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Q1. Time value of money is one of the important concepts in any business. While considering the concept of time value of money, please introduce term discounting and compounding in detail.

Answer:

Discounting

Discounting is the process of determining the present value of a payment or a stream of payments that is to be received in the future. Given the time value of money, a dollar is worth more today than it would be worth tomorrow. Discounting is the primary factor used in pricing a stream of tomorrow's cash flows.

In economic evaluations, "discounting" is equivalent to "present value" or "present worth" of money. As we know, the value of money is dependent on time; we prefer to have 100 dollars now rather than five years from now, because with 100 dollars we can buy more things now than five years from now, and the value of 100 dollars in the future is equivalent to a lower present value. That's why when we take loan from the bank, the summation of all your installments will be higher than the loan that we take. In an investment project, flow of money can occur in different time intervals. In order to evaluate the project, time value of money should be taken into consideration, and values should have the same base. Otherwise, different alternatives can't be compared.

Assume we temporarily worked in a project, and in the end (which is present time), we are offered to be paid 2000 dollars now or 2600 dollars 3 years from now. Which payment method wills we chose?

In order to decide, we need to know how much the value of 2600 dollars is now, to be able to compare that with 2000 dollars. To calculate the present value of money occurred in the future, we need to discount that to the present time and to do so, we need discount rate. Discount rate, i , is the rate that money is discounted over the time; the rate that time adds/drops value to the money per time period. It is the interest rate that brings future values into the present when considering the time value of money. Discount rate represents the rate of return on similar investments with the same level of risk.

So, if the discount rate is i=10% per year, it means the value of money that we have now is 10% higher next year. So, if we have P dollars money now, next year we will have $P+iP = P(1+i)$ and if we have F dollars money next year, our money is equivalent to F/ (1+i) dollars at present time.

Going back to the example, considering the discount rate of 10%:

We can calculate the present value of $2600 occurred 3 years from now by discounting it year by year back to the present time:

Value of 2600 dollars in the 2nd years from now =2600/ (1+0.1) =2363.64

Value of 2600 dollars in the 1st years from now = (2600/ (1+0.1))/ (1+0.1) =2600/ [(1+0.1)2] =2148.76

Value of 2600 dollars at the present time = ((2600/ (1+0.1))/ (1+0.1))/ (1+0.1) =2600/ [(1+0.1)3] =1953.42

So, it seems at the discount rate of i=10%, present value of 2600 dollars in 3 years equals 1953.42 dollars, and we are better off, if you accept the 2000 dollars now.

With the following fundamental equation, present value of a single sum of money in any time in the future can be calculated. It means a single sum of money in the future can be converted to an equivalent present single sum of money, knowing the interest rate and the time. This is called discounting.

$$P=F\,(1/(1+i)\,n)$$

P: Present single sum of money.

F: A future single sum of money at some designated future date.

n: The number of periods in the project evaluation life (can be year, quarter or month).

i: The discount rate (interest rate).

Another Example of Discounting:

Assuming the discount rate of 10 %, present value of 100 dollars which will be received in 5 years from now can be calculated as:

F**=100 dollars**

n **=5**

i $=0.1$

$P=F\,(1/(1+i)\,n) = 100\,(1/(1+0.1)5)$ **=62.1**

We can see how time and discount rate can affect the value of money in the future. 62.1 dollars is the equivalent present sum that has the same value of 100 dollars in five years under the discount rate of 10%.

Compounding

Compounding is the process in which an asset's earnings, from either capital gains or interest, are reinvested to generate additional earnings over time. This growth, calculated using exponential functions, occurs because the investment will generate earnings from both its initial principal and the accumulated earnings from preceding periods. Compounding, therefore, differs from linear growth, where only the principal earns interest each period.

Compounding typically refers to the increasing value of an asset due to the interest earned on both a principal and accumulated interest. This phenomenon, which is a direct realization of the time value of money (TMV) concept, is also known as compound interest.

Compound interest is a method that can help applying the time value of money. Compound interest works on both assets and liabilities. While compounding boosts the value of an asset more rapidly, it can also increase the amount of money owed on a loan, as interest accumulates on the unpaid principal and previous interest charges.

In order to compare different alternatives in an economic evaluation, we should have the same base (equivalent base).

For example, assume we have 100 dollars now and we put it in a bank for interest rate of 3% per year. After one year, the bank will pay us 100+100 x 0.03 =$103. Then, we will put the 103 dollars in the bank again for another year. One year later, we will have 103+103 x 0.03 =$106.09. If we repeat this action over and over, we will have:

After one year: 100 + 100 x 0.03 =100 x (1+0.03) = **$103**

After second year: 103 + 103 x 0.03 =100 x (1+0.03) +100 x (1+0.03) x 0.03 =100 x (1+0.03) x (1+0.03) =100 x (1+0.03) 2 = **$106.09**

After third year: 106.09+106.09 x 0.03=100 x (1+0.03)2 +100 x (1+0.03)2 x 0.03 =100 x (1+0.03)2 x (1+0.03) = 100 x (1+0.03)3 **= $109.27**

After fourth year: 109.27 +109.27 x 0.03 =100 x (1+0.03)3+100 x (1+0.03)3 x 0.03 = 100 x (1+0.03)3 x (1+0.03) =100 x (1+0.03)4 = **$112.57**

This can be written as:

After first year: $P+Pi=P(1+i)$

After second year: $P(1+i)+P(1+i)i=P(1+i)(1+i)=P(1+i)^2$

After third year: $P(1+i)2+P(1+i)2i=P(1+i)2(1+i)=P(1+i)^3$

After forth year: $P(1+i)3+P(1+i)3i=P(1+i)3(1+i)=P(1+i)^4$

In general:

The value of money after nth period of time can be calculated as:

$$F = P(1+i)n$$

Which F is the future value of money, P is the money that we have at the present time, and i is the compound interest rate.

Other Example of Compounding:

Let's assume that we put 20,000 dollars (principal) in a bank for the interest rate of 4%. How much money will the bank give us after 10 years?

$$F=P(1+i)n = 20{,}000 \times (1+0.04)10=20{,}000 \times 1.48024=29604.8$$

So the bank will pay us 29604.8 after 10 years.

Q2 What do we meant by annuity in time value of money. Explain the concept of annuity in both perspectives annuity due and ordinary aunty explain it with formulas how to calculate annuity due and ordinary annuity.

Answer:

Annuity in Time Value of Money

An annuity is a series of payments at a regular interval, such as weekly, monthly or yearly. Fixed annuities pay the same amount in each period, whereas the amounts can change in variable annuities. The payments in an ordinary annuity occur at the end of each period. In contrast, an annuity due features payments occurring at the beginning of each period.

Regular payments, such as the rent on an apartment or interest on a bond, are sometimes referred to as "annuities." The future value of an annuity is the total value of payments at a specific point in time. The present value is how much money would be required now to produce those future payments.

The present value of an annuity refers to how much money would be needed today to fund a series of future annuity payments. Because of the time value of money, a sum of money received today is worth more than the same sum at a future date.

How an annuity reflect on time value of money

The time value of money draws from the idea that rational investors prefer to receive money today rather than the same amount of money in the future because of money's potential to grow in value over a given period of time.

Annuity Due

Annuity due refers to a series of equal payments made at the same interval at the beginning of each period. Periods can be monthly, quarterly, semi-annually, annually, or any other defined period. Examples of annuity due payments include rentals, leases, and insurance payments, which are made to cover services provided in the period following the payment.

The first payment is received at the start of the first period, and thereafter, at the beginning of each subsequent period. The payment for the last period, i.e., period n, is received at the beginning of period n to complete the total payments due.

Present Value of an Annuity Due

The present value of an annuity due uses the basic present value concept for annuities, except we should discount cash flow to time zero.

The formula for the present value of an annuity due is as follows:

$$PV\ of\ Annuity\ Due = PMT\ x\ \frac{1-(1+r)^{-n}}{r} x(1+r)$$

Alternatively,

$$PV\ of\ Annuity\ Due = PMT + PMT\ x\ \frac{1-(1+r)^{-(n-1)}}{r}$$

Where:

- PMT – Periodic cash flows
- r – Periodic interest rate, which is equal to the annual rate divided by the total number of payments per year
- n – The total number of payments for the annuity due

The second formula is intuitive, as the first payment (PMT on the right side of the equation) is made at the start of the first period, i.e., at time zero; hence it comes without a discounting effect.

Example

An individual makes rental payments of $1,200 per month and wants to know the present value of their annual rentals over a 12-month period. The payments are made at the start of each month. The current interest rate is 8% per annum.

Using the formula above:

$$PV\ of\ Rentals = \$\ 1.200.00\ x\ \frac{1-(1+(0.08/12))^{-12}}{\left(\frac{0.08}{12}\right)} x(1+(\frac{0.08}{12}))$$

FV of the Investment = $1,200 x 11.57

FV of the Investment = $13,886.90

Future Value of an Annuity Due

The future value of an annuity due uses the same basic future value concept for annuities with a slight tweak, as in the present value formula above.

To calculate the future value of an ordinary annuity:

$$FV\ of\ Annuity\ Due = PMT\ x\ \frac{(1+r)^n-1}{r} x(1+r)$$

Where:

- PMT – Periodic cash flows
- r – Periodic interest rate, which is equal to the annual rate divided by the total number of payments per year
- n – The total number of payments for the annuity due

Example

A company wants to invest $3,500 every six months for four years to purchase a delivery truck. The investment will be compounded at an annual interest rate of 12% per annum. The initial investment will be made now, and thereafter, at the beginning of every six months. What is the future value of the cash flow payments?

Using the formula above:

$$FV\ of\ Investment = \$\ 3.500.00\ x\ \frac{(1 + (\frac{0.12}{2}))^{2*4} - 1}{\left(\frac{0.12}{2}\right)} x(1 + (\frac{0.12}{12}))$$

FV of the Investment = $3,500 x 10.49

FV of the Investment = $36,719.61

The calculations for PV and FV can also be done via Excel functions or by using a scientific calculator.

Ordinary Annuity

An ordinary annuity is a series of equal payments made at the end of consecutive periods over a fixed length of time. While the payments in an ordinary annuity can be made as frequently as every week, in practice, they are generally made monthly, quarterly, semi-annually, or annually. The opposite of an ordinary annuity is an annuity due, in which payments are made at the beginning of each period.

Examples of ordinary annuities are interest payments from bonds, which are generally made semi-annually, and quarterly dividends from a stock that has maintained stable payout levels for years. The present value of an ordinary annuity is largely dependent on the prevailing interest rate.

The present value formula for an ordinary annuity takes into account three variables. They are as follows:

- PMT = the period cash payment
- r = the interest rate per period
- n = the total number of periods

Given these variables, the present value of an ordinary annuity is:

- Present Value = PMT x ((1 - (1 + r) ^ -n) / r)

For example, if an ordinary annuity pays $50,000 per year for five years and the interest rate is 7%, the present value would be:

- Present Value = $50,000 x ((1 - (1 + 0.07) ^ -5) / 0.07) = $205,010

Because of the time value of money, rising interest rates reduce the present value of an ordinary annuity, while declining interest rates increase its present value. This is because the value of the annuity is based on the return your money could earn elsewhere. If you can get a higher interest rate somewhere else, the value of the annuity in question goes down.

Q3. Capital budgeting is one of the important elements while considering strategic decision making. What are the basic steps that we should consider while considering capital budgeting decision making? Explain the five steps in detail.

Answer: The Capital Budgeting process is the process of evaluating and selecting long-term investments that are consistent with the firm's goal of maximizing owner wealth and planning which is used to evaluate the potential investments or expenditures whose amount is significant. It helps in determining the company's investment in the long term fixed assets such as investment in the addition or replacement of the plant & machinery, new equipment, Research & development, etc. These process the decision regarding the sources of finance and then calculating the return that can be earned from the investment done.

Steps in the Process

The capital budgeting process consists of five distinct but interrelated steps.

1. **Proposal generation**
2. **Review and analysis**
3. **Decision making**
4. **Implementation**
5. **Follow-up**

Proposal generation:

The first step towards capital budgeting is to generate a proposal for investments. There could be various reasons for taking up investments in a business. It could be addition of a new product line or expanding the existing one. It could be a proposal to either increase the production or reduce the costs of outputs.

Example:

The real estate company identified two lands where they can build their project. Out of the two lands one land is to be finalized. So the proposals from all the departments will be submitted and the same will be seen by various authorized persons in the organization to check whether the proposals given are according to the various requirements. Also the same will then be classified for better decision making the process.

Review and analysis:

This step mainly involves selecting all correct criteria's to judge the desirability of a proposal. This has to match the objective of the firm to maximize its market value. The tool of time value of money comes handy in this step.

Also the estimation of the benefits and the costs needs to be done. The total cash inflow and outflow along with the uncertainties and risks associated with the proposal has to be analyzed thoroughly and appropriate provisioning has to be done for the same.

Example:

Identification of the underlying trends of the market which can be based on the most reliable information, prior to selecting a specific investment. For instance, before choosing the investment to be made in the company involved in the gold mining, firstly the underlying commodity's future direction is needed to be determined; whether the analysts believe that there are more chances of price getting declined or the chances of price rise is much higher than its declination.

Decision making:

Decision making is the third step. In the stage of decision making the executives will have to decide which investment is needed to be done from the investment opportunities available keeping in mind the sanctioning power available to them.

Example:

For instance, the managers at the lower level of management like work managers; plant superintendent, etc. may have the power to sanction the investment up to the limit of $10,000 beyond that the permission of the board of directors or the senior management is required. If the investment limit extends then the lower management has to involve the top management for the approval of the investment proposal.

Implementation:

Once the decisions have been made, it is time to implement the projects. Implementation is not really a budgeting issue, but management will have to oversee everything to be sure it is done correctly. After the project gets started, management will need to review everything to make sure the finances still make sense.

After the completion of all the above steps, the investment proposal under the consideration is implemented i.e., put into a concrete project. Once Money is spent and thus proposal is implemented. The different responsibilities like implementing the proposals, completion of the project within the requisite time period and reduction of cost are allotted. The management then takes up the task of monitoring and containing the implementation of the proposals.

There are several challenges that can be faced by the management personnel while implementing the projects as it can be time-consuming. For the implementation at the reasonable cost and expeditiously the following things could be helpful:

Formulation of the project adequately: Inadequate formulation of the project is one of the main reasons for the delay in the projects. So all the necessary details should be taken by the concerned person in advance and proper analysis should be done well in advance to avoid any delay in the implementation of the project.

Use of responsibility accounting principle: For the expeditious execution of the various tasks and the cost control, the specific responsibilities should be assigned to the project managers i.e., the timely completion of the project within the specified cost limits.

Network technique use: Several network techniques like Critical Path Method (CPM) and Program evaluation and review technique (PERT) are available for project planning and control which will help in monitoring the projects properly and easily.

Example:

For prompt processing, the committee of capital budgeting must ensure that management has properly done the homework on the preliminary studies and compendious formulation of the project before its implementation and after that, the project is implemented efficiently.

Follow-up:

The final stage of capital budgeting is fellow up which involves results are monitored & comparison of actual results with the standard ones. Action may be required if actual outcomes differ from projected ones.

The unfavorable results are identified and removing the various difficulties of the projects helps for future selection and execution of the proposals. The correct time to do this comparison is when the operations get stabilized.

Example:

With this review, the capital budgeting committee concludes on the following points:

- To what extent the assumptions were realistic.
- The efficiency of the decision making
- If there are any judgmental biases
- Whether the hopes of the sponsors of the project is fulfilled.

Thus, the process is a complex one comprising of the various steps that are required to be followed strictly before the finalization of the project.

Q4. Introduce the different cash flows that any business activity has while doing any business (Initial investment, operating cash flow and terminal cash flow). How we have to calculate it while going for replacement of existing asset.

Answer:

Cash Flows

Cash flow is the net amount of cash that an entity receives and disburses during a period of time. A positive level of cash flow must be maintained for an entity to remain in business, while positive cash flows are also needed to generate value for investors. The time period over which cash flow is tracked is usually a standard reporting period, such as a month, quarter, or year. Cash inflows come from the following sources:

- **Operations:** This is cash paid by customers for services or goods provided by the entity.
- **Financing activities:** An example is debt incurred by the entity.
- **Investment activities:** An example is the gain on invested funds.

Cash outflows originate with the following sources:

- **Operations:** This is expenditures made as part of the ordinary course of operations, such as payroll, the cost of goods sold, rent, and utilities.
- **Financing activities:** Examples are interest and principal payments made by the entity, or the repurchase of company stock, or the issuance of dividends.
- **Investment activities:** Examples are payments made into investment vehicles, loans made to other entities, or the purchase of fixed assets.

An alternative way to calculate the cash flow of an entity is to add back all non-cash expenses (such as depreciation and amortization) to its net after-tax profit, though this approach only approximates actual cash flows.

Cash flow is not the same as the profit or loss recorded by a company under the accrual basis of accounting, since accruals for revenues and expenses, as well as for the delayed recognition of cash already received, can cause differences from cash flow.

A persistent, ongoing negative cash flow based on operational cash flows should be a cause of serious concern to the business owner, since it means that the business will require an additional infusion of funds to avoid bankruptcy.

Calculation of Cash Flows while going for Replacement of Existing Asset:

Decision regarding replacement of an existing asset with another is based on the net present value and internal rate of return of the incremental cash flows, i.e. the difference between periodic net cash flows if the existing asset is kept and the periodic net cash flows if the asset is replaced.

In capital budgeting, the existing asset is called the defender and the asset which is proposed to replace the defender is called the challenger. Estimation of incremental cash flows for such replacement analysis involves

calculation of net cash flows of the defender, net cash flows of the challenger and then finding the difference in cash flows for both the assets.

Technique

Calculating periodic cash flows of existing asset is straight forward. Since the existing asset is already purchased, the initial investment outlay is zero and the periodic net cash flows are calculated based on the following formula:

Net cash flows = (revenue – operating expenses – depreciation) x (1 – tax rate) + depreciation

If the asset is replaced, it involves investment is the new asset and sale or disposal of the existing asset. Disposal of exiting asset has some income tax implications which need to be reflected in the calculation of initial investment as follows:

Initial investment after replacement = cost of new asset - sale proceeds of old asset +/- tax on disposal

Tax on disposed asset = (sale proceeds of old assets – book value of old asset) x tax rate

As evident from the equation above, if the old asset is sold at an amount higher than its book value, the company bears a related tax cost which is added to the initial investment. Similarly, if the sale proceeds are lower than the book value of the asset sold, there is a resulting tax shield which is subtracted from sum of cost of new asset and sale proceeds of the old asset.

Example:

Motorway, M1-BUS operates buses on different inter-city routes. The management is considering upgrading its fleet of 50 standard buses (purchased at $8 million) which has a book value of $3 million. It expects to sell the existing fleet for $4 million and purchase a new fleet at a cost of $12 million. The existing revenue of the fleet is $4 million per annum which is expected to rise by 25% per annum if the new fleet is introduced. The existing operating cost of the fleet is $2 million which is expected to drop by 30% after up-gradation.

Determine if replacement is a good idea if the company's weighted average cost of capital is 10% and the analysis period is 8 years. The company pays taxes at the rate of 33% and it charges depreciation on straight line basis.

Solution:

In analyzing whether to replace the fleet or not, we need to work out the net cash flows of the existing fleet and net cash flows after the replacement and then finding the difference between both to arrive at the incremental cash flows. The incremental cash flows are then used to calculate net present value and/or internal rate of return.

Existing fleet

Capital investment = 0

Revenue = $4 million

Operating cost = $2 million

Annual depreciation = $8 million/8 = $1 million

Periodic net cash flows = (revenue – operating cost – depreciation) * (1 – tax rate) + depreciation

Periodic net cash flows = ($4 million - $2 million - $1 million) * (1 – 33%) + $1 million = $1.67 million

Replaced fleet

Cost of new fleet = $12 million

Sale proceeds of old fleet = $4 million

Book value of old fleet = $3 million

Tax on sale of old fleet = ($4 million - $3 million) * 33% = $0.33 million

Net initial investment = $12 million – $4 million + $0.33 million) = $8.33 million

New revenue = $4 million * 1.25 = $5 million

New operating cost = $2 million * (1 – 10%) = $1.8 million

Depreciation expense on new fleet = $12 million/8 = $1.5 million

Periodic net cash flows = ($5 million - $1.8 million - $1.5 million) * (1 – 33%) + $1.5 million = $2.64 million

Incremental cash flows

Incremental cash flows at time 0 = net investment after replacement – net investment before replacement

Incremental cash flows at time 0 = $8.33 million – 0 = $8.33 million

Incremental cash flows in Year 1 to 8 = net annual cash flows after replacement – net annual cash flows before replacement

Incremental cash flows in Year 1 to 8 = $2.64 million - $1.67 million = $0.97 million

Calculating net present value and IRR:

NPV = PV factor for 8 years at 10% * incremental cash flows (Year 1-8) – incremental initial investment

NPV = 5.335 * $0.97 million – $8.33 million

NPV = -$3.15 million

IRR = -2%

Since the net present value is negative and IRR is way below the hurdle rate, it is not feasible to replace the fleet at this stage.