risk zone that would reflect how risk factors are ranged.

The second version of the expert approach implies estimation of the threshold value on a 100-point scale for each of the risk types, and also if necessary a graded estimation on a 10-point scale of the experts’ competence. The expert assessment of risks is to be done with regard to risk event probability (in unit fractions) and to the threat this risk poses to the project’s success (on a 100-point scale). The average score of risk event probability is used as the benchmark. The value of this coefficient indicates that a risk event will take place. After controlling for independent (simple) risks and planning counter-risk measures, a ratio of the distribution of probability of a risk event to the benchmark value can be introduced.

The expert interview method brings more convincing results with it if it includes the following:

- expert opinion assessment,
- assessment of the coherence of information provided by the experts,
- identification of maximum risk factors, i.e. those elements of the investment project that got the lowest score,
- analysis of the scoring scale in defined weighting patterns (i.e. evaluation of the project rating, which is particularly important if alternative projects are on the desk), at the same time the choice of weighting patterns may also be the object of an additional assessment.

The Delphi method is one of the methods of expert assessment of risks described above. Its characteristic features are anonymity and feedback control. For the members of the expert board it means anonymous participation in the risk assessment procedure, as the experts can not discuss the answers to questions asked. This system helps avoid group decisions and ensure that no leading individual opinion will prevail. Processed and generalized results via the feedback control system are given to each of the expert board's member. This helps avoid possible psychological discomfort that may be linked to the fact that each assessment is personified. At a later stage the assessment may be repeated. The quality of the expert assessment of project risks to a great extent depends on the choice of experts.

### 2.2. Investment risk assessment: quantitative methods

The quantitative assessment of investment risks is in fact a continuation of the qualitative one. It implies:

- reliance upon the benchmark version of the project calculations,
- prior completion of a full-scale qualitative analysis.

Quantitative assessments of investment project risks are linked to the numerical determination of the rates of individual risks and of the general project risk. In the process of quantitative analysis we use tools offered by the probability theory, mathematical statistics and the operations research theory. The quantitative analysis means numerical determination of the degree to which the changes of project risk factors checked for risk impact the behaviour of project efficiency indicators (Teplova, 2006).

#### 2.2.1. The method of discounting of the project risk assessment

The method of discounting of project risk assessments relies upon the procedure of normalizing all future earnings of the project (including dividends and net depreciated value of assets) by "today’s cost". The discounting procedure defines the expected income generated after the decision to invest was taken. Its absolute value will be less that the nominal value of all future transactions that can be made during the project implementation. For a detailed description of how this method of discounting is to be applied see the publication by UNIDO and (Metodicheskie , 2000). The key parameter for this method is the discount rate that can be defined by a number of ways. Its value is dependent upon the two following key factors: the risk-free rate and the investment risk markup/premium.

For each planning interval (year, quarter) discounting factors are defined:

\[ DF_i = (1 + DR)_i \]

with:

- \( DF_i \) – discounting factor for planning interval \( i \)
- \( DR \) – discount rate according to the defined planning interval

\( i \) – serial No. of the planning interval provided the beginning of the project is marked as "zero".

Using the obtained values of the discounting factors you can define the NPV – net present value of the project by the formula:

\[ NPV = NCV_0 \cdot DF_0 + NCV_1 \cdot DF_1 + \ldots + NCV_n \cdot DF_n \]
n – total No. of planning intervals
NPV – net present value
NCVi – net cash flow by the end of the i planning interval (positive or negative)
NCVn – net cash flow by the end of the final planning interval
DFi – discounting factor for planning interval i
DFn – discounting factor for the final planning interval

The interim net cash flows are defined by the formula (can have different level of detail):

\[ NCV_i = \text{Profit}_i + \text{Depreciation charges}_i + CI_i + \text{Taxes}_i \]  
\[ \text{(1)} \]

with:
Profit – profit for the i planning interval;
Depreciation charges – depreciation expenses;
CI – investment costs;
Taxes – taxes.

The final net cash flow (NCVn) also includes the net depreciated value of assets (capital and floating stock).

If the net current value of the project calculated by formula 1 is 0, then it means that the investor will repay his/her expenditures but gain no profit. The higher the NPV value, the more attractive the project for investment. If its NPV is negative, then the project will be loss-making, and it is recommendable not to implement it.

The choice of the method for calculation of the discounting rate depends on the type of cash flow. If the cash flow is positive, then you have to apply the method of weighted average cost of capital; if this is the owner’s capital cash flow, then use the method of cost estimation for owner’s capital. Cash flow surplus is the sum of net disposable income + depreciation + other balance sheet items. From this sum the investment into the capital and floating stock are deducted. Loan interest and any changes in the long-term debt balance shall not be taken into account. The owner’s capital cash flow differs from the previous one in that loan interest and other debt interest are deducted from it. So this is the way to calculate the value of cash flow getting into the hands of the owners of the capital or shareholders. In either case the cash flow may be calculated before or after the income tax deduction.

Calculations may be done both in effective and nominal prices (i.e. prices not adjusted to inflation). Most adequate is the assessment of investment projects by calculation on the basis of owner’s capital cash flow after the deduction of all taxes. Besides, it is necessary to consider applying the discount rate to the actual cost, i.e. you should take the inflation component away from it.

To get a complete picture of the investment risk assessment problem, let us consider two of the most popular approaches to the definition of discounting rate for owner’s capital. These are the CAPM – Capital Asset Pricing Model (also called the β-coefficient model), and the "build-up"/cumulative model. In either case risk adjustment is done by calculation of relevant corrections for the discount rate. The description of the models is given in compliance with the World Bank guidelines on the matter.

2.2.2. Capital Asset Pricing Model (CAPM)

The Capital Asset Pricing Model is based upon the perception that any additional risk for the investor is reflected by the rise in the expected return rate for the project. The volume of the expected return on owner’s capital and a relevant discount rate are defined by the following three items: the risk-free return rate, coefficient β and the market risk premium (Blank, 2003; Dubinin).

The CAPM in its classical version is defined by the following equation:

\[ Rc = Rf + \beta \cdot (Rm - Rf) \]  
\[ \text{(2)} \]

with:
Rc – expected return (discount rate) in the owner’s capital
Rm – average market return rate
Rf – risk-free return rate.

A difference between the average market return rate and the risk-free return rate is called the market risk premium. It means assessing additional risks for the optimum investment of funds into market assets (shares, bonds, deposits, etc.) in comparison with the so called risk-free investments. The size of the market premium reflects the weighted risk of a diversified market portfolio. The β-coefficient defines a systematic risk of a company balanced against the average market risk. A modified version of the CAPM also takes account of the non-systematic risks or a firm that depends upon the company’s structure and management characteristics.

The modified equation of the CAPM model looks as follows:

\[ Rc = Rf + \beta \cdot (Rm - Rf) + E \]  
\[ \text{(3)} \]

with:
E – Increase of the discounting rate resulting from the non-systematic risk.

It seems worth telling here about the peculiarities of the CAPM method if foreign investment is in question. Parameters included in the CAPM equation vary for different countries. Thus, the value of risk-free rate for Russia is higher than in the USA. There are more than one approach to taking account of these circumstances, which shall be discussed later. In most cases the risk-free return rate is defined on the basis of the return rate on government bonds, because they have a very low insolvency risk and a high degree of liquidity. Besides, when defining the risk-free return rate for these types of assets usually account is taken of the long-term inflation exposure.
The 2008 financial crisis in Russia brought about corrections to these rules. Russian government bonds virtually ceased to be profitable and liquid. Amidst the crises, it is necessary to use other criteria for calculation of the risk-free rate for investment in Russia (Koshechkin).

In the CAPM model, there are two types of risk: the systematic and non-systematic. The systematic risk is related to general changes in the equity market produced by macro-economic and political factors (rises or drops in the base rate, inflation exposure, shifts in state policy, etc.). Exposure to these factors to a certain degree impacts all companies in a country. In the CAPM model, the systematic risk is measured by the \( \beta \)-coefficient that defines to what degree the global factors described above impact the fluctuation range of the value of the chosen assets. At the equity market, the \( \beta \)-coefficient is a measure for the range of prices of company’s shares balanced against the general market fluctuation measured for a diversified market portfolio. An equation for the \( \beta \)-coefficient is as follows:

\[
\beta_i = \sigma_{im}/\sigma_{2m}
\]

with:

\[
\beta_i \quad \text{-- \( \beta \)-coefficient for i-share}
\]

\[
\sigma_{im} \quad \text{-- covariance between the return on the i-share and the return on a diversified portfolio}
\]

\[
\sigma_{2m} \quad \text{-- return variance of a diversified portfolio.}
\]

The average market risk rate corresponds to the \( \beta \)-coefficient that is equal to ‘1’. If the \( \beta \) for a company exceeds ‘1’, this means that this investment may be associated with a higher risk rate that the average. Accordingly, if \( \beta < 1 \) then this reflects a lesser variability of the company’s shares and therefore a lesser risk. Negative \( \beta \) means a tendency that is opposite to the market trend: if the market is rising, then the shares are falling, and vice versa.

The non-systematic risk is linked to the specific financial performance and business procedures of this particular company. Rate fluctuation resulting from the non-systematic risks do not depend on the market situation. The non-systematic risk results from the following situations:

- entrepreneurial risk linked to company’s management, competitiveness, cost control, etc.
- financial risks linked to the asset liquidity rate, external and internal debt indexes, asset turnover, etc.
- entrepreneurial risks linked to the management of sales and of supply of raw materials/component parts.

If the company's shares are listed stock, then the coefficient \( \beta \) is calculated by formula 4. Stock indexes are used as the indicator of a diversified portfolio’s return rate. For shares listed at the Russian stock market the RTS or MICEX indices are used. For companies whose shares are listed at the New-York Stock Exchange (NYSE) the Standard and Poor’s 500 (S&P 500) index is used. For companies whose shares are not quoted at the stock exchange, for a rough assessment of the \( \beta \)-coefficient its average value for similar companies of this market sector can be used (Teplova, 2006).

Besides, another method is to be used – the one based upon the analysis of different parameters of the company's activities, and on the assessment how such parameters impact the risk rate. This type of the \( \beta \)-coefficient is called a "fundamental \( \beta \)-coefficient".

The financial research and information firm Ibbotson Associates that specializes on the analysis of international capital market risks issues its annual reports on the \( \beta \)-coefficient value for different industries and service sectors by the country, region and individual large enterprise. In these reports Ibbotson Associates also offer data on risk-free rates, on the market risk premium for different countries, and on other risk parameters. The key indicators having a strong correlation with the systematic risk of a company are such indexes as the financial risks, industry risks, and macroeconomic risks (Kolisnyk).

To find the yield of the average market portfolio we’ll have to use in our calculations profitability measures for stock market indexes over a long period of time. The average yield on the Russian stock market is calculated by the RTS index. For a more precise calculation of the discount rate we will have to use the average values for the market risk premium on different financial markets over the Globe for the last 20 - 30 years. At the final stage of our calculations according to CAPM, the value for the discount rate is to be corrected subject to company-specific (non-systematic) risks. One of such factors is the size of a company in comparison with other firms in this market. According to Western analysts, for investment into smaller businesses the discount rate has to be increased by 5% minimum to compensate for additional risks (Bocharov, 2008).

Taking into account all this, the algorithm for owner’s capital discount rate calculation should be as follows:

- define the risk-free return rate
- define the coefficient \( \beta \)
- calculate the market premium rate
- assess non-systematic risk factors
- calculate the discount rate according to the modified CAPM equation.

2.2.3. Cumulative discount method

The cumulative discount method is based upon the expert assessment of risk factors. Similar to the CAPM method, here the basis is the risk-free return rate to which additional premium is added as related to the risk of making investments in this particular project. Cumulative discount rate calculation: define the risk-free rate, evaluate the size of an additional risk premium (Fainshmidt, 2012; Shkodskii, 2007; Voronov).

Subject to the assessment of individual risk factors, they
are assigned a value by the following rule: high risk corresponds to the maximum estimate, no risk is indicated by zero estimate. The resulting values are added to each other and then summed with the risk-free rate. Considerable influence upon the efficiency of an investment project is exerted by the so called country-specific risk.

2.2.4. **Country risk assessment method**

In the "International Risk Management" publication its authors give the following definition: "Country risks refer to a direct loss on material or other sort of assets invested in this country, or an unforeseen decrease of return on these assets resulting from macroeconomic, financial or social political events taking place in the country, beyond control of either private companies or individuals."

Country risks are indirectly assessed while calculating the risk-free rate specific for the country where investments are being made. The country risk can be also assessed by direct methods of which the most popular is the method of discount rate correction. Country risk assessment is very important when you have to take a decision about investments in foreign countries. The country risk assessment is done in several steps:

- definition of the key factors impacting the country risk
- choice of a country risk assessment method
- expert assessment of the contribution of different factors to the final result.

At the first step of country risk assessment, a list of factors is build that have a substantial impact upon its score. The country risk is assessed using a number of different methods: cash flow correction or calculation of the investment payback period. Most popular, however, is the method of the discount rate correction. First, the chosen risk factors are assessed on the 10-point scale and then the average weighted sum of all factors is found, whose value falls within the range of 0 to 10. The 0 score corresponds to no risk at all, the 10 score – to maximum risk. Values in the middle of the scale indicate a moderate country risk. Then, on the basis of the assessment, additional country risk premium is found that is afterwards added to the discount rate. What international experts can recommend in this respect comes down to the following: add 5% of additional risk premium for countries with a moderate risk rate (4 - 6 points) and 10% for countries with a high level or risk (7 – 10 points) (Bocharov, 2008). For a more precise calculation of a country risk you have to further specify the expert assessment of risk factors by assigning a relative weight to each of the factors showing its lesser of bigger significance in comparison with other ones.

2.2.5. **Sensitivity analysis method**

For the assessment of the impact the environment (market situation) has upon the efficiency of an investment project, a single-factor sensitivity analysis is used. The key concept of a sensitivity study is that the degree of variance of the main result-bringing parameters is compared to the variance of the model parameters (distribution of probabilities, variation ranges of some values, etc.).

Sensitivity analysis is based upon sequential and incremental change of all parameters that can be controlled for risk: at each increment only one variable is changed by the forecasted %, which leads to recalculation of the efficiency parameter. When variables are changed, then all the key efficiency indicators of an investment project are recalculated:

- net present value (NPV)
- internal rate of return (IRR)
- profitability index (PI)
- payback time (PB).

In sensitivity analysis, two main types of factors are usually singled out by their impact: value of receipts, cost value. In addition to that, we have to consider direct effect factors that impact the efficiency of investments:

- inflation rate
- sales volume in the market
- company’s share in the market
- growth potential and fluctuations of market demand for the company’s products
- mercantile price and its trends
- variable cost and its trends
- fixed cost and its trends
- necessary volume of investment
- cost of attracted capital subject to its sources and formation conditions.

In an emerging market the following factors have to be analyzed:

- time factor
- duration of manufacturing cycle
- time needed for sale of finished products
- time needed for receipt of funds from product sales (banking system efficiency, transport problems linked to payment by L/C, inter-enterprise arrears, sales terms: credit and leasing)
- the contracted payment delay period
- stock formation and management (reserve stock of finished products, reserve stock of raw materials and components, dynamically built production supplies)
- capital formation conditions.

Application of sensitivity assessment and the choice of variable components impacting the project's sustainability are defined individually for each project with regard to its specific nature. The method of quantitative risk assessment of an investment project described above allows us to study the behaviour of efficiency indicators of a project during its
risks’ analysis, when the number of possible values of the NPV is finite, but in practice there are unlimited number of scenarios resulting from the change of project risks that impact its profitability. Sensitivity analysis method has deficiencies of its own, however: difficulties with getting the adequate data providing a means of defining model parameters, impossibility to assess the uncertainty of future investment opportunities. This said we have to make a conclusion that this method is limited in its application to the assessment of investment project risks.

The results of sensitivity assessment for an investment project reflect the degree of reliability of results obtained from risk analysis. If they are uncertain, then we have to carry out one of the following:

- change the method of processing of initial data in order to reduce the results’ sensitivity;
- change the mathematical model of project risk assessment;
- refrain from doing quantitative assessment of project risks.

2.2.6. Investment project sustainability method

The situation we have examined when we need to choose a method for investment risk management gives grounds to suppose (and to prove it a little bit later) that there is no necessity to refrain from quantitative analysis, because we can use the method of investment project sustainability assessment, which is a further development of the sensitivity method (Nikolova, 2012).

The sustainability method is based upon finding those risk-factor values of a project that bring the efficiency indicator to its critical limit. It is used as a tool for risk management. Let us take the net present value (NPV) as an efficiency indicator of an investment project. If NPV = 0, then the assessed values of benefits (incomes) and costs (expenses) are equal. Similarly, the profitability index (PI) = 1 if and only if the NPV = 0. The point where discounted flows of benefits and costs of a project are equal, similarly with the case when we find a sale volume with zero profit, can be called the discounted or integral "break-even point".

This point has to be defined for different project indicators. It is found by the following formula:

\[ x_i = \{ x_i | NPV(x_1, \ldots, x_i, \ldots, x_n) = 0 \}, \]

with:

\[ x_1 \] any project parameter.

The minimum number of parameters to be analyzed -- 3, the maximum is unlimited (at the discretion of the analyst). Let us choose, for instance, the indicators most significantly impacting an investment project’s efficiency (on the basis of sensitivity analysis):

- income (inflow minus operating costs) -- R
- capital investment – cost of equipment -- CI1
- capital investment – cost of equipment installation -- CI2.

By the formula below let us calculate such values for these indicators when the project reaches its break-even point:

\[ NPV(\Delta R \%, \Delta CI1 \%, \Delta CI2 \%) = -CI(\Delta CI1 \%, \Delta CI2 \%) + PV(\Delta R \%) \]

Let us denote \( \Delta R \%, \Delta CI1 \%, \Delta CI2 \% \) as q1, q2, q3, respectively.

Sustainability zone for an investment project is a range of value sets:

- q1, q2, q3 (q1 ≤ 0, q2 ≥ 0, q3 ≥ 0),

for which the following in equation is true:

\[ NPV(q1, q2, q3) ≥ 0 \]

Let us suppose that the relative variation of a flow is defined by the relative variation of each of its component.

\[ PV(q1) = q1 \cdot PV \]

\[ CI(q2, q3) = q2 \cdot CI1 + q3 \cdot CI2 \]

where q1, q2, q3 are defined by the following formula:

If q2, q3 = 0: \( NPV(q1^*) = 0 \rightarrow q1^* = (CI / PV – 1) \cdot 100 \).

If q1, q3 = 0: \( NPV(q2^*) = 0 \rightarrow q2^* = ((PV – CI2 – CI 3) / CI 1 – 1) \cdot 100 \).

If q1, q2 = 0: \( NPV(q3^*) = 0 \rightarrow q3^* = ((PV – CI 1 – CI 3) / CI 2 – 1) \cdot 100 \).

Thus, the sustainability zone for an investment project is defined as a range of value sets of the q1, q2, q3 variables matching the following system of in equations:

\[ NPV(q1, q2, q3) ≥ 0, q1^* ≤ q1 ≤ 0; 0 ≤ q2 ≤ q2^*; 0 ≤ q3 ≤ q3^*. \]

While considering the three indicators impacting the efficiency of investment for which the NPV = 0, we’ll get the sustainability zone for an investment project as a pyramid with its base looking at us.

Then we have to analyze how the variance of the discount rate influences the sustainability of an investment project. An increase in the discount rate leads to a situation where the critical point of the analysis will be \( IRR = E \). If we carry on, then with \( IRR = E \) all the indicators will be close to 0 (how "close" depends upon the inflation rate for each of them).

Similarly, we can consider finding four, five etc. threshold values for the parameters impacting the efficiency of an investment project. With the analysis algorithm described above there will be an irregular polygon at the base of the figure limiting the sustainability zone of an investment project. With more parameters taken into, the figure at the basis will be tending to a circle, while the figure limiting the sustainability zone of an investment project (with the internal discount rate less than the discount rate) will have the appearance of a one-sheet hyperboloid.

Rounding off our review of quantitative methods for the assessment of the efficiency of investment projects in emerging markets in a risky environment, let us examine...
now the multi-factor analysis or "scenario analysis" that crowns the approach presented by the author of the paper.

2.2.7. Scenario analysis method
Risk assessment during investment project implementation is carried out by the scenario analysis method, being multi-factorial in nature. By scenario analysis we can define how a simultaneous change of all the key variables of the project related to its cash flows will impact the project's efficiency rate.

Its main advantage is that the parameter divergence is calculated with regard to their correlations. Minimum three scenarios has to be constructed as possible variants for risk assessment procedure: the pessimistic one, the optimistic one and the most probable one (realistic scenario). The main problem with this scenario-based approach is that we will have to build a model of the investment project and reveal correlations between a large numbers of variables.

Limitations of the scenario method:
- a need to carry out a serious qualitative study of the project model, i.e. to create several models each corresponding to a scenario and requiring time-consuming preparatory works in order to find and process the data;
- to a large extent undetermined boundaries between scenarios.

To do all this manually is a hard and tedious task.

Today the software market offers a number of packages capable of doing both this type of analysis and all other ones described above. One of the most efficient and user-friendly ones is the Project Expert, v. 7.16.(Nikolova, 2012) To get your analysis results you put in the data on income and expenses, and at the output you have a comprehensive analysis of efficiency, investment sensitivity and of the most probable scenarios of investment process.

III. CONCLUSION
As a conclusion it seems worthwhile to describe several parameters of a company's activity that, to the author's mind, are most important and should always be taken into account during risk assessment procedure:

1. Management quality is evaluated by the presence of a clearly cut organizational structure compliant with the modern managarial standards. Also evaluated is the presence (or absence) of redundancy/overlap in functions and human resources, duty instructions, etc.

2. The size of a company is defined by comparing its assets with the assets of firms whose shares are listed at stock exchange. According to the Listing Regulations by the Russian Trade System (RTS), the net asset value of a company included in the First Level Quotation List must be minimum 30 millions of USD.

3. Funding sources of a company are also examined to evaluate its dependency on loan capital (defined are the resilience, solvency ratio and working asset capacity), and also in order to assess the company's capability to fulfill its commitments (overall and immediate liquidity coefficients are used).

4. Product/territorial diversification are defined by the degree to which the company's business covers different regions and the range of turnout products.

5. Clientele diversification is the degree to which the company’s activity depends on several of its most important clients.

6. The profitability index of a company is calculated using the following factors: return on investment capital, return on assets, return on sales. From the assessment point of view, the first of the three factors above is the most important one.

7. Specific risks that may be significant for a company.

The net asset value of a company on the Second Level Quotation List must be minimum 3 millions of USD.

The approach towards methodology of target economical efficiency of an investment project suggested by the author of this paper allows for efficiently solving direct problems (like defining efficiency with given input parameters), and also for getting the desired economic efficiency in reversed problems while analyzing the sustainability zone for an investment project in emerging markets.

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