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Mohammad Rahman
Institute of Business
Administration, Jahangirnagar
University, Bangladesh

Time value of money: A case study on its concept and its application in real life problems

Mohammad Rahman

Abstract

Purpose of this case study is to understand the concept of time value of money. Way to calculate future value and to use it real life situations.

It is the concept that the value of a rupee to be received in coming future is less than the value of rupee today. Time value of Money is a theory advantage of having money today then latter. The time value of money is a concept, which states money available now has worth more than the same amount of money in future due to its earning capacity.

I have studied advantages / significance of TVM and various reasons which lead to requirement of TVM. Major reason behind time value of money is inflation, risk and rate of return; which lead to reduction in value of same money in future period.

I have tried to find solution to four real life problems through this case study. Problem includes loan repayment problem, investment problem, asset replacement problem, growth rate of profit earned in various years and implicit return on investment.

Keywords: Time value of money (TVM), present value future value rate of return, number of periods, annuity value

Introduction

It is the concept that the value of a rupee to be received in coming future is less than the value of rupee today.

- I. Time value of Money is a theory advantage of having money today then latter.
- II. The time value of money is a concept, which states money available now has worth more than the same amount of money in future due to its earning capacity.

Objectives

1. To understand the concept of Time value of money
2. How we can calculate present value/ future value for profiled cash flows?
3. How time of money can helps us to solve our real life problems?

There are various reasons behind this concept

1. Investment: Money can be invested for generating more money, so money received today has greater value.
2. Interest Earning: Value of rupee currently is more than its future value, as it is expected that it can be A rupee today is worth more today than in future because of its opportunity cost of lost earnings.
3. Inflation: It is expected to increase in price of commodities in coming future due to inflation, which lead to decline in value of today's money. "Positive rate of Inflation reduce the purchasing power of rupee with passage of time".
4. Risk: When someone lends money, there is a risk involved in not paying back the money. Because of that risk interest is charged on the money, which reduces value of money.

Terms attached with Time Value of Money are

1. Present Value is a series of future payment or future value discounted at a rate of interest up to the current date to reflect the time value of money and result is called present value.

Correspondence
Mohammad Rahman
Institute of Business
Administration, Jahangirnagar
University, Bangladesh

- Future Value is amount that is calculated by increasing present value or series of payment at the given rate of interest and result is future value.
- Rate of Interest is a charge against use to inflate/discount present value / future value to achieve desire result.
- Time Value of Money Principle: It is used to compare two different cash flow statements of two different companies or projects for investment. Purpose is to state return provided by them if we make investment now.
- Number of Periods: it represent the time period to which value or payment series discounted / inflated to calculate appropriate return.

Significance of Time Value of Money

It is mostly used concept in Finance world; based on this, decisions are made to maximize return on investments. It helps shareholders to invest their fund wisely. Its concept contributes to this aspect to much extent. Its significance are as follows:

- Investment Decision is decision to make investment of funds for long term purpose. TVM help us to identify long term cash flow statements which will occur at different point of time. So, if investor have two projects to invest its money in, those two projects can be compared with this technique even if their cash flow statement time period doesn't matches with each other by providing present value of their future cash flow. Its concept is mostly used in equity or debt securities investment by using valuation models while doing investments.
- Financing Decision is decision to make to optimize capital structure of the organization. Raising fund for equity, debt or from any other source. TVM helps in this decision by comparing cost to company through usage of effective rate of interest of each source of finance. And then present value of costs of two alternatives is compared against each other to decide on appropriate source of financing.
- Operational Decision: This concept is also used in evaluating creditor cycle and debtors' cycle in managing cash collection under current assets management.

Tvm Formula

$$FV = PV * [1 + (i/n)]^{(n * t)}$$

FV = Future value of money

PV = Present value of money

i = Interest rate

t = number of years taken into consideration

n = number of compounding periods of interest per year

Example:

PV = Rs. 10,000

i = 10%

t = 10 years

n = 1 p.a.

FV = ?

Scenario 1: n changes from 1 to 4 in case 1

Scenario 2: i changes from 10% to 11% in case 1

Scenario 3: t changes from 1 to 4 in case 1

Let see 3 different scenarios; with change in single input how it leads to change in results:

Senario 1	Case 1	Case 2	Unit
Present Value	10,000	10,000	Rupees
i	10%	10%	%
t	10	10	years
n	4	1	#
Future Value	26,851	25,937	Rupees

Senario 2	Case 1	Case 2	Unit
Present Value	10,000	10,000	Rupees
i	11%	10%	%
t	10	10	years
n	1	1	#
Future Value	28,394	25,937	Rupees

Senario 3	Case 1	Case 2	Unit
Present Value	10,000	10,000	Rupees
i	10%	10%	%
t	11	10	years
n	1	1	#
Future Value	28,531	25,937	Rupees

In all three scenarios with increase in any of these inputs leads to increase in future value in all the scenarios and vice versa.

Applications of Time Value of Money in Real Life Problems

Asset Replacement Problem

A Manager has to find out accumulated sum of money in future date to replace it with existing assets.

Example: ABC Ltd has Rs. 100,000 of Debentures (5%). Company want set up a replacement of existing assets after 10 years. This replacement asset earns 8% per year. Required investment will be as follows:

Outcome: So ABC Ltd should invest Rs. 46,319.35 now to get Rs. 100,000 as replacement at 10 years.

$$i = 8\%$$

$$t = 10$$

$$n = 1$$

$$FV = 100,000$$

$$PV = Rs. 100,000 / [1 + (0.08/1)]^{(1 * 10)}$$

$$PV = Rs. 46,319.35$$

Investment Problem (Rate of Return)

Manage wants to calculate implicit rate of return over an investment.

Example: Company offering to pay Rs. 201,475 at the end of 10 years with deposit of Rs. 15,000 p.a. How much implicate rate of return ABC ltd is offering to its customers?

Outcome: Company is offering 5.3% of annual return.

	Yearly Investment	Yearly Sum (with Interest)	Rate of Interest
Start of 1st year	15000	15,000.00	
End of 1st year	15000	30,795.04	5.30%
End of 2nd year	15000	47,427.26	5.30%
End of 3rd year	15000	64,941.04	5.30%
End of 4th year	15000	83,383.09	5.30%
End of 5th year	15000	102,802.62	5.30%
End of 6th year	15000	123,251.44	5.30%
End of 7th year	15000	144,784.10	5.30%
End of 8th year	15000	167,458.05	5.30%
End of 9th year	15000	191,333.79	5.30%
End of 10th year	0	201,475.00	5.30%

Result can be achieved through hit and trial method of through goal seek option in excel.

Loan Repayment Problem

A manager pay loan in fixed period of time through equal installments.

Example: ABC Ltd has a loan of Rs. 100,000 from a Bank at a rate of 9% p.a. Company want to pay back money in 10 equal installments.

Outcome: So company should pay Rs. 23,674 annual to redeem loan in next 10 years.

$i = 9\%$

$t = 10$

$n = 1$

$FV = 100,000 + interest$

	Amount	Rate of Interest
Starting of First Year	100,000	
End of First Year	109,000	9%
End of Second Year	118,810	9%
End of Third Year	129,503	9%
End of Fourth Year	141,158	9%
End of Fifth Year	153,862	9%
End of Sixth Year	167,710	9%
End of Seventh Year	182,804	9%
End of Eighth Year	199,256	9%
End of Ninth Year	217,189	9%
End of Tenth Year	236,736	9%
10 Equal Instalments	23,674	

Profit Problem (Growth Rate of Return)

Manager wants to calculate compounded growth rate over an investment in specified period of time.

Example: ABC Ltd. wants to calculate compounded growth rate over its profit and company is getting annual profit % as follows.

Outcome: Company has achieved 10.66% of rate of return p.a. to achieve its target of profit Rs. 75 lacs.

Years	2014	2015	2016	2017	2018
Profit (Rs. Lacs)	50	55	57	65	75
Profit %		10%	4%	14%	15%

By hit and trial method I found out that compounding annual growth rate is 10.66%. However it can be calculate through goal seek option in excel application.

Valuation Problem

TVM help us to solve problem of valuation for investment in equity, bonds, debentures, fixed deposits, recurring deposits etc.

Conclusion and Recommendation

As per my analysis, TVM is a very vibrant concept in finance world. It helps us to calculate approximate future value of current investment or present value of future returns. It helps us to in making decision where to invest and which not to consider. As discussed in this case study there are various real life problems which can be solved through this technique.

So my recommendation is to always consider this technique before making any investment in any financial instrument like equity, debts, bonds, insurance and various other instruments.

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