ABC Wealth Advisors

Prerequisite Conceptual Understanding


Synopsis of the Case Study

The case study ‘ABC Wealth Advisors’, deals with the importance of time value of money for making investment decisions. A wealth management firm – ABC Wealth Advisors advises its clients on various investment options. The case majorly focuses on various scenarios of estimating the value of cash flows.

Pedagogical Objectives

- To understand the concept of time value of money
- To calculate the value of the investments using compounding and discounting techniques.

Teaching Plan

Both the Teaching Note and the Structured Assignment follow a specific Teaching Plan [Annexure (TN)-I].

Assignment Questions

I. Discuss the concept of time value of money.
II. Evaluate the value of the cash flows using compounding and discounting techniques.
Case Analysis Flow

If one were given a chance to opt for a certain amount today or for the same amount in the future, then one would opt for the amount now than in the future. This is basically because money has time value. The value of money declines as time passes and hence the purchasing power of a certain amount would be more in the present than in the future.

With this foreword, I started the first session of discussion of the case study.

I. Discuss the concept of time value of money.

What is the importance of time value of money in making investment decisions? What are the various attributes of time value of money and the various categories of time value of money problems?

The concept of ‘time value of money’ has different characteristics. Some of its important characteristics are:

• The direction in time that cash flows are converted to equivalent values
• Whether there is a single cash flow or a series of cash flows
• The decision variable or unknown value of the problem.¹

1. The direction in time that cash flows are converted to equivalent values: There are two situations in which the time value of cash flows are calculated.
   • Compounding: This is a situation in which the current value is converted to its equivalent future value for comparison to another future value
   • Discounting: This is a situation, which involves moving back through time or the conversion of a cash flow to be received in the future into its equivalent current value.

2. Whether there is a single cash flow or a series of cash flows: This feature takes into consideration the cash flow type.
   • Single cash flow: The cash flow type can be a single payment which is made at some point in time
   • Multiple cash flow: There can be series of payments through time. These series payments can involve fixed payment size or the payment size may increase or decrease over time.

3. The decision variable or unknown value of the problem: The decision variable for which the value is to be determined is to be established finally.

After discussing the characteristics of time value of money, I discussed the various categories of time value of money problems.

The problems in the time value of money are categorised into six types:

1. Single-Payment Compound Amount (SPCA): Problems that involve a known single initial outlay invested at a specified interest rate and compounded at a regular basis, fall into this category. It is basically used to know the value to which the original single principal or investment will grow by the end of a specified time period

2. Uniform Series Compound Amount (USCA): Problems that have investments which generate interest and which allow that interest to be reinvested into the project fall under this category

3. **Sinking Fund Deposit (SFD):** Problems that involve generation of a predetermined amount after a certain time through regular uniform deposits fall under this category.

4. **Single-Payment Present Value (SPPV):** SPPV problems involve the calculation of the present value of the cash flow which has a certain value in the future.

5. **Uniform-Series Present Value (USPV):** This category involves problems for which the present value of the total series of payments is to be calculated. The series of payments are of equal size and are to be received at different points of time in the future.

6. **Capital Recovery (CR):** This category involves problems that are closely related to USPV. These are also known as loan amortisation payment problems.

After discussing the categories of time value of money problems, I analysed the various scenarios in the case study.

II. **Evaluate the value of the cash flows using compounding and discounting techniques.**

Anirudh wants to invest INR 10,000 for a period of 5 years. What is the amount that he would receive at the end of the tenure?

Anirudh can invest the amount either in Post Office Time Deposit account or fix deposit the amount in the State Bank of India (SBI).

a) **Post Office Time Deposit account:** Anirudh can invest the amount in post office time deposit account for 5 years at an interest rate of 7.50% per annum. The amount he would receive at the end of the tenure is:

\[
FV_n = PV(1+K)^n = 10,000(1+0.075)^5 = 10,000(1.4356) = \text{INR 14,356}
\]

b) **SBI Fixed Deposit Scheme:** Anirudh can invest the amount in SBI fixed deposit scheme for 5 years at an interest rate of 8% per annum. The amount he would receive at the end of the tenure is:

\[
FV_n = PV(1+K)^n = 10,000(1+0.08)^5 = 10,000(1.4693) = \text{INR 14,693}
\]

He would earn INR 337 more if he opts for the second choice.

Akhil expects to receive INR 2,500 as an increment every year. He wants to invest the amount so that he can receive INR 18,000 at the end of 6 years. What is the implied interest rate at which he can invest?

\[
2,500 \cdot FVIFA_{(k,6)} = 18,000 \\
\Rightarrow FVIFA_{(k,6)} = 18,000/2,500 = 7.2
\]
From tables,
\[ \text{FVIFA}_{(7,6)} = 7.153 \]
\[ \text{FVIFA}_{(8,6)} = 7.336 \]

Applying linear interpolation in this interval, we get

Implied interest rate
\[ = 7\% + (8\% - 7\%)*[(7.2-7.153)/(7.336-7.153)] \]
\[ = 7.26 \]

Akhil can invest in National Savings Certificate (NSC) at an interest rate of 8% for 6 years and he can get INR 18,340 at the end of the tenure, which is more than what he had expected.

**Jones wants to invest INR 36,000 per year for the first 4 years, INR 48,000 per year for the next 5 years and INR 60,000 per year for 6 years thereafter. What would be his savings after 15 years?**

Jones can invest the amount in Public Provident Fund (PPF) account. It is a recurring deposit scheme. The duration of the fund is 15 years and the rate of interest is 8% per annum.

Savings of Jones after 15 years:
\[ = \text{INR } [36,000*\text{FVIFA}\_{(8,4)}*\text{FVIF}\_{(8,11)} + 48,000*\text{FVIFA}\_{(8,5)}*\text{FVIF}\_{(8,6)} + 60,000*\text{FVIFA}\_{(8,6)}]\]
\[ = \text{INR } [36,000*4.506*2.332+48,000*5.867*1.587+60,000*7.336]\]
\[ = \text{INR } [378,287.712+446,924.592+4,40,160]\]
\[ = \text{INR } 1,265,372.304 \]

**Frank wants to invest INR 5,000 in a deep discount bond. What is the interest rate he would be paid on the investment?**

Frank can invest in IDBI Deep Discount Bond issue. If he invests INR 5,300 for 25 years, he would get a maturity amount of INR 200,000 (INR 0.2 million).

To calculate the interest rate, that would be paid on his investment,
\[ 5,300*\text{FVIF}_{(k,25)} = 2,00,000 \]
\[ \Rightarrow \text{FVIF}_{(k,25)} = 2,00,000/5300 = 37.74 \]

From the tables,
\[ \text{FVIF}_{(15,25)} = 32.919 \]
\[ \text{FVIF}_{(16,25)} = 40.874 \]

By applying linear interpolation, we get

Interest rate
\[ = 15\% + (16\%-15\%)*[(37.74-32.919)/(40.874-37.74)] \]
\[ = 16.54\% \]

So, Frank would receive an interest rate of 16.54% on his investment.
The second session of the discussion of the case study begins here.

Surya is going to retire in 6 months. He has two options: a) A lump sum amount of INR 40,000 and b) An annual pension of INR 10,000 as long as he lives. The interest rate of the pension plan is 9%. Which option would be best for him if he expects to live for another 20 years?

Present value of the annual pension = \( \text{INR 10,000} \times \text{PVIFA}_{(9,20)} \)
\[ = \text{INR 10,000} \times 51.160 \]
\[ = \text{INR 51,160} \]

The first option is INR 40,000 lump sum amount at present. As the present value of the annual pension is more than the lump sum amount, he should choose the second option.

Rohan has INR 1 lakh (0.1 million) with him. He wants to deposit the amount in a bank for a period of 5 years. How much amount can he draw every year so that there would be no balance left at the end of the period?

Rohan can invest his money in ICICI Bank term deposit scheme for 5 years at an interest rate of 8%. If we assume ‘x’ as the annual amount, then Rohan can withdraw

\[ x \times \text{PVIFA}_{(8,5)} = \text{INR 1,00,000} \]
\[ \Rightarrow \quad x = \frac{\text{INR 100,000}}{3.993} \]
\[ \Rightarrow \quad x = \text{INR 25,044} \]

James wants to invest INR 10,000 at the end of the first year, INR 15,000 at the end of the second year and INR 20,000 each year from the third year to the fifth year. What is the present value of the stream of investment?

James can invest the amount in Oriental Bank of Commerce (OBC) recurring deposit scheme at a rate of 9% per annum. The present value of the income stream

\[ = [\text{INR 10,000} \times \text{PVIF}_{(9,1)} + \text{INR 15,000} \times \text{PVIF}_{(9,2)} + 20,000 \times \text{PVIFA}_{(9,3)} \times \text{PVIF}_{(9,2)}] \]
\[ = \text{INR}[9,170 + 15,000 \times 0.842 + 20,000 \times 2.531 \times 0.842] \]
\[ = \text{INR 64,422} \]

Varun, who is about to retire, wants to receive a pension every year. He expects to receive INR 12,000 per year for 8 years and INR 48,000 per year thereafter. What is the present value of the income stream if the discount rate is 10%?

The present value of the income stream of Varun

\[ = \text{INR 9,170} + \text{INR 12,630} + \text{INR 42,622} \]
\[ = \text{INR 64,422} \]
The third session of the discussion of the case study begins here.

Vishal wants to invest INR 20,000 in a bond instrument for a period of 10 years. What is the amount he would receive after 10 years?

Vishal can invest in Nabard’s Bhavishya Nirman Bonds at an interest rate of 9.5% for 10 years:

\[
\text{Maturity Value} = \text{INR} 20,000 \times (1 + 0.095)^{10} \\
= \text{INR} 20,000 \times 2.478 \\
= \text{INR} 49,560
\]

Ravinder would retire after 14 years. He wants to choose a retirement plan that would give him a perpetual annual income of INR 30,000 from the beginning of the 15th year. What is the amount he should invest in order to meet his criterion?

Ravinder can invest in PPF account, which gives an interest of 8%.

Therefore, the investment needed at the beginning of the 14th year in order to generate an income of INR 30,000 from the beginning of the 15th year:

\[
\text{Investment} = \frac{\text{INR} 30,000}{0.08} \\
= \text{INR} 375,000
\]

If ‘x’ is the amount to be deposited now, then

\[
x \times \text{FVIF}_{(8,13)} = \text{INR} 375,000 \\
\Rightarrow x = \frac{\text{INR} 375,000}{\text{FVIF}_{(8,13)}} \\
= \frac{\text{INR} 375,000}{2.658} \\
= \text{INR} 141,083
\]

Amit wants to invest an amount of INR 25,000 for a period of 7 years. What is the value of his investment at the end of the period? Also, what is the value of his investment at the end of the period keeping the inflation rate of 5% in view?

Amit can deposit his amount in OBC’s fixed deposit scheme at a rate of 9% per annum.

\[
\text{Maturity Value} = \text{INR} 25,000 \times \text{FVIF}_{(9,7)} \\
= \text{INR} 25,000 \times 1.828 \\
= \text{INR} 45,700
\]

If the inflation rate is 5% per year, the real interest rate would be 9% - 5% i.e., 4%
Therefore, the value of the deposit in terms of the current rupee = INR 25,000*(1+0.04)^7
= INR 32,898

David needs an amount of INR 15,000 at the beginning of each year from the 10th to 14th year. What amount should he invest at the end of each year from the 1st to 5th year now at an interest rate of 8%?

The discounted value of annuity due of INR 15,000, receivable at the beginning of each year from 10th to 14th year, calculated at the beginning of the 10th year

= INR 15,000*[(1+k) PVIFA_{k,5}]
= INR 15,000*[(1+0.08)*PVIFA_{8,5}]
= INR 15,000*1.08*3.993
= INR 64,687 (1)

Discounted value of the amount in equation (1), calculated at the end of 5th year

= 64,687*PVIF_{8,4}
= 64,687*0.735
= INR 47,545

If ‘y’ is the amount to be deposited at the end of each year from 1st to 5th year, then

\[ y \times FVIFA(8,5) = \text{INR 47,545} \]
\[ y = \frac{\text{INR 47,545}}{5.867} \]
\[ = \text{INR 8,104} \]

Sujit wants to make an investment in a mutual fund on a Systematic Investment Plan (SIP) basis. He wants to invest INR 1,000 every month for 3 years. He wants to know the value of the investment, if a person had invested in mutual fund 3 years ago. He wants to know whether it is better to invest in a mutual fund or deposit his amount in a recurring deposit scheme.

If the amount is invested in HDFC mutual fund,

From Annexure I of the case study, we can have the Net Asset Value (NAV) of the fund for 3 years starting from April 8th 2006 to April 8th 2009. We can determine the number of units that can be obtained as shown in Exhibit TN-(I).
### Exhibit (TN)-I

**Number of Units Obtained from Investment in Mutual Fund**

<table>
<thead>
<tr>
<th>Month and Year of Investment</th>
<th>Amount Invested (INR)</th>
<th>NAV</th>
<th>No. of Units Obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 2006</td>
<td>1,000</td>
<td>51.9101</td>
<td>1,000/51.9101 = 19.26</td>
</tr>
<tr>
<td>June 2006</td>
<td>1,000</td>
<td>36.842</td>
<td>1,000/36.8432 = 27.14</td>
</tr>
<tr>
<td>July 2006</td>
<td>1,000</td>
<td>40.9813</td>
<td>1,000/40.9813 = 24.40</td>
</tr>
<tr>
<td>August 2006</td>
<td>1,000</td>
<td>42.5981</td>
<td>1,000/42.5981 = 23.47</td>
</tr>
<tr>
<td>September 2006</td>
<td>1,000</td>
<td>47.475</td>
<td>1,000/47.475 = 21.06</td>
</tr>
<tr>
<td>October 2006</td>
<td>1,000</td>
<td>48.6142</td>
<td>1,000/48.6142 = 20.57</td>
</tr>
<tr>
<td>November 2006</td>
<td>1,000</td>
<td>51.7745</td>
<td>1,000/51.7745 = 19.31</td>
</tr>
<tr>
<td>December 2006</td>
<td>1,000</td>
<td>54.0606</td>
<td>1,000/54.0606 = 18.50</td>
</tr>
<tr>
<td>January 2007</td>
<td>1,000</td>
<td>53.7199</td>
<td>1,000/53.7199 = 18.61</td>
</tr>
<tr>
<td>February 2007</td>
<td>1,000</td>
<td>55.7486</td>
<td>1,000/55.7486 = 17.94</td>
</tr>
<tr>
<td>March 2007</td>
<td>1,000</td>
<td>48.8455</td>
<td>1,000/48.8455 = 20.47</td>
</tr>
<tr>
<td>April 2007</td>
<td>1,000</td>
<td>49.355</td>
<td>1,000/49.355 = 20.26</td>
</tr>
<tr>
<td>May 2007</td>
<td>1,000</td>
<td>53.1501</td>
<td>1,000/53.1501 = 18.81</td>
</tr>
<tr>
<td>June 2007</td>
<td>1,000</td>
<td>55.2344</td>
<td>1,000/55.2344 = 18.10</td>
</tr>
<tr>
<td>July 2007</td>
<td>1,000</td>
<td>58.8726</td>
<td>1,000/58.8726 = 16.98</td>
</tr>
<tr>
<td>August 2007</td>
<td>1,000</td>
<td>60.643</td>
<td>1,000/60.643 = 16.49</td>
</tr>
<tr>
<td>September 2007</td>
<td>1,000</td>
<td>61.3966</td>
<td>1,000/61.3966 = 16.29</td>
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<tr>
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<td>1,000</td>
<td>65.2109</td>
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<td>75.4613</td>
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<td>78.6222</td>
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<td>February 2008</td>
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<td>66.227</td>
<td>1,000/66.227 = 15.10</td>
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<tr>
<td>March 2008</td>
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<td>62.3267</td>
<td>1,000/62.3267 = 16.04</td>
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<td>April 2008</td>
<td>1,000</td>
<td>59.4898</td>
<td>1,000/59.4898 = 16.81</td>
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<tr>
<td>May 2008</td>
<td>1,000</td>
<td>63.7144</td>
<td>1,000/63.7144 = 15.69</td>
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<tr>
<td>June 2008</td>
<td>1,000</td>
<td>59.339</td>
<td>1,000/59.339 = 16.85</td>
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<tr>
<td>July 2008</td>
<td>1,000</td>
<td>52.3037</td>
<td>1,000/52.3037 = 19.12</td>
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<tr>
<td>August 2008</td>
<td>1,000</td>
<td>58.1061</td>
<td>1,000/58.1061 = 17.21</td>
</tr>
<tr>
<td>September 2008</td>
<td>1,000</td>
<td>58.6318</td>
<td>1,000/58.6318 = 17.05</td>
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</tbody>
</table>

Contd...
<table>
<thead>
<tr>
<th>Month</th>
<th>Amount</th>
<th>NAV</th>
<th>Maturity Val.</th>
</tr>
</thead>
<tbody>
<tr>
<td>October 2008</td>
<td>1,000</td>
<td>45.3646</td>
<td>1,000/45.3646 = 22.04</td>
</tr>
<tr>
<td>November 2008</td>
<td>1,000</td>
<td>39.9359</td>
<td>1,000/39.9359 = 25.04</td>
</tr>
<tr>
<td>December 2008</td>
<td>1,000</td>
<td>35.6461</td>
<td>1,000/35.6461 = 28.05</td>
</tr>
<tr>
<td>January 2009</td>
<td>1,000</td>
<td>37.3913</td>
<td>1,000/37.3913 = 26.74</td>
</tr>
<tr>
<td>February 2009</td>
<td>1,000</td>
<td>35.2276</td>
<td>1,000/35.2276 = 22.39</td>
</tr>
<tr>
<td>March 2009</td>
<td>1,000</td>
<td>32.0125</td>
<td>1,000/32.0125 = 31.24</td>
</tr>
<tr>
<td>April 2009</td>
<td>1,000</td>
<td>39.3572</td>
<td>1,000/39.3572 = 25.41</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>36,000</strong></td>
<td><strong>707.92</strong></td>
<td></td>
</tr>
</tbody>
</table>

NAV as on May 2009 = 44.155
Hence, total value of the investment = 44.155*707.92 = INR 31,258
The maturity value (INR 31,258) is less than the investment (INR 36,000) made. So, it is not a better choice for investment.
It would be better to invest INR 1,000 every month for 3 years in SBI recurring deposit scheme at an interest rate of 8%. The maturity value of his investment would be,

\[
FV_{An} = A \times \left[ \frac{(1 + k)^n - 1}{k} \right]
\]

\[
= 1,000 \times \left[ \frac{(1 + 0.08/12)^{36} - 1}{(0.08/12)} \right]
\]

\[
= 1,000 \times 40.33
\]

\[
= \text{INR 40,334}
\]

Therefore, one would get more returns if the money is invested in SBI recurring deposit scheme.

**The Big Picture**

What is the importance of time value of money in estimating cash flows?

**Final Thoughts**

The concept of time value of money is very much necessary to make investment decisions. One can choose an optimal one from various investment options after calculating the resultant income from the investment.
## Case Structure

<table>
<thead>
<tr>
<th>I. Introduction</th>
<th>II. ABC Wealth Advisors: Client Portfolio</th>
</tr>
</thead>
</table>

## Teaching Note Flow

**Prerequisite Conceptual Understanding**


### The Big Picture

What is the importance of time value of money in estimating cash flows?

### Time Value of Money: Concept

- Concept of time value of money
- Various categories of time value of money problems.

**ABC Wealth Advisors: Advising clients based on the importance of Time Value of Money**

- Various methods involved in calculating the worth of the investment.

## Pedagogical Objectives

- To understand the concept of time value of money
- To calculate the value of the investments using compounding and discounting techniques

## Classroom Deliverables

- Concept of time value of money
- Various compounding and discounting techniques used in the calculation of time value of money.
- Calculating the value of the investment in the future and its present value using various methods.

Prepared by the author