Lesson 5-4 – Cashflow Equivalence

Take a step back

- The last few videos we've looked at why we value money differently over time, and some simple tools for calculating the value of different cashflows at different times. Why do we care?

- Go back to our earlier question – would you rather have $10,000 now, or $10,000 five years from now?

- Comparing the values of these cashflows over time allows us to determine when they have the same value, or are equivalent to us.
  - Would I rather have $10,000 today, or $14,000 five years from now? Honestly, I could go either way – they're both about the same to me
- If we can determine when two cashflows are equivalent, we can also determine when they are not – i.e. one cashflow is more valuable than the other

Equivalence

- Equivalence with respect to the “time value of money” implies that a sum of money in one time period may have the same “value” to a different sum in another time period with respect to an interest rate.
- Example: $1000 now is equivalent to:
    - $1100 one year from now at 10% per year
    - $1050 one year from now at 5% per year
    - $1210 two years from now at 10% per year
    - $1102 two years from now at 5% per year

Equivalence Continued…

- **Equivalence is dependent on interest rate**
- Equivalence is useful when:
  - There are cash flows (positive and/or negative) over "*n*" time periods that need to be compared
  - There are alternative comparisons of multiple cash flows
  - Equivalent cash flows are considered to have the same value.

The 4 plans discussed on the next slides are considered equivalent because the principle amount and interest rates are identical, as each plan repays the same amount of money (that has the same value today), at the same interest rate.

Repaying a Debt

- Four plans for Loan Repayment of the same principle amount (See pgs. 78-80):

Plan	Repay Principal	Repay Interest	Interest Amount Paid
1	Equal annual amounts	On the unpaid balance	Declines
2	At the end of the loan	On the unpaid balance	Constant
3	Equal annual amounts		Declines at an increasing rate
4	At the end of the loan	At the end of the loan	Grows at an increasing rate

Repay a Debt – Plan 4

- Borrow $5,000 at time zero
- 8% interest, five year term
- No payments until end of term

8%

	Single Payment	
	Compound Amount Factor Find *F* Given *P*	Present Worth Factor Find *P* Given *F*
n	*F/P*	*P/F*
1	1.080	.9259
2	1.166	.8573
3	1.260	.7938
4	1.360	.7350
5	1.469	.6806

- How much do we pay at the end of the term?

- F = P(F/P, i, n) = $5000(F/P, 8%, 5), =$5,000*1.469 = $7,345
- $F = P(1+i)^n = \$5000(1+0.08)^5 = \$7,347$

TABLE 3-1 Four Plans for Repayment of $5,000 in Five Years with Interest at 8%

(a) Year	(b) Amount Owed at Beginning of Year	(c) Interest Owed for That Year, 8% × (b)	(d) Total Owed at End of Year, (b) + (c)	(e) Principal Payment	(f) Total End-of-Year Payment
Plan 1: Constant $1,000 principal payment plus interest due.					
1	$5,000	$ 400	$5,400	$1,000	$1,400
2	4,000	320	4,320	1,000	1,320
3	3,000	240	3,240	1,000	1,240
4	2,000	160	2,160	1,000	1,160
5	1,000	80	1,080	1,000	1,080
		$1,200		$5,000	$6,200
Plan 2: Annual interest payment due and principal payment at end of five years.					
1	$5,000	$ 400	$5,400	$ 0	$ 400
2	5,000	400	5,400	0	400
3	5,000	400	5,400	0	400
4	5,000	400	5,400	0	400
5	5,000	400	5,400	5,000	5,400
		$2,000		$5,000	$7,000
Plan 3: Constant annual payments.					
1	$5,000	$ 400	$5,400	$ 852	$1,252*
2	4,148	331	4,479	921	1,252
3	3,227	258	3,485	994	1,252
4	2,233	178	2,411	1,074	1,252
5	1,159	93	1,252	1,159	1,252
		$1,260		$5,000	$6,260
Plan 4: All payments at end of five years.					
1	$5,000	$ 400	$5,400	$ 0	$ 0
2	5,400	432	5,832	0	0
3	5,832	467	6,299	0	0
4	6,299	504	6,803	0	0
5	6,803	544	7,347	5,000	7,347
		$2,347		$5,000	$7,347

Repay a Debt – Present Values

		Borrow $5,000 at time 0		
		Interest Rate:	8%	
	Plan 1		Plan 4	
Year	**EoY Payment**	**PV of Payment**	**EoY Payment 4**	**PV of Payment**
1	$1,400	$1,296	$0	$0
2	$1,320	$1,132	$0	$0
3	$1,240	$984	$0	$0
4	$1,160	$853	$0	$0
5	$1,080	$735	$7,347	$5,000
Total	$6,200	$5,000	$7,347	$5,000

Spreadsheet Example