UNIVERSITY OF ASIA PACIFIC

Course Code : BUS 401

Course Title: Business and Entrepreneurship

Assignment - 01

Topic - Time Value of Money

Submitted by :

Rashik Rahman

Section : A

Reg. No : 17201012

Submitted to :

M A Kashem

Professor, Dept. of MIS, DU

Topic no.1

Time value money: The time value of money is the concept that a some of money is worth more now, than the same sum will be at ~~the~~ a future date due to it's earnings potential in the interim. The time value of money is also reffered to as present discounted value.

For example, say I have the chance of receiving 10,000Tk now or 10,000Tk two years from now. Despite the equal face value of 10,000Tk today has more value than it will two years from now due to the opportunity costs associated with the delay. In other words we can say, a payment delayed is an opportunity missed.

The rational for incorporating time value of money in financial decisions:

The recognition of the time value of money is extremely significant in financial decision making because most of financial decisions such as the acquisition of assets or procurement of funds affects ~~firm~~ ~~firm~~ firm's cash flows in different time periods, for example if a fixed asset is purchased, it will require an immediate cash outlays and will affect cash flows during many future periods.

Similarly if the firm borrow's funds from a bank or firm anyother sources, it receives cash now and commits an obligation to pay interest and return principle sum in future. While taking decisions on these matters, the financial management must keep the time factor in mind. If the timing of cash is not considered, the firm may make decisions which may ~~fatten~~ falter it's objective of maximizing the owner's welfare.

Techniques of compounding and discounting:

If the interest is compounded that means the interest which is earned at the end of ~~the~~ year, will be added to principal and will go on till the end of time. Future values are calculated by using this compounding interest. As interest rates increases, compounding interest also increases that means if you want large sum of money, interest rates must be high. So, when investers were investing they should look for higher interest rate to get high returns in this method.

General Formula: $FV_n = PV(1+r)^n$

Here,

$1+r$ = future value interest factor

PV = initial cash flow

r = rate of interest

n = number of years.

This formula also used in discounting. Now I will discuss about discounting techniques.

~~During~~

Discounting is the process of determining present value of a series of future cash flows. Present value of a future cash flow is the current worth of a future sum of money of stream of cash flow given a specified rate of return. Present value is also called discounted value. Interest rate used for discounting cash flows is also called the discount rate.

Topic no. 02:

P5-4:

Future value, $FV = PV(1+R)^n$

Here,

PV = initial cash flow

n = number of years

R = rate of interest

For, A ⇒

$$FV = 200 \times (1+0.05)^{20}$$
$$= 530.66\$$$

For, B ⇒

$$FV = 4500(1+0.08)^7$$
$$= 7712.21\$$$

For, C ⇒

$$FV = 10000(1+0.09)^{10}$$
$$= 23673.64\$$$

D $\Rightarrow$ $FV = 25000(1+0.1)^{12}$

$= 78460.71\$$

E $\Rightarrow$

$FV = 37000(1+0.11)^5$

$= 62347.15\$$

F $\Rightarrow$

$FV = 40000(1+0.12)^9$

$= 110923.15\$$

PS-6:

a) Car value or price after 5 years if inflation is,

(i) 2% then, $FV = 14000(1+0.02)^5 = 15457.13\$$

(ii) 4% then, $FV = 14000(1+0.04)^5 = 17033.14\$$

b) The car will cost 1576.01\$ more with a 4% inflation rate than rate with 2%. This increase is 10.2% ~~more~~ more than would be paid with only a 2% rate of inflation.

c) Car price if inflation is 2% for next 2 years

$$FV = PV(1+R)^n = 14000(1+0.02)^2 = 14565.60\$$$

and 4% for 3 years after that. Price rise at the end of 5th year, $FV = 14565.60(1+0.04)^3 = 16384.32\$$

PS-8:

1) River bank's saving account with an interest rate of 10.8% compounded monthly.

$$r = 10.8\% = \frac{0.108}{12}$$

$FV = 70000\$$

$PV = 3000\$$

$$FV = PV(1+r^n)$$

$$\Rightarrow 70000 = 3000\left(1 + \frac{0.108}{12}\right)^{12n}$$

$$\Rightarrow 1.009^{12n} = \frac{70000}{3000}$$

$$\Rightarrow 1.009^{12n} = 23.333$$

$$\Rightarrow 12n \ln 1.009 = \ln 23.33$$

$\therefore n = 29.3$ years.

2) First state bank's with 11.5% interest compounded annually

$r = 0.115,$

$$\because FV = PV(1+r)^n$$

$$\Rightarrow 70000 = 3000(1+0.115)^n$$

$$\Rightarrow 1.115^n = 23.33$$

$$\Rightarrow n \ln 1.115 = \ln 23.33$$

$\therefore n = 28.94$ years.

3)

Union bank's with 9.3% interest rate compounded weakly

$$r = \frac{0.093}{52}$$

$$70000 = 3000\left(1 + \frac{0.093}{52}\right)^{52n}$$

1.1001788^{52n}

$$\Rightarrow \cancel{1.1001788^{52n}} = 23.33$$

$$\Rightarrow 52n \ln 1.1001788 = \ln 23.33$$

$$\Rightarrow 52n = \frac{\ln 23.33}{\ln 1.0017}$$

$$\Rightarrow n = 33.9 \text{ years}$$

PS-10:

Present value calculation,

Present value of 1\$ = FV

$$PV = \frac{1}{(1+r)^n}$$

for A,

$$PV = \frac{1}{(1+0.02)^4} = 0.9238\$$$

B,

$$PV = \frac{1}{(1+0.1)^2} = 0.8638\$$$

C,

$$PV = \frac{1}{(1+0.05)^3} = 0.8638\$$$

D,

$$PV = \frac{1}{(1+0.13)^2} = 0.7831\$$$

PS-15:

a) The ~~Last~~ least I will sell my claim:

1) $n=10,\ r=0.06,\ FV=1000000\$$

$$PV=\frac{FV}{(1+r)^n}=\frac{1000000}{(1+0.06)^{10}}=558394.78\$$$

2) $r=0.09$

$$PV=\frac{1000000}{(1+0.09)^{10}}=422410.81\$$$

3) $r=0.12$

$$PV=\frac{1000000}{(1+0.12)^{10}}=321973.24\$$$

b) same as for 15 years period:

1) $n=15,\ r=0.06;\ FV=1000000\$$

$$PV=\frac{1000000}{(1+0.06)^{15}}=417265.06\$$$

2) $r=0.09$

$$PV=\frac{1000000}{(1+0.09)^{15}}=274538.04\$$$

3) $r=0.12$

$$PV=\frac{1000000}{(1+0.12)^{15}}=182696.26\$$$

c) As the discount rate increases the present value ~~bec~~ becomes smaller. This decreases is due to the higher opportunity cost associated with the higher rate.

Also the longer the time until the lottery payment is collected, the less the present value due to the greater time over which the oppurtunity cost applies. In other words, the larger the discount rate and the longer the time untill the money is received, the smaller will be the present value of a future payment.

PS-14:

PV = 30000\$, $n = 4$, $r = 15\% = 0.15$

$FV = 30(1+0.15)^4 = 52470.19\$$

∴ So interest received = (52470.19 − 30000) = 22470.19\$

Amount required, 210000\$

So future value = 210000 − 52470.19

= 157529.81\$

for, $r = 0.15$, $n = 5$, $FV = 157529.81\$$

$$\therefore PV = \frac{FV}{(1+r)^n} = \frac{157529.81}{(1+0.15)^5} = 78319.75\$$$

∴ Present value is 78319.75\$

PS-17:

A) $n = 5; r = 10\% = 0.1; PV = 30000\$$

$$PV = \frac{30000}{(1+0.1)^5} = 18627.64\$$$

B) $n = 20; r = 0.1; FV = 3000\$$

$$PV = \frac{30000}{(1+0.1)^{20}} = 445.93\$$$

C) $n = 10, r = 0.1, FV = 10000\$$

$$PV = \frac{10000}{(1+0.1)^{10}} = 3855.43\$$$

D) $n = 40; r = 0.1; FV = 15000\$$

$$PV = \frac{15000}{(1+0.1)^{40}} = 331.42\$$$

Tom should purchase option A and C and shouldn't purchase option B and D.

PS-20:

a) Present value of an ordinary annuity vs. annuity due

1) Ordinary annuity

~~2) Annuity due~~ due

PMT = Annuity payment

r = interest rate

n = number of years

$$PV = PMT\left[\left(1 - \frac{1}{(1+r)^n}\right)/r\right]$$

A) $n=3, r=0.07, PMT = 12000\$$

$$PV = 12000\left[\frac{1-\frac{1}{(1+0.07)^3}}{0.07}\right] = 31491.79\$$$

annuity due $= 31491.79 \times 1.07 = 33696.22\$$

B) $n=15; r=0.12; PMT = 55000\$$

$$PV = 55000\left[\frac{1-\frac{1}{(1+0.12)^{15}}}{0.12}\right] = 374597.55\$$$

annuity due $= 374597.55 \times 1.12 = 419549.25\$$

C) $n=9, r=0.2, PMT = 700\$$

$$PV = 700\left[\frac{1-\frac{1}{(1+0.2)^9}}{0.2}\right] = 2821.68\$$$

annuity due $= 2821.68 \times 1.2 = 3386.02\$$

D) $n=7, r=0.05, PMT = 140000$

$$PV = 140000\left[\frac{1-\frac{1}{(1+0.05)^7}}{0.05}\right] = 810092.28\$$$

annuity due $= 810092.28 \times 1.05 = 850596.89\$$

E) $n=5, r=0.1, PMT = 22500\$$

$$PV = 22500\left[\frac{1-\frac{1}{(1+0.1)^5}}{0.1}\right] = 85292.70\$$$

annuity due $= 85292.70 \times 1.1 = 93821.97\$$

b) The annuity due results in a greater present value in each case. By deposting the payment at the beginning rather than at the end of the year, it has ~~no~~ ~~an~~ one less year to discount back.

P5-22:

a) $n = 40$, $r = 10\% = 0.1$, $PMT = 2000\$$

$$FV = \frac{PMT}{r} \cdot \left[(1+r)^n - 1\right]$$

$$= \frac{2000}{0.1}\left[(1+0.1)^{40} - 1\right] = 885185.11\$$$

b) $n = 30$, $r = 0.1$, $PMT = 2000\$$

$$FV = \frac{2000}{0.1}\left[(1+0.1)^{30} - 1\right] = 328988.05\$$$

c) By delaying the deposits by 10 years the total oppurtunity cost is 556.197\$. The difference is due to both the ~~last~~ lost deposits of ~~20000\$~~ 20 000\$ (2000\$ X 10 years) and the lost compounding of interest on all of the money for 10 years.

d) Annuity due for

a) $885185.11 \times 1.1 = 973703.62\$$

b) $328988.05 \times 1.1 = 361886.85\$$

Both deposits increased due to the extra year of compounding from the beginning of the year deposits instead of the end of year deposits. However, the incramental change in the 40 year annuity is much larger than the incremental compounding on 30 year deposits, due to the larger sum on which the last year of compounding occurs.

P5-24:

a) $n=30$; $r=0.11$; $PMT=20000\$$

$$PV = 20000\left[\frac{1-\frac{1}{(1+0.11)^{30}}}{0.11}\right] = 173875.84\$$$

b) $n=20$; $r=0.09$; $FV=173875.84\$$

$$PV = \frac{FV}{(1+r)^n} = \frac{173875.84}{(1+0.09)^{20}} = 31024.82\$$$

c) Both values would be lower. In other words we can say a smaller sum would be needed in 20 years for the annuity and a smaller amount would have to be put away today to accumulate the needed future sum.

d) $n=30$, $r=0.1$, $PMT=20000\$$

$$PV = 20000\left[\frac{1-\frac{1}{(1+0.1)^{30}}}{0.1}\right] = 188538.29\$$$

then $FV=188538.29\$$

$$PV = \frac{188538.29}{(1+0.1)^{30}} = 28025.02\$$$

More money will be required to support the 20000\$ annuity in retirement, because initial amount will earn 1% less per year. However, ~~more~~ less money will have to be deposited during the next 20 years, because the return on saved funds will be ~~at~~ 1% higher.

PS-25:

a) $n=25, R=0.05, PMT=40000\$$

$$PV = 40000\left[\frac{1-\frac{1}{(1+0.05)^{25}}}{0.05}\right] = 563757.78\$$$

at 5% taking award as annuity is better I think, because the present value is 563760\$ compared to receiving 500000\$ as future value. One has to live at least 23.5 years to benefit more from the annuity stream of payments.

b) $R = 0.07$

$$PV = 40000\left[\frac{1-\frac{1}{(1+0.07)^{25}}}{0.07}\right] = 466143.33\$$$

at 7% compounded sum is better. This is why my decision will be changed and also here the present value of the annuity is only 466143.33 \$.

c) As an investment 500000\$ to get a 25 years annuity of 40000\$. The discount rate,

$n=25, PV=500000\$, PMT=40000\$$

$\therefore I = 6.24\%$

PS-26:

Present value of each perpentoy:

Case	Formula	Present value
A	$\frac{\text{annual amount}}{\text{discount rate}} = \frac{20000}{0.08}$	250000\$
B	$\frac{100\,000}{0.1}$	1000000\$
C	$\frac{3000}{0.06}$	50000 \$
D	$\frac{60000}{0.05}$	1200 000\$

PS-27:

a) $PV = \frac{CF}{r}$

here, PV = Present value of cash flow

CF = annual cash flow = 600\$

r = discount rate = ~~7%~~ 6% = 0.06

$Pv = \frac{600}{0.06} = 10000\$$

for 3 students marla's parents required to make ~~the~~ the payments of ~~3000~~ 30000\$.

b) $Pv = \frac{600}{0.09} = 6666.67\$$ // $r = 0.09$

For 3 students marla's ~~parents~~ parent's required to make the payments of 20000\$.

Scanned with CamScanner

PS-31:

a) PV of a mixed stream cash flow of A: Here $i = 0.15$

$$PV = C_1(1+i)^{-1} + C_2(1+i)^{-2} + C_3(1+i)^{-3} + C_4(1+i)^{-4} + C_5(1+i)^{-5}$$

$$= 50000(1+0.15)^{-1} + 40000(1+0.15)^{-2} + 30000(1+0.15)^{-3} + 20000(1+0.15)^{-4} + 10000(1+0.15)^{-5}$$

$$= 109856.33\$$$

for B,

$$PV = 10000(1+0.15)^{-1} + 20000(1+0.15)^{-2} + 30000(1+0.15)^{-3} + 40000(1+0.15)^{-4} + 50000(1+0.15)^{-5}$$

$$= 91272.98\$$$

b) Cashflow stream A with a present value of 109856.33\$ is higher than cash flow ~~system~~ streeam B's present value of 97292.98\$ because the larger cash flow occurs in A is the early years when their present value is greater, while the smaller cash flows are received further in the future.

PS-33:

a) $i = 8\% = 0.08$

PV of mixed stream $= 5000(1+0.08)^{-1} + 4000(1+0.08)^{-2} + 6000(1+0.08)^{-3} + 10000(1+0.08)^{-4} + 3000(1+0.08)^{-5}$

$= 22214.03\$$ this amount of deposit is needed to fund the short fall.

b) An increase in the earings rate would reduce the amount calculated in part a. The higher rate would ~~have~~ have to a larger ~~inves~~ interest income being earned each year on the investment. The larger interest amounts will

will permit a decrease in the initial ~~in~~ investment to obtain the same future value ~~a~~ avaible for covering the shortfall.

P5-37:

ⓐ Compounding frequency

for A, $n=10$, $r=0.03$, $PV=2500\$$

$$FV = PV(1+R)^n = 2500(1+0.03)^{10} = 3359.79\$$$

B, $n=18$, $r=0.02$, $PV=50000\$$

$$FV = 50000(1+0.02)^{18} = 71412.31\$$$

C, $n=10$, $r=0.05$, $PV=1000\$$

$$FV = 1000(1+0.05)^{10} = 1628.89\$$$

D, $n=24$, $r=0.04$, $PV=20000\$$

$$FV = 20000(1+0.04)^{24} = 51226.08\$$$

ⓑ

Effective interest rate, $i_{eff} = \left(1+\frac{r}{m}\right)^m - 1$

for A, $i_{eff} = \left(1+\frac{0.06}{2}\right)^2 - 1 = 6.1\%$

for B, ~~ieef~~ $i_{eff} = \left(1+\frac{0.12}{6}\right)^6 - 1 = 12.6\%$

for C, $i_{eff} = \left(1+\frac{0.05}{1}\right)^1 - 1 = 5\%$

for D, $i_{eff} = \left(1+\frac{0.16}{4}\right)^4 - 1 = 17\%$

ⓒ The effective rates of interest rise relative to the stated nominal rate with increasing compounding frequency.

PS-41:

ⓐ ① annual:

$n=10,\ r=0.08,\ PMT=300\$$

$$FV=\frac{PMT}{r}\left[(1+r)^n-1\right]=\frac{300}{0.08}\left[(1+0.08)^{10}-1\right]$$
$$=4345.97\$$$

② Semi-annual:

$n=10\times2=20,\ r=0.04,\ PMT=150\$$

$$FV=\frac{150}{0.04}\left[(1+0.04)^{20}-1\right]=4466.71\$$$

③ ~~Quarterly~~ Quarterly:

$n=10\times4,\ r=0.02,\ PMT=75\$$

$$FV=\frac{75}{0.02}\left[(1+0.02)^{40}-1\right]=4530.15\$$$

ⓑ The earlier a deposit is made the earlier the funds will be available to earn interest and contribute to compounding. Thus the earlier the deposit and the more frequent the compounding, the larger the future sum will be.

PS-43:

The annual deposit must be,

ⓐ $n=42,\ r=0.08,\ FV=220000\$$

$$PMT=\frac{FV\times r}{(1+r)^n-1}=\frac{220000\times0.08}{(1+0.08)^{42}-1}=723.10\$$$

ⓑ $n=42,\ r=0.08,\ PMT=600\$$

$$FV=\frac{PMT}{r}\left[(1+r)^n-1\right]=\frac{600}{0.08}\left[(1+0.08)^{42}-1\right]=182546.11\$$$

This amount have accumulated by the end of the 42th year.

P5-44:

ⓐ Given loan = 21600\$, PV

$r = 0.1$
$n = 1$

$FV = PV(1+0.1)^1 = 21600(1+0.1)^1 = 23760\$$

My friend gave me 21600\$ by 10% and if so I have to pay 23760\$ but asked me to ~~play~~ pay 24000\$. So he hasn't changed 10% interest.

ⓑ ~~Ammuat~~ interest rate:

Here,
PV = 21600\$ given money
FV = 24000\$ have to pay after 1year
$n = 1$

So,
$$FV = PV(1+r)^n$$
$$\Rightarrow (1+r)^n = \frac{FV}{PV}$$
$$\Rightarrow r = \left(\frac{FV}{PV}\right)^{\frac{1}{n}} - 1$$
$$\Rightarrow r = \left(\frac{24000}{216000}\right)^{1/1} - 1$$
$$\therefore r = 0.1111 = 11.11\%$$

So the ~~ae~~ interest my friend changed is 11.11%

PS-46:

(a) $n=25, r=0.05, PV=200000\$$

$$FV = PV(1+r)^n = 200000(1+0.05)^{25} = 677270.99\$$$

(b) $n=25, r=0.09, FV=677270.99\$$

$$\therefore PMT = \frac{FV \times r}{(1+r)^n - 1} = \frac{677270.99 \times 0.09}{(1+0.09)^{25} - 1} = 7996.03\$$$

(c) Since John will have an additional year on which to earn interest at the end of the 25 years his annuity due deposit will be smaller each year. To determine the annuity amount John will first discount back the 677270.99\$ one period.

$n=1, r=0.09, FV=677270.99\$$

$$\therefore PV = \frac{FV}{(1+r)^n} = 621349.53\$$$

This is the amount John must accumulate over the 25 years. John can solve for his annuity amount using the same calculation as in part b.

$n=25, r=0.09, FV=621349.53\$$

$$\therefore PMT = \frac{FV \times r}{(1+r)^n - 1} = 7335.80\$$$

to check this value, multiply the annual amount payment by 1 plus the 9% ~~dis~~ discount rate.

So, $7335.80 \times 1.09 = 7996.03\$$

PS-56:

ⓐ Defendants interest rate assumption

here, $n = 25$, $PV = 2000000\$$, $PMT = 156000\$$

formula, $PV = PMT\left[\frac{1-(1+i)^{-n}}{i}\right]$

$\therefore i = 5.97\%$

ⓑ $n = 25$, $PV = 2000000\$$, $PMT = 255000\$$

solve for $i = 12\%$

$\therefore$ prosecution interest rate is 12%.

ⓒ $n = 25$, $i = 0.09$ $PV = 2000000\$$

then; $PMT = \dfrac{PV}{\frac{1-(1+i)^{-n}}{i}} = \dfrac{2000000}{\frac{1-(1+0.09)^{-25}}{0.09}}$

$= 203612.50\$$,

Ans.

PS-61:

ⓐ here, given, $i = 12\% = 0.12$

$PV = 14000\$$

$PMT = 2450\$$

using $PV = PMT\left[\frac{1-(1+i)^{-n}}{i}\right]$ this formula we find $n = 10.21$ years.

ⓑ $i = 0.09$ then $n = 8.38$ years

ⓒ $i = 0.15$ then $n = 13.92$ years

(d) The higher the interest rate, the greater the amount of time periods needed to repay the loan fully.

P5-62:

** In next Page **

Spreadsheet Exercise

At the end of 2015, Uma Corporation is considering undertaking a major long-term project in an effort to remain competitive in its industry. The production and sales departments have determined the potential annual cash flow savings that could accrue to the firm if it acts soon. Specifically, they estimate that a mixed stream of future cash flow savings will occur at the end of the years 2016 through 2021. The years 2022 through 2026 will see consecutive and equal cash flow savings at the end of each year. The firm estimates that its discount rate over the first 6 years will be 7%. The expected discount rate over the years 2022 through 2026 will be 11%.
The project managers will find the project acceptable if it results in present cash flow savings of at least $860,000. The following cash flow savings data are supplied to the finance department for analysis.

End of year	Cash flow savings
2016	$ 110,000.00
2017	120,000.00
2018	130,000.00
2019	150,000.00
2020	160,000.00
2021	150,000.00
2022	90,000.00
2023	90,000.00
2024	90,000.00
2025	90,000.00
2026	90,000.00

To Do
Create spreadsheets similar to Table 5.2, and then answer the following questions.
a. Determine the value (at the beginning of 2016) of the future cash flow savings expected to be generated by this project.
b. Based solely on the one criterion set by management, should the firm undertake this specific project? Explain.
c. What is the "interest rate risk," and how might it influence the recommendation made in part b? Explain.

Discount rate for years 2016 - 2021	7%
Discount rate for years 2022 - 2026	11%

End of Year	Year (n)	Cash Flow	Present Value End of Year 2021	Present Value Beg of Year 2016
2016	1	$110,000		$ 102,803.74
2017	2	120,000		104,812.65
2018	3	130,000		106,118.72
2019	4	150,000		114,434.28
2020	5	160,000		114,077.79
2021	6	150,000		99,951.33
2022	7	90,000	81,081.08	54,027.75
2023	8	90,000	73,046.02	48,673.65
2024	9	90,000	65,807.22	43,850.13
2025	10	90,000	59,285.79	39,504.62
2026	11	90,000	53,410.62	35,589.75
				$ 863,844.42

(a) First, we will discount the cash flows at the end of years 2022 through 2026 at 11% back to the end of year 2021. Next, we will discount the cash flows at the end of years 2016 through 2021 (don't forget the present values found in the first step are now at the end of year 2021) at 7% back to the end of year 2015. The end of year 2015 is the beginning of year 2016, which is when we want the present value of the cash flow savings. By discounting cash flows for at the end of years 2016 through 2021 at 7%, we get PV of $863,844.42.

(b) Based solely on the criteria set by management, the firm should undertake this project as the present value of the expected future saving total $863,844.42 which exceeds the $860,000 hurdle.

(c) The concept of interest-rate risk states that changes in the interest rates will affect the present value of future cash flows. For this problem, if the the interest rates were to rise just 1 percentage point, the present value of the expected savings would fall below the required $860,000 limit set by mangement.