

RISK ANALYSIS OF PUBLIC-PRIVATE PARTNERSHIPS

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Abstract

International and domestic experience show that, in the conditions of economic instability and financial crisis, the need to address risk assessment in the implementation of national projects and programs increases. Also, forecast of results is an important aspect because of possible losses during implementation of administrative, financial, and investment activities of Russian companies, which are involved in public-private partnerships (PPP). The problem of quantitative and qualitative assessment of risks in times of economic instability has recently become even more relevant. In this paper authors proposed a new method of risk assessment for implementation of national projects. The proposed method allows determining the riskiness of investment projects for decision makers and public stakeholders, such as regional and federal authorities. Taking into account the specifics of the state's involvement, authors discussed a quantitative risk analysis of projects under public-private partnerships. The proposed techniques can be a basis for a further cooperation between a state and a private sector in a formation of a permanent public-private efficiency monitoring of the companies that are engaged in investment projects with public funding on a regional level.

Keywords: investment project, public-private partnership, states financing, risk, cash-flow

JEL code: B16, C02, D78.

Introduction

Direct investments in national projects, as an economic category, have a number of important functions (reproduction; the acceleration of scientific and technological progress; the restructuring of social production, and a balanced development of all sectors of the economy, and others.), which are indispensable for the normal development of the economy of any country.

In this paper, term “investments” means implementation of certain economic projects and public-private partnerships *in this program*, with the expectation to receive income in the future (Gorodnova, 2009). This approach to the understanding of the investment is traditional and

predominant both in the domestic and foreign economic literature (Gorodnova, 2012; Hoesli, Jani, & Bender, 2006; Ryabov, 2011).

In Russia, the company's investment activity is usually focused on investment in fixed capital, which amounts to over 98% of total investments. This type of investments is a combination of capital expenditures for fixed assets to renovate and expand of the production and economic potential of enterprises. According to the results of 2011, Russia has seen growth 5% in investment in fixed assets from 2010 levels.

Projects' classification, which is based on certain traits, regulations, consideration of the risk component, is needed in order to further study, record, analyze, and improve investment efficiency in the implementation of public-private partnerships.

To justify the author's methodology for assessing the risks of investment projects implemented by the state and private capital, based on the study of domestic and foreign literature, the authors have developed a classifier of investments based on the risk factor.

1 Risk assessment methodology

A key purpose of evaluation of the investment project is the most effective realization of investment strategy at various stages of its development. Evaluating the effectiveness of the project, in the framework of the selected investment strategy, the investor (government and private businesses) finds answers to the following questions: What is the estimated risk component of the investment project?

What is the total volume of capital investments, which must be provided in the investment plan and budget? In what proportions state and private business can finance investment projects (Gorodnova, 2009)?

The main sources of financing investment projects with state participation (projects implemented by public-private partnerships) is a mixture of private (enterprises and banks) and public sources (budget for projects falling within the scope of interest of the city and the state).

As practice shows, experts use three approaches to assess risk in justifying the efficiency of projects (Popov, 2011): intuitive, factor, and statistical. The intuitive approach in risk assessment is based on collecting and processing of data on similar projects previously implemented and is based on the level of competence of the experts in risk assessment.

To assess the level of risk using factor method, the overall risk of the investment project is calculated only in cases when each risk corresponds to a specific set of factors, and the

overall risk is determined by weighted sum of these risks:

$$R = \sum k_i \times R_i(f_n) \quad (1)$$

R - the overall risk of the project; k_i – weight coefficient (risk share); $R_i(f_n)$ - the risk of investment project, function of set factor f_n , affecting the risk.

For statistical method, all statistical data regarding company’s operations is analyzed to calculate the probability of a loss.

Risk Evaluation methods should be used as a single complex. Analysts need to pay special attention to problems solving for a single risk and account for uncertainties in implementation of project with state’s involvement.

For valuation of the project, discounted cash flow method is used (Ryabov, 2011). In fact, this method is widely accepted as it is based on valuation of project costs using international standards. This method is convenient for calculations, but certain limitations and assumptions need to be met. For example, the discount rate for the project is based on the weighted average cost of capital. In addition, this method doesn’t account for changes in impact factor of risk and uncertainty, and preferences of investors in risk-system of the project.

These limitations impact valuation of the project, which depends greatly on horizon value, growth rate, and discount rate. If these parameters are not strictly defined, the value of project can be inadequate and distant from real market value. Another shortcoming comes from capital structure of the project. In this case, single project risk indicator is defined as the standard deviation of the project internal rate of return. The calculation is based on the definition of the uncertainty inherent in the cash flows of the investment project.

Tab. 1: The structure for risk analysis of the investment project

Components of the project risk				
Indicator of internal the risk Bf	Correlation coefficient Kof	Indicator of single project risk, Bo	Correlation coefficient Kor	The indicator of the market risk Br
The standard deviation of return of company assets prior to the project for execution	Coefficient correlation project profitability and yield other company assets	The standard deviation of profitability project	Coefficient correlation project profitability and return on the stock market on average	Average quadratic deviation market profitability
$Bf = \frac{(D+a+b)}{(Q_s+Q_z)}$, where D - net income firm;	$0 < K < 1$	It is calculated by Monte Carlo (Hoesli, Jani, & Bender,	$0 < \text{or } K < 1$	Calculated static method based on analysis of historical

a - Depreciation - ing deductions; b - profitability assets firm; Q S - own capital; Q Z - loan capital.		2006)		data
the project's contribution to the company's risk Vof		the project's contribution to the market risk, Vor		
Vof = (Bo / Bf) K of		Vor = (Bo / Br) or K		
Vof = 1 → internal degree of risk is equal to the average degree of risk of the project, Vof > 1 → risk of the project greater than the average internal risk Vof < 1 → risk of the project is less than the average internal risk.		Vor = Vfr → project has a high degree of market risk; Vor > Vfr → project risk more than the market average; Vor < Vfr → risk of the project is less than the market average. Vfr = (Bf / Br) By fr, Where To fr - coefficient correlation between internal and market risks and calculated statistics by		

Source: (Popov, 2011).

Sensitivity analysis reveals that changes in long-term interest rate, growth rate, and set of other valuation parameters of a project. During valuation, taking into account uncertainty comes from distribution of parameters, not the project cost. Therefore, the project cost has different thresholds for government and private business (Ryabov, 2011).

Application of Monte - Carlo method revealed that project cost and value of financial assets is more sensitive to change in profit margin than to change in expected cash flow. Modeling of forecast period requires modeling of variable nature of future profits. For example, during forecast period, risk premium is positively correlated with economic conditions in the country.

This method is applicable to an investment portfolio with specified characteristics, which require the estimation of efficiency of socially oriented project implemented through Public - private partnerships (Gorodnova, 2012; Ryabov, 2011). In these cases, cost of social projects for private business can be increased by one standard deviations risk premium.

Determining the project cost, authors assume that assets of the company have a positive value that comes from favorable market conditions and possibly additional value arising from negative market conditions. If we consider debt financing for the project as negative phenomenon and consider future cash flows till a forecast horizon, the project cost is calculated using the following formula:

$$PV_0 = \sum_{t=1}^T \frac{FCF_t}{(1+k_c)^t} + \sum_{t=1}^T \frac{k_f \times a \times D_{t-1}}{(1+k_f)^t} + \frac{TV_T}{(1+k_f)^T} \quad (2)$$

where PV 0 - project cost at time t = 0; FCFt – free cash flow for project at t time (t = 1

to T); D_t - cost of debt in time t; TV_T – terminal value in time T; k_u – cost of capital for fully-financed project unit; k_i - cost of debt before taxes; a – Tax rate.

Equation (2) is different from standard WACC DCF because, in this case, effects of debt financing are estimated separately. Also, free cash flow is impaired when government compensates a part of expenses (Hoesli et al., 2006; Ryabov, 2011). If investors have tax privileges from involvement in social projects and programs, the equation (2) can be formulated as follows

$$PV_0 = \sum_{t=1}^T \frac{FCF_t}{(1+k_c)^t} + \frac{TV_T}{(1+k_f)^T} \quad (3)$$

Authors have estimated risk of the portfolio with public financing, so the Equation (3) applies for computing the cost of social investment project. Annual FCF for forecast period, the project value at end of the forecast period, and discount rate for the project have to be identified.

For private businesses owner that is involved in social project as an investor with tax benefits, free cash flow (FCF) in a certain year t can be determined as follows :

$$FCF_t = (1-x_t) PGI_t - C_t - CAPEX_t \quad (4)$$

Where x_t – Tax rate in shares before period time t (year); PGI_t - potential gross income for a period of time t (year) ; C_t - Operating expenses for the period of time t (year) ; $CAPEX_t$ - additional investments for a period of time t (year).

PGI growth for the forecast period will be distributed evenly. It depends on macroeconomic factors (expected GDP growth, expected inflation, the demographic factor, etc.) and from certain specific features of the project (innovative and technological level of production, product quality, turnover period, the quality of a construction facility, location, infrastructure, the possibility of using leases, and etc.).

For example, the amount of cash flow in leasing is considered as function of certain types of risk, associated with implementation of the investment project. These cash flows uniformly distributed between minimum and maximum possible cash flows. The value, which is obtained by multiplying the tax corrector $(1 - x)$ and the potential gross income (PGI) for a period of time of PGI, is defined as the volume of cash inflows, which are expected from the most effective use of the object when it is rented. To simplify the calculation, the amount fully or partially unpaid rent is not taken into account. Cash outflows are defined and include current costs, operating costs, principal and interest on debt, taxes, insurance, etc. As a rule, additional investments are

made for further modernization of the object of investment or quality improvement. During assessment of efficiency and risk of the project, complexity and accuracy of modeling of future cash flows greatly depends on accuracy of evaluation of additional investment.

In normal market conditions, the net present project cost must be a basic parameter for calculation of market cost of investment at the end of the forecast period. To reduce likelihood of deviations in estimation of the project cost, free cash flows of previous period are necessary. For this reason, modeling of future cash flows is done, using average arithmetical free cash flows of the last few years.

As a rule, never ending increase of cost of capital is connected to rising inflation, but this growth rate can become negative as the investment object ages. Therefore, in countries with a low level of inflation, the growth rate of the cost capital is low or even close to zero. In the opposite case, project cost might be too high for the level of potential growth income (of PGI) at the end of the forecast periods. In the other words, under normal market conditions, income factor should be used to assess project cost. Income factor has the following form

$$TV_0 = \frac{FCF_{T+1}}{k_u - g} = \frac{((FCF_T + FCF_{T-1} + \dots + FCF_{T-(T-1)})/T) \times (1 + g)}{k_u - g} \quad (5)$$

FCF_{T+1} - free cash flow for period (T + 1) ; k_u - the discount rate ; g - growth rate ; The T - forecast period.

In forecasting the expected income for the project, discount rate is assumed to be a variable value, which depends on market interest rates. For one fully financed unit of production, discount rate is higher than the refinancing rate, but lower than the rate of return of the stock market.

$$i_r < k_u < k_s \quad (6)$$

Where i_r – refinancing rate, %; the k_u - the discount rate for one fully financed unit of the project, %; the k_s - the rate of return of the stock market, %.

Discount Rate the k_u can be identified as risk free plus a risk premium of the investor:

$$i_r < (k_u = i_r + B_0) < k_s \quad (7)$$

Where B_0 - premium for a single risk, %.

Premium for a single risk for Investor B_0 is between two limits and will be always a positive value. Specific characteristics of location (country) and a set of basic parameters for the project make premium change. This premium can be calculated in the following way

$$B_0 = r_1 + r_2 \quad (8)$$

The first component r_1 depends on the impact of implemented project on industry market. The second component r_2 is a function of the project specific features, which take into account several sources of Risk (location, quality and etc). To calculate the premium r_2 , you need to build linear system of estimates, the accuracy of which will depend on availability of reliable information on market (Hoesli, Jani, & Bender, 2006).

The next calculation takes place, if government strictly defined the basic parameters of project (for example, the quality of raw materials, quality and timing of construction, location and etc.). In this case, a private investor considers project as riskless or with low risk. Valuation parameters will partially depend on one another.

As a rule, an increase in interest rates should cause a reduction in the project cost, and vice versa. However, the rising interest rate not only causes increase in debt interest payment, but also increases in the cost of fully financed unit of production. Therefore, an increase in payments (for example, rental) can occur.

In this article, the hypothesis of a positive correlation between interest rates and rent payments and hypothesis of a negative correlation between fraction of not used space (capacity) and rent payments are proposed. Further assumed, r_1 is higher when interest rates are low. This means that there is a negative correlation between the two. It is possible to account for compensation if interest rates for Landlords change.

To apply the authors' methodology for risk assessment of investment projects implemented by public-private partnership, authors analyzed the risks specific to the private sector.

During the forecast of the situation's development associated with implementation of the investment project, the project manager is suggested to use control points, which will provide feedback: the cost of improvement of the quality of works (services) associated with the use of innovation; the cost of the production process upgrade (management of new types of business); the cost of efficiency improvement for construction and installation works (services), including: in connection with the introduction of innovations; Market reaction to the implementation of the investment project; the possibility debt financing (total liquidity of the project).

2. Calculation of main risk factor

Next step is calculation of the main risk factors for the above mentioned company, which is

implementing an investment project under the PPP, which should be carried out according to the riskiness of the analysis plan presented in the Table. 3.

1. Calculation of firm risk indicator.

Net income = 338 568 thousand rubles; depreciation = 37 245 thousand rubles; the profitability of the firm's assets = 24 406 thousand. rub .; Equity = 763 017 thousand rubles; Debt = 794 161 thousand rubles.

$$Bf = \frac{(338,568 + 37,245 + 24,406)}{(763,017 + 794,161)} = 0.257 \quad (9)$$

2. Calculation of the correlation coefficient Kof. The correlation coefficient between the project's yield and yield of assets Kof is 0.2. This value comes from the ratio of the marginal profitability and real profitability of assets. The size of this indicator is sensitive to the fact that existing fixed assets will be used, composition of current assets (buying new raw materials and materials) can happen, the risks of unfinished work may increase.

3. Single risk indicator B₀.

$$B_0 = 0,4(0,6) + 0,1(0,15) + 0,15(0,3) + 0,1(0,1) + 0,7(0,08) = 0,366 \quad (10)$$

This figure is high and describes the difficulty of getting the average profit realized by the investment project. This is primarily explained by the socio-economic orientation of the project

4. Correlation coefficient K is equal to 0.3. This indicator describes the relationship between the rate of return for the project and market rate of return and is fairly low. As a result, one can conclude that this construction project is for the Northern region of Russia, which has its own specific features.

5. Definition of market risk indicator. According to statistics, the standard deviation of market returns in construction industry Br is about 0.45, but, in the conditions of public - private partnership, this indicator is 0.25.

6. The calculation of the contribution of the considered investment project in riskiness of the company $V_{of} = 0.2 (0.366 / 0.257) = 0.285$. This value indicates that risk of the proposed project is below average internal risk. This fact favorably affects the financial condition of the enterprise.

The discount rate takes into account the investor risks associated with the project and can be justified as follows:

$$r = r_f + \square Dr = 0.079 + 0.29 = 0.369 \quad (11)$$

where r_f – risk free rate, which is equal to an rate of return on sovereign debt of the country, in fractions of units; Δr – risk premium ($V_{of} = 0.29$) for additional risk of the investor.

By 2020, Net Present Value of the project will be + 0.758 billion rubles. In fixed prices, payback period of this investment project will be approximately 3 years. If we account for time factor of money, payback period will be 5,5 years.

The internal rate of return IRR is greater than discount rate. In this Project IRR exceeds r by 5.1 %:

$$D/IRR = \left[\sqrt[7]{(1.82 + 0.758) / 1.82} \right] - 1 = 0.051 \quad (11)$$

In this case, internal rate of return IRR for the project will be $IRR = 36.9 \% + 5.1 \% = 42 \%$.

Profitability index will be

$$PI = \frac{(PV_0 + \dot{a} NPV)}{PV_0} = \frac{1.82 + 0.758}{1.82} = 1.42 \quad (12)$$

This index is greater than 1.0, so the project is effective.

In general, all calculated indicators comply with criteria of efficiency of the investment project.

7. Project's contribution to the market risk :

$$V_{or} = 0.3 (0.366 / 0.25) = 0.44, \quad V_{fr} = 0.3 (0.257 / 0.25) = 0.31$$

Since the inequality $V_{or} > V_{fr}$ or $0.44 > 0.31$ holds, project risk is above the market average, and higher than the internal rate of return ($0.44 > 0.42$). These values confirm the high social significance of the proposed investment project.

Conclusion

Conducted calculations show that project risks are lower than internal risks of analyzed construction company. Implementation of this project will improve financial sustainability of the enterprise, which operates as public - private partnership.

The proposed methodology allows determining the riskiness of investment projects for decision makes, a quantitative risk analysis of the implementation of public-private partnerships project, accounting for the specifics of participation of the state. The proposed tool can become a basis for further work of the state and the private sector in the implementation of a permanent

public-private efficiency monitoring of the companies in the implementation of investment projects with public funding on a regional level.

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