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# Effect of Risk on Evaluating the Financing Methods of New Technology-Based Firms

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**KEYWORDS**

Risk analysis;
Monte carlo simulation;
Partnership;
Project portfolio financing;
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**ABSTRACT**

*Innovation & Prosperity Fund (IPfund) in Iran as a governmental organization aims to develop new technology-based firms (NTBF) by its available resources through financing these firms. The innovative projects, which refer to IPfund for financing, are in a stage which can receive both fixed rate (debt financing) facilities and partnership in the projects, i.e., profit loss sharing (PLS). Since this fund must protect its initial and real values of its capital against inflation rate, this study, hence, aims to examine suitable financing methods considering risk. For this purpose, risk assessment models are studied concerning how to use risk-adjusted net present value for knowledge-based projects. On this basis, the NPV of a project is analyzed by taking into account the risk variables (sales revenue and the cost of fixed investment) and using Monte Carlo simulation. The results indicate that, in most cases, the risk-adjusted NPV in the partnership scenario for a project is more than that in other scenarios. In addition, the partnership in projects, demanding for industrial production facilities, is preferable for the IPfund than that in projects calling for working capital.*



## 1. Introduction

The primary role of the government's support in financing innovation systems is an important issue. Support of new technology-based firms (NTBFs) and entrepreneurship projects is known as the basic element of knowledge-based economy in many countries, and attempt has been made to design and present a diverse range of services and support in accordance with the need of these developing companies.

Every government has different methods for financing knowledge-based projects whose common programs are fixed rate (debt financing) facilities and partnership (PLS); therefore, suitable mechanisms should be sought for financial resource allocation. This study examines and compares two methods of financing, i.e., partnership and fixed-rate facilities, for these types of projects to pick out the suitable one for projects. For this purpose, the project that has been supported by a governmental organization has been considered herein, named Innovation & Prosperity Fund (IPfund) in Iran.

New models for financial analysis try to consider risk factors within the net present

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value. The main objective of this study is to make a comparison between the two types of financing methods in new technology-based projects, considering the risk in net present value analysis. The current paper is organized as follows. The following section is a review of literature relevant to financial analysis, considering risk and articles related to financing strategies of NTBFs. Next, the proposed method along with the description of project cash flows and risk variables is elaborated. The final section is dedicated to the results of our research.

## 2. Literature Review

Net present value (NPV) is still the widely used tool for decision-making in financial analysis and investment; however, some controversy remains concerning the existing, unexplored problem of uncertainty and project flexibility. To determine the impacts of varying assumptions in the NPV model, sensitivity analysis can be used; however, defining the impact of risk on those assumptions is a difficult task. A decision tree, which uses probability-based expected monetary values (EMV), is more conforming with the multi-stage nature of development; however, implementing it can be time-consuming and complex. Real options can provide us with an emerging alternative to decision trees: a technique that applies the theory of financial options to non-financial assets and encourages managers to consider the risk of investments that can be held, hedged or transferred. In the development process, the required information for constructing the real option models may not be readily available, making this method unpopular in practice [1].

To deal with the stage-gate decision process, Davis [1] developed the net present value risk-adjusted (NPVR) framework which addresses critical risk factors in traditional return on investment (ROI) models. NPVR is a gate-three tool that weighs risk in terms of market, technique, and user by questioning the business plan holders and assesses investment decisions in six key areas of value chain, market segment, innovation, capabilities, interaction, and specification. The risk scores of the NPVR model identify high, medium, or low rate of success after converting the qualitative assessments into numerical values through a consensus. Based on a 1-to-5 scale, this model assigns a high chance of success to rank 5 and a low chance of success to rank 1.

Herath & Kumar [2] introduced copula-based Bayesian analysis for capital budgeting. In the case of decision-making under uncertainty, using all available information is cautiously needed, particularly when financial issues can be affected by a decision's consequences. In traditional approaches, to estimate parameters of population models, parameters were assumed to be fixed. An alternative approach is the Bayesian model, which assumes that the population model is random and quantity parameters are not fixed; this approach has been used in capital budgeting to evaluate sequential investment decisions. Bayesian models complement decision theory and real option analysis in capital budgeting.

Farr et al. [3] applied simulation-based costing (SBC) to perform risk evaluation in an environmental remediation project. By considering cost distributions and, then, conducting simulations of various cost distributions repeatedly, SBC provides the total cost risk profile and helps decision-makers estimate the expected cost range interval and associated level of confidence, which is changeable as needed.

Having evaluated the governmental investment projects, Gradl et al. [4] incorporated a set of risk factors into the net present value and addressed a matrix framework to assess risk levels.

Ye & Tiong [5] introduced the NPV-at-risk method derived from the value-at risk model, except that the former mostly focuses on market risk. NPV-at-risk was defined as the minimum expected return of a project at a specific confidence level. When using the NPV-at-risk method for evaluating a project, there is a decision rule: that the project is acceptable with a confidence level of 1-α if the NPV-at-risk at the given confidence level is greater than zero.

The NPV-at risk method, which combined the weighted average cost of capital (WACC) with dual risk-return methods, is used for financial assessment. It requires probability distributions of variables and is useful in risk evaluation of privately financed infrastructure projects [6].

Gong [7] applied a risk control model to investigate the variability of cost and inflation during the whole operating period, proving that the risk can be controlled by adjusting the consumer price index and cost parameter.

Ke et al. [8] proposed the currently financial evaluation methods for a public-private partnership (PPP) project just to represent and evaluate benefits of the private sector. Hence, to fill this gap, they developed an equitable financial evaluation method considering the inherent characteristics of PPP projects by applying six separate indicators and Monte Carlo simulations. By means of the NPV-at-risk and IRR-at-risk methods and using confidence levels and discount rate concepts, they analyzed the risk of achieving more equitable results for both parties, including the PPP project, and also estimated a reasonable public sector comparator (PSC).

Kuo & Lu [9] categorized three procedures often used in project risk assessment: first, probability analysis techniques include sensitivity analysis, basic probability analysis, decision-tree analysis, and Monte Carlo simulation techniques. Second, interval analysis is the second procedure which gives an acceptable range of results estimation according to the ranges of the input variables. In addition, the third approach is fuzzy set theory which has been used recently to solve uncertainty problems, especially when probability information is limited and when the boundaries of variables are not obvious. Kuo & Lu [9] employed a fuzzy multiple criteria decision-making (FMCDM) approach to systematically assessing risk for a metropolitan construction project.

Applying a dynamic structural model of the firm, Gamba & Triantis [10] analysed the value of alternative financing strategies. They showed that a simple debt contract designed to restrict financing or investment behaviour could decrease agency costs quite effectively. By using a heuristic policy, they found that firm values could be quite sensitive to the exact specification of financing policies in a dynamic setting.

Conti et al. [11] showed how to select a startup portfolio in a venture capital (VC) in the case of shortage of financial resources and to decide the best investment strategy. Francois & Hubner [12] considered investor choice, share of investment, and equity dilution to be quite factors that affect an optimal contract of the entrepreneur. Based on their study in the portfolio approach, the investor choice is dictated by project size and risk, entrepreneur's risk aversion, and investor's funding characteristics. Fulghieri & Sevilir [13] also showed that, in the investment strategy of a venture capitalist (VC), the portfolio size and scope could influence both entrepreneurs' and the VC's incentives.

In financing strategies, Peng et al. [14] compared the advance payment containing a risk compensation mechanism with bank loan financing, and found that when the capital deficit is small, the investor can do better with the bank loan financing, despite the fact that a higher interest rate needs to be paid in this case. In their research, Minola & Giorgino[15] compared the capital requirements of NTBFs and SMEs by determining the role of bank and venture capitals in the fund-raising process.

In their article, Robe & Coleman [16] compared the financing strategies of women and men who owned NTBF, and found that women used a significantly higher level of external debt and a significantly lower level of external equity during the start-up year.

Milona et al. [17] considered the financing patterns of NTBFs by extending the pecking order theory and examining the effect of human capital as determinants of financing decisions.

## 3. The Proposed Method

Based on Ye & Tiong [5] work, the NPV-at-risk method is the difference of the mean value and multiple standard deviations. It can be expressed as deviations from the mean NPV in units of the standard deviation

$$\text{NPV-at-risk} = \text{mean NPV} - Z(\alpha) \cdot \sigma \qquad (1)$$

where $Z(\alpha)$ is the number of units of standard deviation corresponding to the given confidence level; for example, at the 95% confidence level, $Z(\alpha) = 1.65$. This means that 95% of possible outcomes fall within the range of $\mu - 1.65\sigma$ to $\infty$.

To calculate the risk-adjusted NPV, Gradl et al. [4] applied the certainty equivalent value (CEV) model based on the work of Ridlehoover[18], as shown in Equation (2).

$$CEV = E[x] - R\,\sigma[x] \qquad (2)$$

where E[x] is the expected value of NPV from Monte Carlo simulation, R is the combined risk factor as shown in equation (3), and σ[x] is the standard deviation of NPV from Monte Carlo simulation.

$$\sum_{i=1}^{k} W_i R_i \quad (3)$$

where W is the decimal equivalent of factor weight, R is the risk factor, i is the factor that involves sales revenue and investment cost), and k is the total number of factors.
In this article, to apply the CEV model to finally compare the risk-adjusted NPVs of two financing methods for NTBFs, the primary steps are followed as presented by Gradl et al. [4]. The first step is to develop appropriate weights for each of the factors selected for the risk model. These weights should be normalized in a decimal format. The next step is to develop and apply a rating system to each of the risk factors in each of the options. The third step is to develop the overall risk factor.
In IPfund, the projects are divided into two categories: start-up and non-start-up companies. For start-ups, Qarzol-Hasane (money is loaned without interest) facilities are dedicated with the rate of 4% and up to 3000 million Rials. In this research, only the projects of non-start-up companies, which require at least 5000 million Rials of initial investment, with available data (some projects with missing or incomplete data was ignored) within the commencement of IPfund activity till July 2015 (i.e., approximately within one year) have been selected. In addition, the status of projects should be approved in a committee including IPfund board of director to consider this research.

## 4. Description of Project Cash Flow

1-Fixed rate (debt financing) Facilities:
Currently, for supporting NTBFs, IPfund dedicates its financial resources to some facilities with rates less than bank loan rate. For instance, it is shown in Table 1 for a project in technology scope of electronics and control.

**Tab. 1. Facilities proposed for Project No.1**

| Item | Description |
|---|---|
| Amount of facility | 36000 million Rials |
| Kind of facility | Long term- industrial production |
| Payment period | 9months(summer, autumn, winter 2015) |
| Breaking time | 3 months |
| Repayment period | 45 months |
| Number of instalment(N) | 15 (every 3 months) |
| Interest rate(i) | 14% |
| Discount rate | 22% ( equal to bank rate) |

To calculate the project NPV, it is required to consider the payment amount of facility by IPfund and repayment, i.e., the instalment by NTBF in the cash flow. The payment is an inflow and repayment is an outflow. Since the instalment is quarterly, the interest rate should be quarterly, too. Based on this assumption and P to A factor: $A = p\left[\frac{i}{1-(1+i)^{-N}}\right]$ (4), the amount of each quarterly instalment would be 3125.70 million Rials. Table 2 shows the cash flow of project No.1 in the case of receiving fixed rate (debt financing) facilities.

**Tab. 2. The Cash Flow of Project No.1 When Receiving Fixed rate (debt financing) Facilities**

| Year | Sales revenue | Facilities amount | Cost | Instalment | Inflation rate | Inflow | Outflow | Net cash flow |
|---|---|---|---|---|---|---|---|---|
| 0 | 0 | | 120663 | | 0.190 | | 120663.0 | -120663.0 |
| 1 | 116000 | 36000 | 82560 | | 1.190 | 174040 | 98246.4 | 75793.6 |
| 2 | 127250 | | 103,864 | 12,503 | 1.416 | 180198.7 | 159584.6 | 20614.1 |
| 3 | 149750 | | 115,440 | 12,503 | 1.685 | 252352.6 | 207037.6 | 45315.0 |

| Year | Sales revenue | Facilities amount | Cost | Instalment | Inflation rate | Inflow | Outflow | Net cash flow |
|---|---|---|---|---|---|---|---|---|
| 4 | 183500 | | 133,406 | 12,503 | 2.005 | 367979.7 | 280027.1 | 87952.7 |
| 5 | 228500 | | 157,858 | 9,377 | 2.386 | 545281.8 | 386082.1 | 159199.7 |

Note: The NTBF are tax-free; figures are in million Rials

The cost of year 0 is related to fixed investment cost followed by annual operational costs. In year 5, the project is in its 100% production capacity. Except the cost amount of facility and instalment, all costs and revenue are inflated since year 1. The average inflation rate based on the Central Bank of Iran in a period of 10 years (2005-2014) is 19%.

2-*IPfund Partnership:* Therefore, the required resources of investing in projects are financed by IPfund partnership. The cash flows are the same as the previous financing method, except that the financing costs are borne by both parties, i.e., IPfund and NTBF. Therefore, it has been removed from the project cash flow, as shown in Table 3.

**Tab. 3. The Cash Flow of Project No.1 in the Case of Partnership**

| Year | Sales revenue | Cost | Inflation rate | Inflow | Outflow | Net cash flow |
|---|---|---|---|---|---|---|
| 0 | 0 | 120663 | 0.190 | | 120663.0 | -120663.0 |
| 1 | 116000 | 82560 | 1.190 | 180880.0 | 98246.4 | 39793.6 |
| 2 | 127250 | 103,864 | 1.416 | 180198.7 | 164787.0 | 33116.9 |
| 3 | 149750 | 115,440 | 1.685 | 252352.6 | 215604.0 | 57817.8 |
| 4 | 183500 | 133,406 | 2.005 | 367979.7 | 292596.7 | 100455.5 |
| 5 | 228500 | 157,858 | 2.386 | 545281.8 | 399082.1 | 168576.8 |

## 5. Introduction of Risk Variables

To evaluate the projects in terms of uncertainty, when the forecast cash flow of the project with certainty does not occur, it is necessary to identify risk factors of projects. After determining the probability distribution of the variables specified to be used in Monte Carlo simulations, the risk-adjusted NPV in both PLS and fixed rate (debt financing) facilities is calculated, and the results are compared.

One of the major risks associated with knowledge-based projects is sales revenue that may face the prediction of product market with fluctuations and risk. Another factor with exposure to risk is the risk of capital expenditure, because the estimation of capital for project investment comes with uncertainty. For example, in some projects that request industrial production facilities to purchase machinery and equipment, if they need to import certain relevant equipment, the exchange rate fluctuations expose investments to risk.

Gradl et al. [4] applied five variables to the Monte Carlo simulation: government labour rate increase (%), government inflation-interest rate (%), contractor labour rate increase (%), material cost increases (%), and contractor MARR value (%), and assumed triangular distribution for these factors. Ye and Tiong [5] used the following risk factors in the investment evaluation, as shown in Table 4.

**Tab. 4. Probability Distribution of Risk Variable in Study of Ye & Tiong [5]**

| Variable | Distributional assumption |
|---|---|
| Construction cost | lognormal ($\mu$, $\sigma^2$) |
| Completion time | lognormal ($\mu$, $\sigma$2) |
| O&M cost | lognormal ($\mu$, $\sigma$2) |
| Market demand | normal ($\mu$, $\sigma$2) |
| Sale price | normal ($\mu$, $\sigma$2) |
| Inflation rate | normal ($\mu$, $\sigma$2) |
| Foreign exchange rate | normal ($\mu$, $\sigma$2) |
| Interest rate | normal ($\mu$, $\sigma$2) |

In this article, we assume sales revenue and capital investment as risk input variables for Monte Carlo simulation. Inflation rate is also a risk factor. However, since the observed data of inflation rate in Iran are dependent observations, the Monte Carlo technique is inapplicable, and the inflation rate has not been considered as an input variable in the Monte Carlo simulation.

**Selecting a Distribution in the Absence of Data**

One of the steps of Monte Carlo simulation is specifying the probability distribution of each input risk variable. To define a distribution for a random variable when there are no data available and no idea what the shape of the distribution is, many simulation practitioners use heuristic procedures to choose a distribution. Two probability distributions often used for this purpose are the triangular and beta distributions [19].

Since the historical data of the assumed risk variables in this research, i.e., sales revenue and investment cost, were unavailable to fit a suitable probability distribution and estimation of shape parameters (a,b) in beta distribution was impossible, in this study, it was assumed that the probability distribution for risk variables is triangular. Triangular distribution has 3 parameters: the most likely value ($M_0$) which is the mode of the distribution, most pessimistic (L), and optimistic (H).

**Risk Variable of Sales Revenue**

The estimation of year 1 for sales revenue is assumed parameter M0 of the triangular distribution, pessimistic value (L) is assumed 12% less than M0, and 5% more than M0 is defined for optimistic value (H). These probabilities are based on experts' opinion. The calculation for project No.1 has been shown below as an example:

$M_o$=116000 M.R , L= $M_o$ (1– 0.12) = 102080 M.R , H= $M_o$ (1+0.05) = 121800 M.R (5)

(MR:Million Rials)

**Risk Variable of Investment Cost**

Investment cost stands in opposite to sales revenue, meaning that, in reality, investment cost may turn out to be higher than the estimated amount, i.e., the optimistic value would be 12% more than parameter $M_0$ and the pessimistic value would be 5% less than that. The calculation for project no.1 has been shown below as an example:

$M_o$=120663 M.R, L= $M_o$ (1– 0.05) = 114630 M.R, H= $M_o$ (1+0.12) = 135143 M.R (6)

**NPV Simulation**

Gradl et al.[4] completed a Monte Carlo simulation using @Risk Monte Carlo software from the Palisade Corporation (2002). To run the Monte Carlo technique to simulate an investment project, Atthayuwat [20] used Crystal Ball Microsoft Excel Add-in. To model the risk with Monte Carlo, Mun [21] introduced the software of Risk Simulator. In this study, risk simulation was applied. The input variables were those discussed above and the output variable was NPV used for the expected value and standard deviation of it for the CEV model. Figs. 1 and 2 show the results of simulation with 1000 iterations for both financing methods proposed in this study for project No.1 as an example.

| | |
|---|---|
| Number of Datapoints | 1000 |
| Mean | 73544.0034 |
| Median | 73909.0633 |
| Standard Deviation | 6008.8583 |
| Variance | 36106378.1450 |
| Coefficient of Variation | 0.0817 |
| Maximum | 87457.5889 |
| Minimum | 55581.7446 |
| Range | 31875.8443 |
| Skewness | -0.3093 |
| Kurtosis | -0.3615 |
| 25% Percentile | 69515.6083 |
| 75% Percentile | 77992.0681 |
| Error Precision at 95% | 0.0051 |

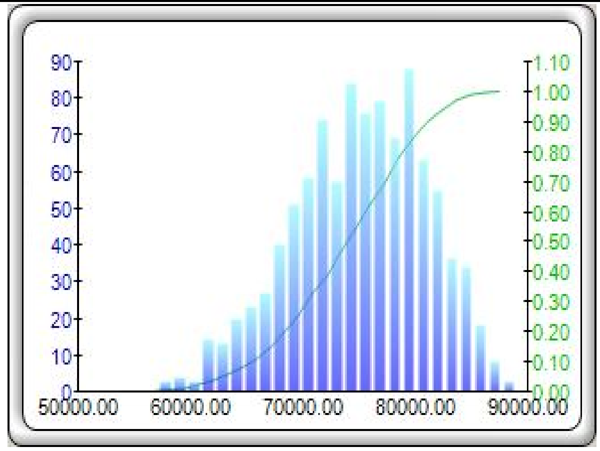


**Fig. 1.Monte Carlo simulation result of NPV in project No.1 in the case of fixed rate (debt financing) facility**

| | |
|---|---|
| Number of Data points | 1000 |
| Mean | 68434.6380 |
| Median | 68799.6979 |
| Standard Deviation | 4570.1092 |
| Variance | 36106378.1450 |
| Coefficient of Variation | 0.0878 |
| Maximum | 82348.2235 |
| Minimum | 50472.3792 |
| Range | 31875.8443 |
| Skewness | -0.3093 |
| Kurtosis | -0.3615 |
| 25% Percentile | 64406.2429 |
| 75% Percentile | 72882.7027 |
| Error Precision at 95% | 0.0054 |

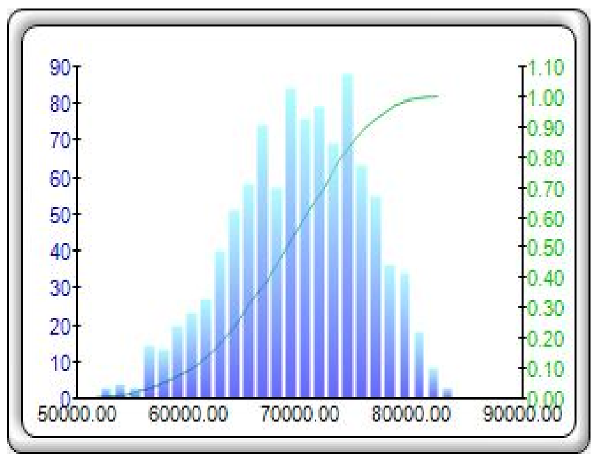


**Fig. 2.Monte Carlo simulation result of NPV in project No.1 in the case of partnership**

As mentioned in the previous section to calculate the risk-adjusted NPV, the CEV model based on Gradl et al. [4]a nd Ridlehoover [18] was used.

$$CEV=E[x] - R\,\sigma[x] \quad (7)$$
$$R= \sum_{i=1}^{k} W_iR_i \quad (8)$$

where E[x] is the expected value of NPV from Monte Carlo simulation, R is the combined risk factor, and σ[x] is the standard deviation of NPV from Monte Carlo simulation. W is the decimal equivalent of factor weight which should be normalized with summation equal to unit, R is the risk factor based on scaling 1–3 (3 being the highest risk), i is the factor that involves inflation rate, capital investment, and sales revenue, and k is the total number of factors.

Prior to the completion of any steps for the applied CEV model, the appropriate factors for this study must be decided. Different variables from the NPV variables could be applied within the risk model. In this article, the same factors as those used to run the Monte Carlo simulation, in addition to inflation rate, have been used. These factors include inflation rate, sales revenue, and capital investment cost.

The first step in the model of Gradl et al. [4] is to develop the factor weights. The factor weights are based on expert rating. The higher values mean higher relative importance of that factor. In knowledge-based projects, sales revenue is the most important factor that has the highest weight. With regard to the high fluctuation in inflation rate and its impact on the financial item of the project, the next important factor is inflation rate; afterwards, the capital investment cost is regarded. The factor weights of both partnership and fixed rate (debt financing) facilities are equal.

The next step to apply the model of Gradl et al. [4] is to determine a value for each of the risk factors and for each of the options. The scale of 1 to 3 was used with 3 being the highest risk and 1 being the least associated risk.

In the case of IPfund partnership in NTBFs, since the risk of not having a suitable market for product is borne by both parties, i.e., NTBF and IPfund, the sales revenue has a lower risk level than the other case. However, in a fixed rate (debt financing) facility, if the product sales do not occur as estimated, then the NTBF has to bear this risk by itself. Therefore, the sales revenue in the case of fixed rate (debt financing) facility has a higher risk level. The other factors, such as inflation rate and capital investment cost, are assumed to have the same risk level in both financing methods. The inflation rate was scored as 2 and capital investment cost as 1. The factor weights and risk level are shown in Tab. 5.

**Tab. 5. Factor Weights and Risk Factor Ratings for Each Option**

| Factor | Fixed rate (debt financing) Facilities | | IPfund Partnership | |
|---|---|---|---|---|
| | $W_i$ | $R_i$ | $W_i$ | $R_i$ |
| Inflation Rate | 0.35 | 2 | 0.35 | 2 |
| Capital Investment | 0.2 | 1 | 0.2 | 1 |
| Sales Revenue | 0.45 | 3 | 0.45 | 2 |

Thus, the combined risk factor for partnership is R=1.8 and is R=2.25 for fixed rate (debt financing) facility. The risk-adjusted NPV is calculated based on CEV model for all projects in two financing cases, and higher value of NPV means that the financing method is more appropriate for that project. The calculation for project No.1 is shown below as an example.

1. Fixed rate (debt financing) facility:
$CEV= E(x)-R\sigma(x)=73544-2.25(6008.8)=60024.2$ (9)
2. IPfund partnership in project:

CEV= E(x)-Rσ(x)=68434.6-1.8(4570)=60208.60 (10)

The same calculation has been done for other projects; the weight factors and risk level are defined, as explained for project No.1. The results of all the studied projects are provided in Table 6.

**Tab. 6. Risk-Adjusted NPV (in Million Rials) for Each Project**

| Project number | Kind of required facility | Risk-adjusted NPV in case of PLS | Risk-adjusted NPV in the case of fixed rate (debt financing) facilities |
|---|---|---|---|
| 1 | Industrial production | 60208.60 | 60024.20 |
| 2 | Industrial production | 156996.69 | 156634.02 |
| 3 | Industrial production | 498096.76 | 497572.65 |
| 4 | Industrial production | 11499.40 | 17676.75 |
| 5 | Industrial production | -1638.78 | 3021.53 |
| 6 | Working capital | 5607.55 | 5036.77 |
| 7 | Industrial production | 116729.78 | 116156.70 |

**Sensitivity Analysis**

In this section, the sensitivity of NPV to inflation rate and discount rate is analysed in both financing methods; moreover, in fixed rate facilities, the NPV sensitivity to interest rate is also considered, and the result is shown in Tables 7, 8, and 9. As shown in Tables 7 and 8, both methods of financing the NPV are more sensible to discount rate changes in comparison with inflation rate. In most projects, the frequencies of changes in both methods are similar; in projects No. 4&5, in the case of partnership, the NPV is much more sensible to inflation and discount rate, as compared to other methods.

The NPV sensitivity to interest rates in fixed rate facilities is considered to find which interest rate is profitable to the partner. The results are summarized in Table 9; in most projects except project no.4&6, when the interest rate exceeds 25% (i.e., bank loan), the partnership of IPfund in NTBFs projects is more profitable for the NTBFs. In project no.6, for interest rates more than 14%, the partnership is suggested; in project no.4 for every interest rate, the fixed rate facility is suggested. The main reason for such a different result is that the facilities, which demanded from IPfund, are different from the other projects in project No.6. While the other projects demanded industrial production facilities, project No.6 demanded working capital. In addition, project No.4 received loans from other financial resources except IPfund, and the annual remittance of this loan had effect on cash flow; hence, the results differed.

**Tab. 7. Sensitivity Analysis of Discount Rate**

| discount rate | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Project no.1 | | Project no.2 | | Project no.3 | | Project no.4 | | Project no.5 | | Project no.6 | | Project no.7 | |
| 0 | 240% | 278% | 583% | 586% | 328% | 334% | 148% | 227% | 615% | 1570% | 67% | 79% | 107% | 110% |
| 0.05 | 162% | 187% | 328% | 330% | 196% | 200% | 100% | 153% | 416% | 1054% | 48% | 56% | 74% | 76% |
| 0.10 | 101% | 116% | 175% | 176% | 110% | 112% | 62% | 95% | 260% | 653% | 31% | 36% | 47% | 48% |
| 0.15 | 52% | 60% | 79% | 80% | 52% | 53% | 32% | 49% | 135% | 337% | 17% | 20% | 25% | 26% |
| 0.19 | 21% | 24% | 28% | 29% | 19% | 20% | 13% | 19% | 53% | 132% | 7% | 8% | 10% | 10% |
| 0.22 | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| 0.25 | -18% | -21% | -22% | -22% | -16% | -16% | -11% | -17% | -47% | -116% | -6% | -7% | -9% | -9% |
| 0.30 | -44% | -51% | -49% | -50% | -36% | -37% | -27% | -41% | -115% | -281% | -16% | -18% | -22% | -23% |
| 0.35 | -66% | -75 | -68% | -69 | -51% | -52 | -41% | -61 | -172 | -417 | -24% | -28 | -33% | -34% |

| discount rate | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Project no.1 | | Project no.2 | | Project no.3 | | Project no.4 | | Project no.5 | | Project no.6 | | Project no.7 | |
| | | % | | % | | % | | % | % | % | | % | | |

**Tab. 8. Sensitivity Analysis of Inflation Rate**

| Inflation rate | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Project no.1 | | Project no.2 | | Project no.3 | | Project no.4 | | Project no.5 | | Project no.6 | | Project no.7 | |
| 0 | -106% | -113% | -92% | -92% | -72% | -72% | -76% | -105% | -310% | -626% | -44% | -44% | -52% | -53% |
| 0.05 | -83% | -89% | -78% | -78% | -59% | -60% | -60% | -82% | -244% | -492% | -33% | -34% | -40% | -41% |
| 0.10 | -57% | -61% | -58% | -58% | -43% | -43% | -41% | -56% | -167% | -338% | -22% | -22% | -27% | -27% |
| 0.15 | -27% | -29% | -30% | -30% | -22% | -22% | -19% | -27% | -79% | -160% | -10% | -10% | -13% | -13% |
| 0. | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |

| Inflation rate | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS | NPV% in fixed rate facilities | NPV% in PLS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Project no.1 | | Project no.2 | | Project no.3 | | Project no.4 | | Project no.5 | | Project no.6 | | Project no.7 | |
| 19 | | % | % | % | % | % | % | % | % | % | % | % | % | % |
| 0.22 | 22% | 24% | 28% | 29% | 19% | 20% | 16% | 22% | 65% | 132% | 8% | 8% | 10% | 10% |
| 0.25 | 46% | 49% | 63% | 63% | 42% | 43% | 32% | 45% | 136% | 275% | 16% | 16% | 21% | 21% |
| 0.30 | 90% | 96% | 138% | 139% | 89% | 90% | 63% | 88% | 267% | 539% | 30% | 30% | 40% | 40% |
| 0.35 | 139% | 149% | 242% | 243% | 149% | 151% | 97% | 136% | 415% | 838% | 45% | 46% | 61% | 61% |

**Tab. 9. Sensitivity Analysis of Interest Rate**

| Interest rate | %NPV in P1 | %NPV in P3 | %NPV in P4 | %NPV in P5 | %NPV in P6 | %NPV in P7 |
|---|---|---|---|---|---|---|
| 0.05 | 4.7% | 0.9% | 3% | 36% | 5% | 0.7% |
| 0.10 | 2.2% | 0.5% | 1% | 17% | 2% | 0.4% |
| 0.14 | *0.0%* | | 0% | 0% | 0% | |
| 0.17 | | 0.0% | | | | 0.0% |
| 0.19 | -2.8% | -0.1% | -2% | -21% | -3% | -0.1% |
| 0.22 | -4.6% | -0.4% | -3% | -35% | -4% | -0.3% |
| 0.25 | -6.4% | -0.6% | -4% | -48% | -6% | -0.5% |

| Interest rate | %NPV in P1 | %NPV in P3 | %NPV in P4 | %NPV in P5 | %NPV in P6 | %NPV in P7 |
|---|---|---|---|---|---|---|
| 0.30 | -9.4% | -1.0% | -6% | -72% | -9% | -0.8% |
| 0.35 | -12.6% | -1.4% | -9% | -96% | -12% | -1.1% |

## Results

When risk in financial analysis is considered possible, it is important to define relevant risk variables with regard to investment project nature and simulate the NPV in the absence of historical data for input variables; the triangle distribution is one of the choices of probability distribution of input variables. In this study, the risk-adjusted NPV is used to see check if the fixed rate (debt financing) facility is an appropriate alternative to support and finance the investment projects of NTBFs or the partnership.

According to the results, in the projects except for two of them, the risk-adjusted NPV in the case of partnership is more than that in the fixed rate (debt financing) facilities, meaning that the partnership scenario is reasonable for a project to be run by the support of NTBFs in IPfund, instead of the current method of the fixed rate (debt financing) facilities. When a project receives loan from a bank, other projects might produce varying results. Therefore, if the project receives loan from other resources, it has some effect on decision-making. The kind of facilities, e.g., industrial production or working capital, which the projects demanded for has also effect on the result.

Based on the sensitivity analysis, NPV is more sensible to discount rate than to inflation rate. In most projects, the NPV sensitivity to the parameters in the case of PLS is more than that of the other method of financing. In most projects, if the interest rate of the facilities received from IPfund is close to the bank loan rate, it is more profitable for the NTBFs to use partnership investment. Overall, it is evinced that, considering the partnership objective, the projects that need industrial production facilities are preferable to those with working capital requirement.

## Future Research

This paper did not entail and study the optimal amount of IPfund investment in projects for which the PLS is suitable, which is recommended for future studies. In addition, the suitable time of terminating the partnership in projects can be another subject for more research.

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