**Chapter Five**

**Financial Analysis of Project**

The analysis of financial costs and benefits is a key step in the project preparation process, which seeks to ascertain whether the proposed project will be financially viable in the sense of being able to meet the burden of servicing debt and satisfy the return expectations of the promoters.

 **Components of Financial Analysis**

* Investment cost estimation
* Revenue estimation
* Estimation of production costs & expenses
* Profitability analysis
* Cash flow estimation and evaluation
* Financial ratio analysis
* Uncertainty (or Risk) analysis
* Preparation of debt repayment (or loan amortization) schedule

**Financial Evaluation Criteria**

Broadly, these criteria are classified in to two as “discounting” and “non-discounting” criteria.

1. **The Discounting Criteria:**
* Net Present Value (NPV)
* Benefit-Cost Ratio (BCR) or Profitability Index (PI)
* Internal Rate of Return (IRR)
* Modified Pay Back Period (MPBP)

***Payback period (PBP)***

The payback period represents the number of years it takes for cash inflows from a project to recoup (recover) the initial investment (original cash outlay) of a project. Firms using payback approach define a maximum acceptable payback period and accept only those projects that have a payback period less than the maximum pre-specified threshold. This technique can serve as a risk indicator—the more quickly you recover the cash, the less risky is the project.

 $PBP= \frac{Initial Investment }{Annual Cash Flows }=\frac{Io}{CF}$ , for **constant annual cash inflows**.

 And

 PBP = Years before cost recovery$+ \frac{Remaining Cost to recovery}{Cash inflow during the year }$, for **uneven annual cash inflows**.

**Decision Rules for payback period**:

An investment is acceptable if its calculated payback period is less than some pre specified number of years (maximum desired payback period). This means if

* Payback period < Payback cutoff point 🢣 Accept the project.
* Payback period > Payback cutoff point 🢣 Reject the project.
* Payback period = Payback cutoff point 🢣 indifference.

***Example 1:*** *Payback period for constant cash inflow*

Assume that a project requires an outlay of Br. 12,000 and yields annual cash inflow of Br. 3,000 for 7 years. Compute the payback period for the project and decide whether to accept or reject the project if the cutoff periods are:

1. 3 years b. 4 years c. 6 years

Solution:

$PBP= \frac{Initial Investment }{Annual Cash Flows }=\frac{Io}{CF}$ = $\frac{Br.12,000}{Br.3,000}=4 years$

InvestmentDecisions:

1. Since the calculated PBP is greater than the cutoff period, ***reject*** the project.
2. Either accept or reject the project (indifference).
3. Since the calculated PBP is less than the cutoff period, ***accept*** the project.

*Example 2:- payback period for uneven cash inflows*

Suppose that a project requires a cash outlay of Br.20,000 and generates cash inflows of Br.8,000, Br.7,000, Br. 4,000 and Br.3,000 for the next four years.

 PBP =Years before cost recovery + $\frac{Remaining cost to recovery }{Cash inflow during the year }$

 = 3 years + $\frac{Br.1,000}{Br.3,000}$ = 3.33 years

**Discounted Payback Period**

The discounted payback period is the length of time it takes for the discounted cash inflows to equal the amount of initial investment. It fails to consider the cash flows occurring after payback period. The discounted payback period rule is to accept if the project’s discounted payback is less than some pre-specified number of years.

Example: Let us assume project X involves an outlay of Br. 4,000 at 10% discount rate. The cash flow (CF) of the project and the discounted payback period are given below.

|  |  |  |
| --- | --- | --- |
| Year  | Undiscounted CF  | The discounted CF  |
| 0 | Br.(4,000) |  |
| 1 | 3,000  | Br. 2,727 |
| 2 | 1,000 2 years |  826 2.6 years  |
| 3 | 1,000 |  751 |
| 4 | 1,000 |  683 |

The undiscounted PBP is 2 years where as the discounted PBP is 2.6 years. Discounted PBP rule is better as it does discount the cash inflows until the initial investment is recovered. But it does not help much. It does not take into consideration the entire series of cash inflows through the life of the project.

To illustrate the computation of the discounted payback period, suppose a project being considered requires initial investment of birr 30,000 the economic life which is 5 years. The after-tax cash flows from this project during years

1, 2, 3, 4, and 5 are birr 15,000, birr 18,000, birr 12,000, birr 20,000, and birr 22,000 respectively. The cost of capital (the required rate of return) is 10 percent. What is the discounted payback period for this project?

Solution:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Year  | Cash flows | Discount factor | Present value | Cumulative DCFs |
| 1 | 15,000 | 0.909 | 13,635 | 13,635 |
| 2 | 18,000 | 0.826 | 14,868 | 28,503 |
| 3 | 12,000 | 0.751 | 9,012 | 37,515 |
| 4 | 20,000 | 0,683 | 13,660 | 51,175 |
| 5 | 22,000 | 0.621 | 13,662 | 64,837 |

As you can see from the cumulative discounted cash flows, the discounted payback period for this project is between

2 to 3 years. This is because the cumulative discounted cash flow at the end of year 2 is less than the initial investment of birr 30,000 and the cumulative discounted cash flow at the end of year 3 is greater than the net initial investment. The exact discounted payback period can be obtained as follows:

Discounted Payback Period = 2 years + (1,497/9, 0120) years

= 2 years + 0.17 years = 2.17 years

Or = 2 years + (0.17 x 12 months)

= 2 years and 2 months

A period of 2 years and 2 months is required to recover the project’s initial net investment taking the time value of money into account.

 **Net Present Value (NPV)**

A project’s NPV equals the difference between the sum of its cash inflows and outflows, discounted at a rate that is consistent with the project’s risk. In other words, NPV can be defined as the present value (PV) of future cash inflows minus the initial investment (costs). It is the recommended technique used to value capital investments, as it takes into account both the timing of the cash inflows and their risk.

Therefore, NPV = $\frac{CF1}{(1+r)^{1}}+ \frac{CF2}{(1+r)^{2}}+ …+ \frac{CFt}{(1+r)^{t}}$ − Io

 = $\sum\_{t=1}^{n}\frac{CFt}{(1+r)^{t}}$ – Io

Where: NPV = Net Present Value, CF = Cash inflows throughout the life of the investment at a time t, t = time, Io = initial investment costs, and r = required rate of return.

**The NPV decision rules:**

When NPV > 0 -- accept the project, a firm creates wealth for shareholders.

When NPV < 0 -- reject the project, a firm destroys wealth by undertaking project.

When NPV = 0-- in-between a breakeven point.

**Example 1:** an investment alternative that has initial investment of Br.100,000 produces a cash inflow annuity of Br.14,000 for 16 years. Compute the NPV if the required rate of rate (RRR) is 10% and make an investment decision.

NPV = $\frac{ACF}{r }(1-\frac{1}{(1+r)^{n}})$ – Io

 NPV = $\frac{Br.14,000}{0.1 }(1-\frac{1}{(1+0.1)^{16}})$ – Br.100, 000.00

 = Br.14,000 (7.824) – Br.100,000 = Br.9,536 (+ve)

Investment decision- accept the investment because the NPV > 0.

Example 2: A projects has an initial investment of Br.10, 000.00 and a cash inflow of Br. 4,000.00 through three years. Compute and interpret the NPV if the required rate of return (RRR) is 12%.

 NPV = $\frac{Br.4,000}{(1.12)}+ \frac{Br.4,000}{(1.12)^{2}}+ \frac{Br.4,000}{(1.12)^{3}}$ – Br.10,000

 = Br. -392 (-ve)

Investment decision- reject the project because it offers negative NPV. The negative NPV indicates that the project’s rate of return (r) is less than the RRR 12%. Does this mean that the project is not profitable? The answer is no, the project is profitable but it fails to earn the required 12% rate of return.

 **Internal Rate of Return (IRR)**

IRR is the rate that equates the investment outlay with the present value of cash inflows received after one period. This implies that the IRR is the discount rate that makes NPV equal to zero. The IRR is an important and legitimate alternative to the NPV method. The NPV and IRR techniques are similar in that both depend on discounting the cash inflows from a project. When we use the IRR, we are looking for the rate of return associated with a project so we can determine whether this rate is higher or lower than the firm’s cost of capital. We will need to apply trial-and-error method to compute the IRR.

**Computing internal rate of return (IRR)**

 IRR = NPV = 0

 IRR = $\frac{CF1}{(1+r)^{1}}+ \frac{CF2}{(1+r)^{2}}+…+ \frac{CFn}{(1+r)^{n}} -Io=0$

 = $\sum\_{t=1 }^{n}\frac{CFn}{(1+r)^{n}}- Io=0$

**Decision Rule:**

* Accept the project if the IRR is greater than the cost of capital,
* Reject the project if the IRR is less than the cost of capital, and
* The decision maker will be indifferent if the IRR is equal to the cost of capital.

**Example:** Consider the following data:

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year  | 0 | 1 | 2 | 3 | 4 |
| Cash flows | -100,000 | 30,000 | 30,000 | 40,000 | 45,000 |

The IRR is the value of r, which satisfies the following equation:

100,000 = 30,000 + 30,000 + 40,000 + 45,000

 (1+r) 1 (1+r) 2 (1+r) 3  (1+r) 4

The calculation of r consists of a process of trial and error. We try different values of r till we find that the right hand side of the above equation is equal to 100,000.

Let us, to begin with, try r = 12 percent. The right- hand side of the above equation becomes:

30,000 + 30,000 + 40,000 + 45,000 = 107,773

 (1.12)1 (1.12)2 (1.12)3  (1.12)4

Since this is more than 100,000, we have to try a higher value of r. (In general, a higher r lowers the right-hand side value and a lower r increases the right-hand side value.) Let us try r = 14 percent. This makes the right-hand side equal to:

30,000 + 30,000 + 40,000 + 45,000 = 103,046

 (1.14)1 (1.14)2 (1.14)3 (1.14)4

Since this value is higher than the target value of 100,000, we have to try still a higher value of r. Let us try r = 15 percent. This makes the right-hand side equal to:

30,000 + 30,000 + 40,000 + 45,000 = 100,802

(1.15)1 (1.15)2 (1.15)3 (1.15)4

NPV = 802

This value is a slightly higher than our target value, 100,000. Therefore, we increase the value of r from 15 percent to 16 percent. The right – hand becomes:

30,000 + 30,000 + 40,000 + 45,000 = 98,641

 (1.16)1 (1.16)2 (1.16)3 (1.16)4

NPV = -1,359

Since this value is now less than 100,000, we conclude that the value of **“r”** lies between 15 percent and 16 percent.

For most of the purposes, this information suffices; however, if a single value is required, we have to resort to interpolation. In this regard,

IRR = 15% + (16% - 15%) [2161802] = 15.371%

IRR could also be obtained by trial and error using discount factors at different rates of return. Assume that for a given level of capital invested, the NPV at 12% discount rate equals 6,967,000. In order to find the IRR for this investment, several discount rates greater than 12% should be tried until the NPV is approximately zero.

In this regard, it is depicted in the table that discounted at 18%, the net cash flow is still positive, but it becomes negative at 20%. Therefore, the IRR must lie between 18% and 20%.

**IRR = 18% + 2% 265**

1. **486 = 18.71%**

**Profitability Index (PI)**

It is the ratio of the present value cash inflows to the initial cash outflows of the investment. The formula for calculating profitability index is as follows:

$$PI=\sum\_{t=1}^{n}^{\frac{CFt}{\left(1+r\right)t}}/\_{I0}$$

**Decision rules for profitability index**:

The following are the PI acceptance rules:

* Accept the project when PI is greater than one (PI > 1).
* Reject the project when PI is less than one (PI < 1).
* Either accept or reject the project when PI is equal to one (PI = 1).

***Example:*** The initial cash outlay of a project is Br.10,000 and it can generate cash inflow of Br.4,000, Br.4,000, Br.3,000 and Br.3,000 in year one through four. Compute PI and make investment decision at 10% discount rate.

 PI = $\frac{\left(4,000\right)(1.1)^{-1}+ \left(4,000\right)(1.1)^{-2}\left(3,000\right)(1.1)^{-3}\left(3,000\right)(1.1)^{-4}}{10,000}$ = 11,244/10,000 = 1.1244

*Investment decision* - Since the project’s PI is greater than one, accept the project.

The project with positive NPV will have PI > 1. PI less than one means that the project’s NPV is negative.

To illustrate the calculation of these measures, let us consider a project, which is being evaluated by a firm that has a cost of capital of 12 percent. In this regard, assume that the initial investment on the project amounts to Birr 100,000 and the estimated cash flows over its economic life are as given below:

|  |  |
| --- | --- |
| Year  | Benefits  |
| 1 | 25,000 |
| 2 | 40,000 |
| 3 | 40,000 |
| 4 | 50,000 |

The two benefit-cost ratios (i.e. the gross and net measures) for this project are computed as follows:

BCR = 25,000(1.12)-1 + 40,000 (1.12)-2 + 40,000(1.12)-3 + 50000(1.12)-4 **= 1.145**

 100,000

NBCR = BCR - 1 = **0.145**

The foregoing benefit-cost ratios give the same decision signals, as the difference between them is simply unity.

**Accounting Rate of Return (ARR)**

* It is also known as the return on investment (ROI) or the book rate of return.
* It compares the average after-tax profits with the average size of investment.
* This method computes the return on a capital project using accounting profits, the project’s net income (NI) and book value (BV) rather than cash inflow data.
* ARR is the ratio of the average after-tax profit divided by the average investment. That is,

**Acceptance rule: -** *accept a project whose ARR is higher than the minimum rate established by the management.*

 **Merits**

* This method considers all the years in the life of the project.
* It is based upon profits and not concerned with cash flows.
* Quick decision can be taken when a number of capital investment proposals are being considered.

 **Demerits**

* Time Value of Money is not considered.
* It is biased against short-term projects.
* The ARR is not an indicator of acceptance or rejection, unless the rates are compared with the arbitrary management target.
* It fails to measure the rate of return on a project even if there are uniform cash flows

**ARR** = **Average Income After tax (Annual)**

 **Initial Investment**

It is defined as the ratio of the annual net profit on capital and this ratio is often computed only **for one year**, generally a year of full production. This ratio can be computed either for the **total investment outla**y or **for the** **equity capital**.