

DCF TECHNIQUES CONFLICT AND CAPITAL RATIONING

OBJECTIVES

After studying this lesson you should be able to

- Explain the reasons for DCF techniques conflict
 - Explain the meaning of capital rationing
 - Select the projects under capital rationing situation
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STRUCTURE

- 10.1 Introduction
 - 10.2 NPV v/s IRR
 - 10.3 NPV v/s PI
 - 10.4 Meaning of capital rationing
 - 10.5 Use of profitability index in capital rationing
 - 10.6 Limitations of profitability index
 - 10.7 Summary
 - 10.8 Self Examination Questions
 - 10.9 Glossory
 - 10.10 Books for further Reading
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10.1 INTRODUCTION

In the previous lesson the discounted methods of evaluating capital budgeting along with their decision rules were explained. This lesson is intended to explain the reasons for conflicting accepts/reject signals and also to suggest the solution in case of a conflict. It is also intended to explain the meaning of capital rationing and use of profitability index in selecting projects under capital rationing.

10.2 NPV V/S IRR

Net present value (NPV) is one of the discounted methods of evaluating capital budgeting projects. It is the difference between the present value of inflows and outflows. The present value is calculated by using cost of capital (K). Thus, NPV is an absolute criterion which expresses the value in rupees. Ex: NPV Rs. 15,000/-. Internal Rate of Return (IRR) is another discounted methods of evaluating capital budgeting projects. It is the rate that equalises the present value of inflows with outflows. In other words IRR, is that rate where NPV becomes zero. It is thus a relative criterion which is expressed in percentage Ex: IRR = 15%

NPV and IRR are two closely related investment criteria. Both are based on and consider time value money. In case of conventional independent projects, two methods lead to same decisions. However, under non conventional projects a conflict arises between them.

10.2.1 CONVENTIONAL INDEPENDENT PROJECTS

A conventional independent project can be defined as one whose cash flows take the pattern of an initial cash outlay followed by cash inflows. For example cash out flow required for project is Rs. 10,000 and it is expected to generate a cash inflows of Rs. 2,000/- Rs. 3,000/- Rs. 2,500/- Rs. 4,000/- Rs. 5,000/- over a life of 5 years. It is clear from the above example that one outflow followed by several inflows.

In this case both NPV and IRR methods result in same accept or reject decision. As it is already explained in the previous lesson, all the projects with a positive NPV would be accepted and if projects IRR is more than required rate of return would be accepted. The last project acceptable under NPV method is the one which has zero net present value, while using IRR method, the projects IRR should be equal to required rate of return. If the projects NPV is zero, the IRR also would be equal to required rate of return.

10.2.2 NON CONVENTIONAL INVESTMENTS

Non Conventional Investments are those investments whose cash outlay (investment) may not yield series of cash inflows. Further investment may be required to make use of the project. For example

Initial Investment	Rs. 10,000/-
CASH FLOWS	
Year	
1	3,000
2	4,000
3	- 5,000
4	2,500
5	5,000

In the above example it is clear that the project requires an additional investment of Rs. 5,000 in the third year.

In this case IRR method yields more than one rate of return. The number of rates of return depends on the number of times the sign of cash flow stream changes. In order to solve this problem in selecting the project, it is advisable to use NPV method.

10.2.3 MUTUALLY EXCLUSIVE INVESTMENTS

As it is already explained mutually exclusive projects are those projects, acceptance of one alternative automatically rejects other alternative. In other words, investment projects are said to be mutually exclusive when only one investment could be accepted and others have to be excluded. In this case NPV and IRR method will give conflicting ranking to the projects under the following conditions:

(a) Investment differ in size

Ex-project A Investment Rs. 10,000

Project B Investment Rs. 18,000

(b) Investment differ in expected lives

Ex-Project A's Life is 5 Years

Project B's Life is 8 Years

(c) The cash flow pattern of the projects may differ

Ex-Project A cash inflows 2,000 3,000 4,000 5,000 6,000

Project B cash inflows 8,000 7,000 6,000 5,000 4,000 3,000 2,000 1,000

In case of different ranking by both the NPV and IRR methods for mutually exclusive projects it is advisable to use NPV method which is consistent with the objective of maximising wealth.

3 NPV V/S PI

The NPV and Profitability Index (PI) methods are the discounted cash flow techniques to evaluate the capital budgeting projects. These two methods yield same accept or reject decisions because PI can be greater than one only when the projects NPV is positive. In case of marginal projects, NPV will be zero and PI will be equal to one. But a conflict may arise between the two methods in case of mutually exclusive projects having different size of investment consider the following examples.

	Project A	Project B
	Rs	Rs
PV of cash inflows	1,00,000	50,000
- Investment	50,000	20,000
	-----	-----
NPV	50,000	30,000
PI =	-----	-----
	50,000	20,000
	2.0	2.5

Project A should be accepted if we use NPV method, but project B should be selected according to PI method. Which method is better ?

The NPV method should be preferred, except under capital rationing, because NPV represents the net increase in the wealth.

10.4 MEANING OF CAPITAL RATIONING

The firm's aim is to maximise the wealth of its share holders. In order to achieve this a firm must invest on all the available projects in such a way that the marginal cost of capital is equal to the marginal rate of return generated by the project. But in practice, the firm may not be able to mobilise the required size of funds for investment on all these projects. It may have to choose among profitable investment opportunities because of the limited financial resources. This is the case of capital rationing in investment decisions.

In this section, it is intended to discuss the methods of solving the capital budgeting problems under capital rationing situation. "Capital Rationing refers to a situation where the firm is constrained for external, or self imposed, reasons to obtain necessary funds to invest in all investment projects with positive NPV". Under capital rationing, the management has not simply to determine the profitable investment opportunities, but it has to decide to obtain that combination of the profitable projects which yield highest NPV within the available funds.

WHY CAPITAL RATIONING?

Capital rationing may arise due to external factors or internal constraints imposed by the management. Thus, there are two types of capital rationing.

- External capital rationing mainly occurs in account of the imperfections in capital markets. Imperfections may be due to lack of information or by rigidities of attitude that hamper the free flow of capital.
- Internal capital rationing is caused by self imposed restrictions by the management. For example, the management is averse to debt in principle. It is difficult to justify the internal capital rationing. But generally, it is used as a means of financial control.

USE OF PROFITABILITY INDEX IN CAPITAL RATIONING

Under capital rationing it is necessary to choose the method for evaluating and ranking the projects. Among the DCF techniques the profitability index is considered to be

the best method under capital rationing. The projects should be ranked by their profitability index, and top ranked projects should be undertaken until funds are exhausted. For example, the capital budget available is Rs. 1,00,000. The following alternative are available.

Project	Investment	PI	Rank
A	50,000	1.15	3
B	25,000	1.25	2
C	25,000	1.36	1
D	30,000	1.05	4

In the above example it is advisable to select project C.B.A to exhaust available Rs. 1,00,000

10.6 LIMITATIONS OF PROFITABILITY INDEX

Profitability Index does not always work under capital rationing. It fails in two situations.

(A) MULTI PERIOD CAPITAL CONSTRAINTS

If the capital constrains vary from year to year it is very difficult to come to a conclusion about the investment projects by applying profitability index.

(B) PROJECT INDIVISIBILITY

The PI rule of selecting projects under capital rationing can also fail because of project indivisibility. It may be more desirable to accept many lower ranked smaller projects than a single large project. For example:

Project	Investment	PI	Rank
A	1,00,000	1.22	1
B	50,000	1.20	2
C	20,000	1.15	3
D	30,000	1.10	4

Suppose that the firms budget ceiling is Rs. 80,000. Though the project A is given rank 1 as per PI we cannot accept because of budget constraint. In this case it is advisable to accept projects B and D.

The above examples clearly shows that the PI can be used to choose projects under simple one period capital constraint situation. It fails to yield good results incase of multi period and projects indivisibility situations.

10.7 SUMMARY

NPV and IRR methods are two closely related investment criteria. Both are based on and consider time value of money. These two techniques yield same results in case of conventional independent projects. However, under non conventional projects and mutually exclusive projects which differ in size, life and cash flow pattern a conflict arises between them. Between the two methods NPV method considered to be superior.

It is consistent with wealth maximisation. Generally, NPV and PI methods will yield the same result except in a situations where the two mutually projects differ in size of investment. In this case also NPV is considered to be the best method of evaluating the projects except under capital rationing.

In capital rationing situations, the firm cannot accept all profitable projects. Therefore, the firm will aim to maximise NPV subject to the funds constraint. The PI method can be used to select the projects under capital rationing. However, it may not yield good results in case of multi period constraints and projects indivisibility.

10.8 SELF EXAMINATION QUESTIONS

- (a) Explain the situations in which NPV and IRR give conflicting results. Which is better.
 - (b) "NPV method is better evaluation criterion than PI method" explain.
 - (c) What is capital rationing?
 - (d) Why capital rationing in a firm?
 - (e) Explain the use of PI method and its limitations under capital rationing.
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10.9 GLOSSORY

- NPV Net present value is the difference between the PV of inflows and PV of outflows
- IRR Internal Rate of Return is that rate which equals the PV of inflows with PV of outflows
- PI Profitability Index is also known as benefit cost ratio. It is the ratio between PV of inflows and PV of outflows.

CAPITAL RATIONING : A situation in which due to financial constrains, the limited funds are allocated to a number of profitable projects.

10.10 BOOKS FOR FURTHER READING

- (A) Pandey, I.M : "Financial Management Vikas publishers 7 ed. 1995, New Delhi.
- (B) Maheshwari, S.N : "Financial Management" Sultan Chan & Sone, New Delhi.
- (C) Khan & Jain : "Financial Management" Tata Mc Graw Hill Co. Ltd., New Delhi.

Unit : 3

Lesson : 11

RISK ANALYSIS IN CAPITAL BUDGETING

OBJECTIVES

After studying this lesson, you should be able to :

- Explain the meaning of risk and sources of risk in capital budgeting.
- Explain the conventional techniques to handle risk

STRUCTURE

- 11.1 : Introduction
 - 11.2 : Meaning of risk
 - 11.3 : Sources of risk
 - 11.4 : Conventional Techniques to handle risk
 - 11.5 : Summary
 - 11.6 : Self examination questions
 - 11.7 : Glossary
 - 11.8 : Books for further reading
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11.1 INTRODUCTION :

In the preceding lessons you have studied the meaning and process of capital budgeting. It was also examined the various techniques for evaluating capital budgeting proposals. In the process of evaluating and selecting, the basis assumption was that these proposals did not involve any kind of risk. This assumption was made simply to facilitate the understanding of the capital budgeting techniques. In real world situation, however, the firm, in general, and its investment project in particular, are exposed to different degrees of risk. The risk arises in capital budgeting proposals because we cannot estimate the future cash flows with certainty, and consequently cannot make any correct prediction about the cash flow sequence. The purpose of this lesson is to explain the meaning and sources of risk and conventional techniques to handle risk. However, statistical techniques to handle risk will be explained in the next lesson.

11.2 MEANING OF RISK

In order to understand the meaning of risk it is better to understand the meaning of certainty, uncertainty.

- (a) **Certainty** : It is a situation where the returns are assured and no variability likely to occur in future returns. For example, fixed deposit in a bank or investment in fixed rate government bonds.
 - (b) **Uncertainty** : It is a situation where the probable events are not known. In an uncertain situation probable cash flows cannot predicted. For example, investment in corporate securities where no return are assured.
 - (c) **Risk** : The risk associated with an investment may be defined as "the variability that is likely to occur in future returns from the investment". In other words, risk is a situation in which the probabilities of future cash flows accruing are known. For example, investing Rs. 20,000 in a project and expecting returns of Rs. 5,000/- each in five years life. These returns may vary due to various reasons which are explained in the following paragraphs.
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11.3 SOURCES OF RISK

As explained above, risk is associated with the variability of future returns of a project. The factors which will influence the future returns of the projects may be explained as follows :

- (a) **Size of the Investment :** The size of the investment in terms of amount required will determine the risk. Large size project involves more risk and vice versa. For example, a project involves Rs. One Crore investment involves more risk than a project involves Rs. 10,000/-.
- (b) **Life of the Project :** The life of the project will determine the risk involved. More the projects life is more risk involves less the life less risk involved. For example, a project with a life of 5 years involves less risk than a project with 20 years life.
- (c) **General Economic Conditions :** There are the conditions which will influence the general level of business activity. For example, economic and political situation in the country, Governments monetary and fiscal policies etc.
- (d) **Industry Factors :** These factors effect all the companies in the industry. For example, industrial relations in the industry, innovation, material cost etc.
- (e) **Company Factors :** These are internal to the company which will effect only a company. For example change in the Management, strike in the company, fire in the company etc..

As seen above, various factors responsible for variations in the returns of a proposed project. The greater the variability of the expected returns, the riskier the project. However, risk can be reduced (cannot be avoided) by using certain techniques in evaluating and selecting the projects. These techniques include (a) Conventional Techniques (b) Statistical Techniques. Conventional techniques are explained in the following paragraphs. However, Statistical Techniques are explained in the next lesson.

11.4 CONVENTIONAL TECHNIQUES TO HANDLE RISK

A number of techniques to handle risk are used by managers in selecting capital budgeting projects. The following are the popular techniques to handle risk.

11.4.1 PAY BACK PERIOD

Pay back period is one of the oldest and commonly used methods for selecting capital budgeting projects. It is the period required to recover initial investment of the project. Firms using this method prefer short pay back period to longer pay back periods . Short period involves less risk to longer period. For example, there are two projects A and B project A pay back period is 3 Years and Project B pay back period is 4 Years. If the pay back criteria is applied project A should be selected as its pay back period is less than project B. Thus, the project A involves less risk than project B.

11.4.2 RISK ADJUSTED DISCOUNT RATE

This method is based on the presumption that investors expect more rate of return on risky projects as compared to less risky projects. The required rate of return will be equal to the free rate plus risk premium. This method is similar to net present value method except adding some percentage of risk premium to risk free rate of return. Net Present Value may be computed by using the following formula.

$$NPV = \sum_{t=0}^n \frac{At}{(1+K)^t}$$

$At =$ Cash inflows for period (t)

- N = No. of years
 K* = Risk free rate + Risk premium

The risk adjusted discount rate accounts for risk, by varying the discount rate, depending on the degree of risk of investment projects. A higher rate will be used for riskier project and lower rate for less risky projects. The net present value will decrease with increasing K, indicating that the riskier a project is perceived the less risky it will be accepted. For example, consider an investment project costing Rs. 50,000 initially and is expected to generate cash flows of Rs. 25,000, Rs. 20,000, Rs. 10,000. What is the NPV if it is discounted at 15% rate of return (10% risk free rate + 5% risk premium)

$$\text{NPV} = \frac{25000}{(1+15)^1} + \frac{20000}{(1+15)^2} + \frac{10000}{(1+15)^3} + \frac{10000}{(1+15)^4} - 50000$$

$$= -845$$

Since the projects NPV is negative the project should be rejected.

ADVANTAGES

- (a) It is easy to understand and simple to calculate
- (b) It recognise the risk involved in projects.

DISADVANTAGES

- (a) There is no easy way to determine risk adjusted discount rate
- (b) It does not make any adjustment in the numerator for the cash flows that are forecast over the future years.
- (c) It is based on the assumption that investors are risk averse.

11.4.3 CERTAINTY EQUIVALENT METHOD

According to this method the estimated cash flows are reduced to conservative level by applying a correction factor called a certainty equivalent coefficient. The correction factor is the ratio of riskless cash flow to risky cash flow.

$$\text{Certainty Equivalent Coefficient} = \frac{\text{Riskless Cash flow}}{\text{Risky Cash flow}}$$

Under this method, certainty equivalent coefficients are calculated for cash flows of each year. They are then multiplied with the cash flows to ascertain cash flows which may be used for the purpose of determining NPV or IRR

$$\text{NPV} = \sum_{t=1}^n \frac{\alpha_t A_t}{(1+K)^t} - C_0$$

If the IRR is to be calculated, we will calculate that rate of discount which equates the present value of certainty equivalent cash inflows with present value of certainty equivalent cash out flows.

EVALUATION OF CERTAINTY EQUIVALENT METHOD

This approach explicitly recognises risk but procedure for reducing cash flows is implicit and likely to be inconsistent from one investment to another investment.

11.4.4 SENSITIVITY ANALYSIS :

It is a technique of analysing change in Projects NPV or IRR for a given change in one of the variables. It indicates how sensitive a projects NPV or IRR is to changes in particular

ables. The more sensitive the NPV, the more critical the variable. The following three are involved in the use of sensitivity analysis.

- (a) Identification of all the variables which have an influence on the projects NPV or IRR
- (b) Establish the relationship between the variables
- (c) Analyse the impact of change in each of the variables on the projects NPV or IRR

ADVANTAGES

- (1) It compels the decision maker to identify the variables which will influence projects NPV or IRR. This helps him in understanding the project in totality.
- (2) It indicates the critical variables which have negative impact on the project NPV or IRR
- (3) It helps to expose in appropriate forecasts.

LIMITATIONS

- (1) It does not provide clear out results
- (2) It fails focus on the inter-relationship between variables

11.5 SUMMARY

Risk may be defined as the variability that is likely to occur in future returns from the investment. It arises due to various factors like size and life of the investment, economic condition, industry factors and company factors. The techniques to handle risk include conventional and statistical techniques. Conventional Techniques include (a) pay back period (b) Risk adjusted discount rate (c) Certainly equivalent coefficient method and sensitivity analysis.

11.6 SELF EXAMINATION QUESTIONS

- (a) Define and distinguish risk and uncertainty
- (b) What are the sources of risk?
- (c) What are the conventional techniques to handle risk ?
- (d) Explain the concept sensitivity analysis

11.7 GLOSSORY

Risk :	Variability that is likely to occur in future returns from the investment
Uncertainty :	It is the situation where the probable events are not known
Certainty Equivalent Coefficient:	It is the ratio between riskless cash flows and risky cash flows
Sensitivity Analysis :	It is a technique of analysing changing in projects NPV or IRR for a given change in one of the variables.

11.8 BOOKS FOR FURTHER READING :

Pandey I.M.,	"Financial Management" 7 ed., Vikas Publishers, New Delhi, 1995
Khan & Jain.,	"Financial Management" .. 2 ed., Tata Mc Graw Hill Co Ltd., New Delhi