African Journal of Business Management Vol.5 (8), pp. 3269-3273, 18 April 2011
Available online at http://www.academicjournals.org/AJBM
DOI: 10.5897/AJBM10.1372
ISSN 1993-8233 ©2011 Academic Journals

Full Length Research Paper

Analysis of internal rate of return on investments: Dynamic and static approach

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Accepted 25 January, 2011

The success of an investment is determined and described statically and dynamically by several parameters. One of the key indicators of justification of a project implementation is the internal rate of return which is determined statically and dynamically in each project. Renowned scientific methods, such as the method of classification, statistical method and methods of analysis and synthesis were used in establishing a connection between these indicators. The obtained results confirmed the initial hypothesis about correlation and numerical values of the rate of return of investment.

Key words: Investment, internal rate of return, efficiency and effectiveness.

INTRODUCTION

The investment program is a professional prediction of future operations of the intended investment structure. Its main objective is to help the investor to decide whether to consider its implementation or not (Maric, 2000).

The decision is based on a series of data in the section "project appraisal" by which the quantified data from the project's content are divided into several criteria, which provide sound basis for decision making process regarding the project feasibility (Maric, 2008).

During the appraisal process, the project is monitored both statically and dynamically. The static approach implies several parameters which are monitored in a representative year (the turning points of business, the time of return of the investment, internal rate of return, as well as several ratio-indicators). The dynamic approach implies several parameters which are monitored throughout the project's entire lifetime by means of several assessment methods (the period of return of the investment, net present value, internal rate of return, method of annuities, etc.), identifying thereby the feasibility of implementation (ODA, 1988).

The authors choose the method of internal rate of return as dynamic method of appraisal which actually represents the discount rate by which the net present value is made equal to zero, i.e. the maximum interest rate at which the project can be indebted on credit basis. Decision-makers should asses and evaluate investment alternatives, basing on their knowledge, experience and subjective judgment (Lin et al., 2010).

Values of internal rates of return which are determined statically and dynamically are close to each other, with certain deviations in static rate of return as compared to dynamic one, which is authoritative for drawing final conclusion (Demir, 2010).

This paper attempts to determine whether there is a rule in the direction and degree of deviation of static and dynamic rates.

Literature review

Dynamic approach in defining the internal rate of return

The NPW is defined as the difference between present worth of savings and cost of investment (Sengar et al., 2008). The method of internal rate of return defines the discount rate by which the net present value of the project makes equal to zero, that is (Jain et al., 2004):

$$\sum_{n=0}^{i} \frac{N P_n^e}{\left(1+\frac{p_r - D}{100}\right)^n} = 0$$

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where

p_r - D is internal rate of return determined dynamically and NP_n^e is the net pressure of the project's financial flow during its lifetime.

Static approach in defining the internal rate of return

$$p_r - S = \frac{D_{ob}}{PVI},$$

where

p_r - S is internal rate of return determined statically, D_{ob} is the profit from a representative year[1] of the projet's lifetime acccroding to the balance sheet and PV I is the investment's estimated value.

In every investment project p_r – D and p_r – S are calculated within both static and dynamic appraisal.

Snapshot of the current state

Table 1 shows the data collected for 50 investment projects which were carried out in the AR of Vojvodina (Serbia) in ten different industries (Olawale et al., 2010). Data on the amount of internal rate are shown in the Table 1, they are determined statically and dynamically. Industries that comprise the sample of the research are:

1. AC: Agricultural complex
a) Food production
b).Manufacture of beverage
c).Production of fodder

2. SI: Service industry
a).Various kinds of services (manicure and pedicure, solarium, taxi vehicles, beauty salon, procurement of equipment for radio and TV stations, computer science courses)

3. GI: Graphic industry
a).Opening printing shop
b).Production of cardboard packaging.

TR: Trade
a).Opening a retail outlet

4. MI: Metal industry
a). Metal processing (production of machine parts, devices and assemblies)

5. TI: Timber industry
a). Manufacture of furniture, primary processing of wood, manufacturing wooden packing.

6. PI: Plastic industry
a). Plastic packaging (different forms and dimensions)

7. BM: Building materials
a). Production of building materials

8. TX - textile industry
a). Manufacture of garments and clothing

9. ED: Electrical distribution
a). Reconstruction of street lighting

A wide range of manufacturing and service areas is presented in different branches of production which contribute the rapid development of countries in transition that reorganize the structure of ownership along with the adjustment of economic environment.

The data shown in Table 1 are the mean internal rate of return determined in each project by dynamic and static appraisal (Maric, 2010). The obtained results show that the values of both internal rates of return are close to each other (29.2) and (23.9%) although there is a certain deviation ranging from 1 to 43.6%. The data on the presented sample of 50 projects is statistically processed (Table 2).

Figures 1 and 2 show the frequency distribution curves of the dynamic and static rate of return, and thus, it can be concluded whether the two variables are described best by log-normal distribution.

Statistical analysis shown in Table 2 provides insight into the basic numerical value, and thus, due to the similarities of frequency distribution curves it can be concluded that both rates of return are close in value.

RESULTS AND ANALYSIS

The collected database was used for the research which resulted in several interesting facts.

First, the results show that the values of both static and dynamic internal rates of return are close to each other, regardless to the fact that both of them were determined in a different way. As earlier discussed, the static appraisal of the internal rate of return is to calculate the quotient (ratio) of the profit from the income statement and the employed assets (estimated value), yielding with a projection for one year of the project's lifetime, while the dynamic appraisal of the internal rate of return is based on the difference between the sum of the profit in the investment's entire lifetime and the employed assets. Furthermore, it is necessary to note that the profit from the income statement is lower than the profit from the financial flow due to depreciation and interests (financial expenses), that in the financial flow do not appear as expenses because they are considered as transfer payments.

Despite the above facts, the close values for different indicators of statistic processing indicate that both parameters are of similar values and tendencies and a subject to similar distribution laws. Due to the fact that the decision regarding the project feasibility assessment is based on dynamic indicators, this research proves that the degree of error in a feasibility assessment is not high when the internal rate of return method is preceded by the static method. Similar

[1] The representative year is the year in the project's lifetime when the project reached its full production volume, while credit obligations are still present.

Table 1. Internal, dynamic and static rates of return of a sample of 50 investment projects.

Project	Internal rate of return	
	Dynamic	Static
1	57.0	72.6
2	36.3	35.3
3	29.3	31.1
4	10.6	8.1
5	10.1	6.5
6	27.8	5.1
7	64.7	21.1
8	11.8	13.7
9	18.5	17.1
10	43.6	33.1
11	30.3	34.1
12	12.3	11.3
13	26.3	20.6
14	28.1	32.1
15	38.0	21.4
16	29.0	19.6
17	22.3	15.1
18	39.9	34.7
19	37.6	34.4
20	42.0	23.2
21	32.7	35.7
22	40.1	42.1
23	25.2	17.2
24	17.9	4.7
25	34.8	24.6
26	42.6	32.1
27	20.7	4.9
28	60.6	50.8
29	18.2	11.8
30	28.1	15.1
31	32.8	28.1
32	41.2	25.6
33	31.7	36.6
34	23.4	20.1
35	45.4	50.8
36	21.2	40.9
37	6.2	4.5
38	49.8	47.2
39	32.8	28.4
40	21.7	17.6
41	23.3	22.6
42	10.7	14.2
43	27.2	20.0
44	24.3	18.8
45	31.8	7.2
46	8.5	6.1
47	6.5	7.7
48	48.8	44.8
49	10.5	8.1
50	26.7	19.1
The mean value 1 to 50	29.2	23.9

situation was found by Alam et al., 2009 in Bangladesh using education sector (Alam et al., 2009).

The mean values of internal rates of return, as determined in dynamic (29.22%) and static appraisal

Table 2. Descriptive statistics.

Variable	p_r - D	p_r - S
Sample size	50	*50*
Mean value	29.22	*23.95*
Mediana	28.10	*20.85*
Geometrycal mean value	25.53	*19.36*
Variance	193.86	*214.80*
Standard deviation	13.92	*14.66*
Standard error	1.97	*2.07*
Minimum value	6.20	*4.50*
Maximum value	64.70	*72.60*
Distance	58.50	*68.10*
Lower quartile	20.15	*13.23*
Higher quartile	38.48	*34.18*
Interquartile distance	18.33	*20.95*
Skewness	0.44	*0.89*
Kurtosis	*-0.02*	*1.07*

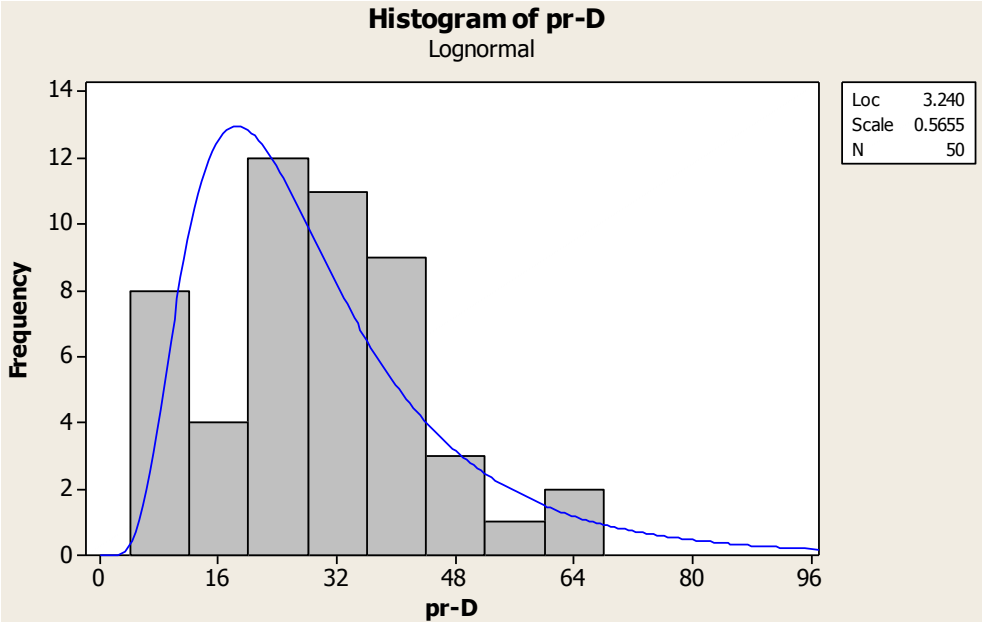

Figure 1. The frequency distribution curve of the dynamic internal rate of return.

(23.9%), suggest that they are relatively high, even for the conditions of the Serbian transitional economy (Maric, 1997). The internal rate of return can be compared with the mean interest rate of all sources of founding involved in the project. In Serbia, the real interest rates of long-term credit sources of financing are in the range of 5-15%, so the actual values obtained from the sample are virtually twice as large. However, due to the fact that investment programs are made for ideal economic conditions, without unpaid claims that are transferred from one year to another, then it is clear that profits of which the projects' profitability depends are high as compared to the actual operation, making thereby the projects' profitability rate also relatively high (ODA, 1998). This will only be occurred if good policy ensured as suggested by Alam (Alam, 2009).

The findings presented in the paper are a part of the original research which resulted from the author's many years long experience in investment management study. According to our knowledge and research experience there are no similar investigations carried out by investment experts and thus, its importance is more valuable and specific.

Conclusions

The stated hypothesis that internal rates of return, as important indicators of investment's feasibility,

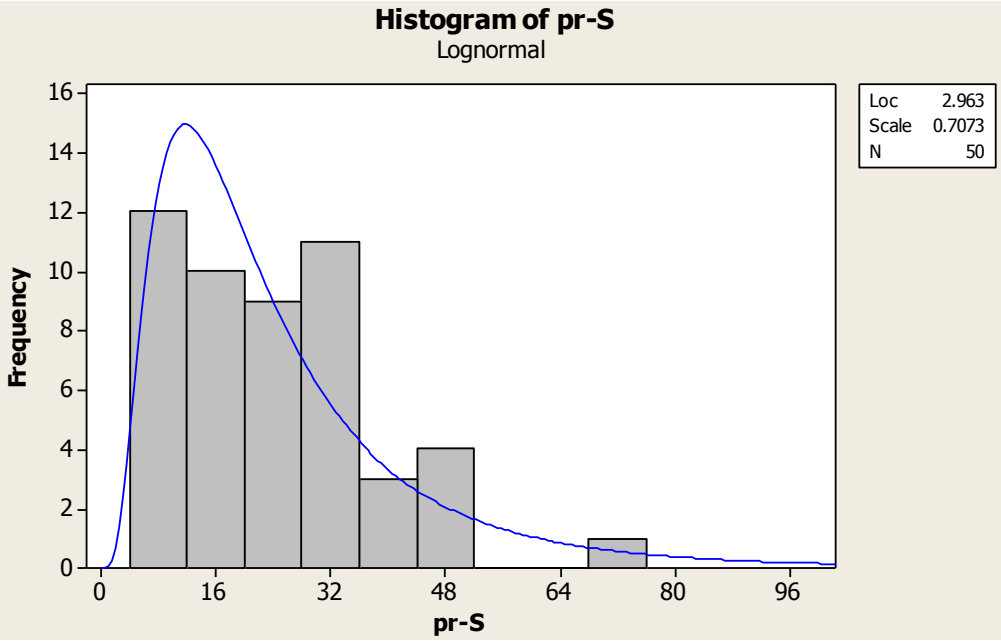

Figure 2. The frequency distribution curve of the static internal rate of return.

determined statically and dynamically are mutually related is proved by this research regardless to the fact that internal rates of return are determined differently.

Distribution laws, the mean value and the other statistical indicators of random variables p_r-S and p_r-D all prove that an investment's feasibility may be analyzed by considering both variables.

The mean values p_r-S and p_r-D show that p_r-D is higher than p_r-S by 22%.

Furthermore, it is concluded that the internal rates of return of the Serbian economy in the period of transition is relatively high, and the reasons are explained in the paper as well.

Finally, the obtained results may be useful as a blueprint for those involved in investment project design.

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