FIN 2004 Finance Tutorial 8:

Capital Budgeting II

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Revisit some important concepts

- The starting point in cash flow estimation is identifying the relevant cash flows.
- Two important rules :
  - Capital budgeting decision must be based on cash flows, not accounting income
  - Only incremental cash flows are relevant
- Sunk cost is an outlay that has already been incurred and which cannot be recovered regardless of whether the project is accepted or rejected. Examples of sunk costs are fees paid to hire a consulting firm to perform feasibility study or site analysis and R&D expenses. These costs should not be included in the cash flow estimation.
- Opportunity cost is the return on the best alternative use of an asset, or the highest return that will not be earned if funds are invested in a particular project. For example, a firm bought a piece of land many years ago for $1.5 million and now it has a market value of $2 million and the land is now use to build a warehouse for the new project. So the opportunity cost is to be included in the cash flow estimation is $2 million.
- The incremental cash flows represent the change in the firm's total cash flow that occurs as a direct result of accepting the project.

Expansion Project

In general, the incremental cash flows from an expansion project can be classified as follows :

1. **Initial investment outlay**
   - Cost of fixed capital or asset (FCInv)
   - Change in NOWC (NOWCInv)

   Hence, Outlay = FCInv +NOWCInv

NOWCInv = ΔNon-cash current assets – Δ non interest-bearing current liabilities

Cash outflow if > 0

Cash inflow if < 0

Cont'd

2. After-tax Operating cash flows

$$\mathbf{OCF} = \mathbf{EBIT}\,(\mathbf{1} - \mathbf{T}) + \mathbf{D}$$
$$= (S - C - D)(1 - T) + D$$
$$= (S - C)(1 - T) - D(1 - T) + D$$
$$= (S - C)(1 - T) + (T \times D)$$

Depreciation Tax-Shield Method,

$$\mathbf{OCF} = (\mathbf{S} - \mathbf{C})(\mathbf{1} - \mathbf{T}) + (\mathbf{T} \times \mathbf{D})$$

where S = Sales

C = Cash operating expenses

D = Depreciation

EBIT = Earnings Before Interest and Tax

T = Marginal tax rate

Cont'd

3. **Terminal Year After-tax Non-operating Cash Flows (TNOCF)**

$$TNOCF = Sal_T - T(Sal_T - B_T) + NOWCInv$$

Cont'd

3. After-tax Salvage Value

$Sal_T - T(Sal_T - B_T)$

Replacement Project

1. **Initial Outlay**

$$\text{FCInv} + \text{NOWCInv} - [\text{Sal}_0 - \text{T}(\text{Sal}_0 - \text{B}_0)]$$

Sal_0 = proceeeds from sale of old fixed asset

B_0 = Book value of old fixed asset

2. **After-tax incremental operating cash flow**

$$\text{OCF} = (\text{S} - \text{C} - \Delta\text{D})(1 - \text{T}) + \Delta\text{D}$$

ΔD = incremental depreciation

$$\text{OCF} = (\text{S} - \text{C})(1 - \text{T}) + \Delta\text{D} \times \text{T}$$

3. **Terminal year after-tax non-operating cash flow (TNOCF)**

$$\text{TNOCF} = \text{Sal}_\text{T} + \text{NOWCInv} - \text{T}(\text{Sal}_\text{T} - \text{B}_\text{T}) - \text{Opportunity Cost}^*$$

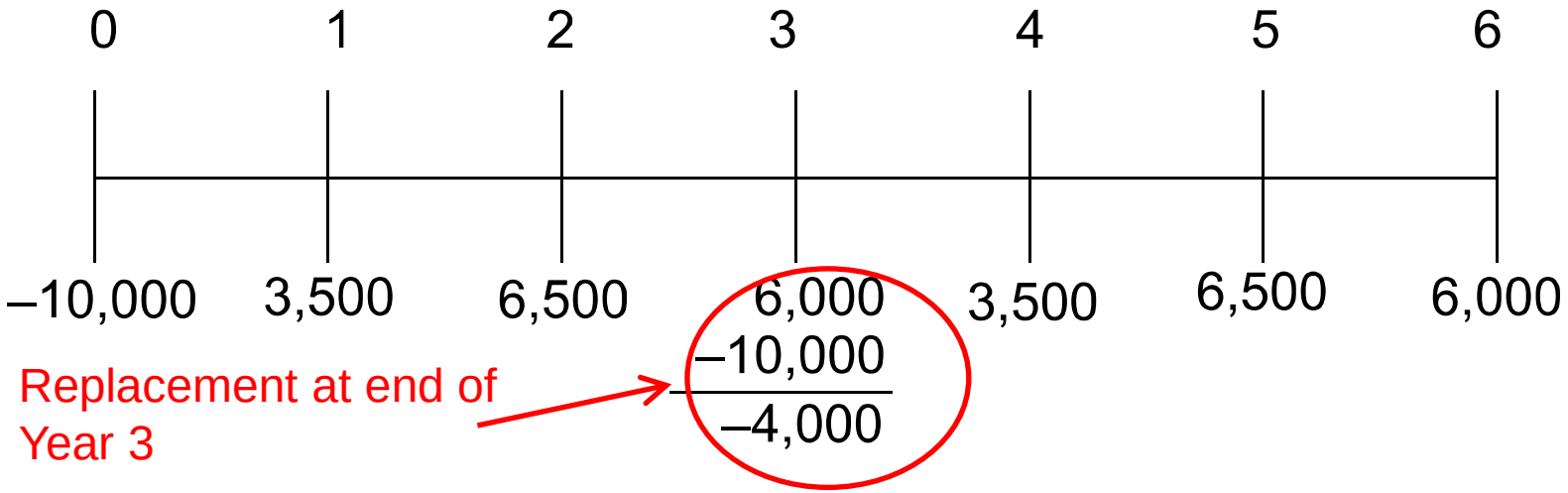
*opportunity cost = after-tax salvage value of old fixed asset at the end of the project, if applicable.

Projects with Unequal lives (Replacement Chain Approach)

- For mutually exclusive projects having unequal lives, we can use the following methods to evaluate the projects.

1. Replacement chain (Common Life Approach)

   In this example, we are evaluating two projects. The first has a useful life 3 years and the other has a useful life of 6 years. We assume that the 3-year project would be repeated once its useful life ends at year 3. The initial outlay of 3-year project is $10,000 and it generates cash flow of $3,500, $6500 and $6,000 at the end of year 1, year 2 and year 3 respectively.



$NPV_{chained\ printers}$ @ 12% = $4,412.01; IRR = 25.2%.

Projects with Unequal lives (EAA & EAC Methods)

2. EAA approach :
   - Find each project's NPV
   - Use NPV as PV and solve for PMT, the PMT is the equivalent annual annuity
   - Select project with higher EAA

3 EAC approach :
   - Find each project's present value of costs each year to operate the equipment (including the cost of equipment at time t=0)
   - Find an annuity (EAC) that equates to the project's present value of costs over its individual life at project's cost of capital
   - Select project with lower EAC

Revisit some important concepts

- Effects of inflation on Capital Budgeting
  - Inflation is built into interest rates
  - Causes the WACC to increase
  - Causes the PV of future cash flows to decrease, which lowers the NPV
  - Future cash flows must be adjusted upward to reflect inflation

#1:

When is EAC analysis appropriate for comparing two or more projects? Why is this method used? Are there any implicit assumptions required by this method that you find troubling? Explain.

The EAC approach is appropriate when comparing **mutually exclusive projects with different lives that will be replaced when they wear out.**

This type of analysis is necessary so that the projects have a common life span over which they can be compared; in effect, **each project is assumed to exist over an infinite horizon of N-year repeating projects**. For example, 2-year project can be repeated 3 times during the life to have life span of 6 years to compare with another project which has a life of 6 years

Assuming that this type of analysis is valid implies that the project cash flows remain the same forever, thus ignoring the possible effects of, among other things: (1) inflation, (2) changing economic conditions, (3) the increasing unreliability of cash flow estimates that occur far into the future, and (4) the possible effects of future technology improvement that could alter the project cash flows.

#2:

Parker & Stone, Inc is looking at setting up a new manufacturing plant in South Park to produce garden tools.

The company bought some land six years ago for $6 million in anticipation of using it as a warehouse and distribution site, but the company has since decided to rent these facilities from a competitor instead.

If the land were sold today, the company would net $6.4 million. The company wants to build its new manufacturing plant on this land; the plant will cost $14.2 million to build, and the site requires $890,000 worth of grading* before it is suitable for construction.

What is the proper cash flow amount to use as the initial investment in fixed assets when evaluating this project? Why?

*The purpose of grading is to provide more suitable topography for building, facilities and other land uses

The $6 million acquisition cost of the land six years ago is a sunk cost. The $6.4 million current after-tax value of the land is an opportunity cost if the land is used rather than sold off.

Therefore, the proper year zero cash flow to use in evaluating this project is:

$$CF_0 = 6{,}400{,}000 + 14{,}200{,}000 + 890{,}000 = \$21{,}490{,}000$$

#3:

Winnebagel Corp, currently sells 30,000 motor homes per year at $53,000 each, and 12,000 luxury motor coaches per year at $91,000 each.

The company wants to introduce a new portable camper to fill out its product line; it hopes to sell 19,000 of these campers per year at $13,000 each.

An independent consultant has determined that if Winnebagel introduces the new campers, it should **boost the sales of its existing motor homes** by 4,500 units per year and **reduce the sales of its motor coaches** by 900 units per year. What is the amount to use as the annual sales figure when evaluating this project? Why?

Sales due solely to the new product line are:
19,000($13,000) = $247,000,000

Increased sales of the motor home line occur because of the new product line introduction; thus:

4,500($53,000) = $238,500,000 in new sales is relevant.

Erosion of luxury motor coach sales is also due to the new mid-size campers; thus:

900($91,000) = $81,900,000 loss in sales is relevant.

The net sales figure to use in evaluating the new line is thus:

$247,000,000 + 238,500,000 – 81,900,000 = $403,600,000

#4: Expansion Project

New product line: Gas-powered skateboards

Project life:	10 years
Purchase price of production equipment:	$1,000,000
Annual depreciation:	$1,000,000/10 (fully depreciated over 10 years)
Unit selling price of skateboard	$100
Variable cost	$40 per unit
Annual fixed cost:	$160,000
Initial investment in NOWC:	$50,000 (to be recovered at year 10)
Firm's marginal tax rate:	34%

a. What is the initial cash outlay associated with this project?
b. What are the annual net cash flows associated with this project for years 1 through 10?
c. What is the terminal cash flow in year 10?
d. What is the project's NPV given a 10 percent required rate of return?

a. What is the initial cash outlay associated with this project?

The initial cash flow (t = 0) for the gas-powered skateboard project will be:

The cost to purchase the new production equipment plus the incremental investment in inventory
=$1,000,000 + $50,000 = $1,050,000

b. What are the annual net cash flows associated with this project for years 1 through 10?

Operating cash flow each year = EBIT (1 – tax rate)+ depreciation
EBIT= Sales – Variable costs – Annual fixed cost - Depr
Sales = 10,000 x ($100/unit) =$1,000,000
Variable costs = (10,000 units) x ($40/unit) =$400,000
Annual fixed costs = $160,000
Using the straight-line method: Depr = $1,000,000÷10 = $100,000
EBIT= $1,000,000 - $400,000 - $160,000 - $100,000 = $340,000.
Operating cash flow = $340,000 x (1 - 0.34) + $100,000 = $324,400.
This will be our project's cash flow amount for years 1 through 10.

c. What is the terminal cash flow in year 10?

In year 10, the terminal value will be just the recovery of the $50,000 working capital investment since no mention of how much (salvage value) the gas-powered cutter can be sold at the end of project.

d. What is the project's NPV given a 10 percent required rate of return?

To find the project's NPV, we use the following equation:
where our required return, k, is 10%. Substituting for our project's values, we have:

$$NPV = -CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \ldots\ldots\ldots \frac{CF_n}{(1+k)^n}$$

$$NPV = -1{,}050{,}000 + \frac{\$324{,}400}{(1.10)^1} + \frac{\$324{,}400}{(1.10)^2} + \ldots + \frac{\$374{,}400}{(1.10)^{10}} = \$962{,}575.$$

(The easiest way to calculate the NPV is to use financial calculator)
Since the NPV is greater than zero, the project should be accepted.

#5: (Replacement Project)

Old Plasma Cutter:

BV of cutter today (Purchase 4 years ago):	$80,000
Annual depreciation:	$20,000
Selling price today:	$80,000 (=BV today)

New Automatic Plasma Cutter:

Cost of new cutter:	$400,000

Depreciate using SL method over next 4 years with salvage value of $40,000

Annual savings in labour cost:	$100,000
Firm's marginal tax rate:	30%

a. What are the differential operating cash flow savings per year during year 1 through 4 for the new plasma cutter?
b. What is the initial cash outlay required to replace the existing plasma cutter with the newer model?
c. If the company requires a 15 percent discount rate for new investments, should the fleet be replaced?

a. What are the differential operating cash flow savings per year during year 1 through 4 for the new plasma cutter?

	0	1	2	3	4
Cost savings		100,000	100,000	100,000	100,000
New Equipment Depreciation ($400,000 - $40,000)/4		90,000	90,000	90,000	90,000
Old Equipment Depreciation		20,000	20,000	20,000	20,000
Incremental Depreciation		70,000	70,000	70,000	70,000
EBIT (= cost savings – incremental depr)		30,000	30,000	30,000	30,000
EBIT(1 - t)		21,000	21,000	21,000	21,000
OCF (=EBIT(1-t) + Depr)		91,000	91,000	91,000	91,000
New Plasma Cutter	-400,000				
Old Cutter Net Salvage Value (Book Value) ($80,000)	80,000				
Net Capital Spending	-320,000				
New Plasma Cutter Net Salvage Value (new)					40,000
Opportunity cost (net salvage value of old equipment)					0
Increase in NOWC	0				0
NCF	-320,000	91,000	91,000	91,000	131,000

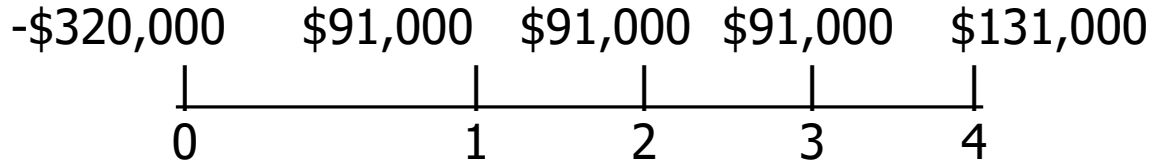
a. The differential operating cash flow savings per year =$91,000

b. The total initial cash outlay = $400,000 - $80,000 = $320,000.

c. If the company requires a 15 percent discount rate for new investments, should the fleet be replaced?

we have assumed that the firm sells the cutter for $40,000, its book value; there is therefore no tax effect from this sale. We will therefore add the full $40,000 to the change in operating cash flow for year 4.

We are not given the salvage value of old cutter at the end of the project. We cannot work out the opportunity cost if the old cutter were not sold at the start of the project, so we ignore this in our calculation



$$NPV = -CF_0 + \frac{CF_1}{(1+k)^1} + \frac{CF_2}{(1+k)^2} + \ldots\ldots \frac{CF_n}{(1+k)^n}$$

$$NPV = -\$320{,}000 + \frac{91{,}000}{(1.15)} + \frac{91{,}000}{(1.15)^2} + \frac{91{,}000}{(1.15)^3} + \frac{131{,}000}{(1.15)^4} = -37{,}327$$

Given the negative NPV, Minot should reject this replacement opportunity. It is better off keeping the old cutter.

#6: (EAC Method)

Dangerfield Industrial Systems Company (DISC) is trying to decide between two different conveyor belt systems.

System A costs $430,000, has a **four-year life**, and requires $110,000 in pretax annual operating costs.

System B costs $570,000, has a **six-year life**, and requires $98,000 in pretax annual operating costs.

Both systems are to be depreciated straight-line to zero over their lives and will have zero salvage value.

Whichever project is chosen, it will be replaced when it wears out. If the tax rate is 34 percent and the discount rate is 11 percent , which project should the firm choose?

If the equipment will be replaced at the end of its useful life, the correct capital budgeting technique is EAC.

Using Depreciation Tax Shield method,
OCF = (Sales – Cost)(1 – tax rate) + Depr x (tax rate)
NPV of System A is:

NCF_A per year = (0 –\$110,000)(1 – 0.34) + 0.34(\$430,000/4)= –\$36,050

NPV_A = –\$430,000 – \$36,050/(1+0.11) – \$36,050/$(1+0.11)^2$ – \$36,050/$(1+0.11)^3$ – \$36,050/$(1+0.11)^4$ = –\$541,843.17

And the NPV of System B is:

OCF = (Sales – Cost)(1 – tax rate) + Depr x (tax rate)

NCF_B per year = –\$98,000(1 – 0.34) + 0.34(\$570,000/6)= –\$32,380

NPV_B = –\$570,000 – \$32,380/(1+0.11) – \$32,380/$(1+0.11)^2$ – \$32,380/$(1+0.11)^3$ – \$32,380/$(1+0.11)^4$ – \$32,380/$(1+0.11)^5$ – \$32,380/$(+0.11)^6$= –\$706,984.82

Using the NPVs calculated above, calculate the EAC for each system:
EAC_A : Enter N=4, I/Y=11, PV=541,843.17, Solve PMT=EAC_A= -174,650.03
EAC_B : Enter N=6, I/Y=11, PV=706,984.82, Solve PMT=EAC_B= -167,114.64
If the conveyor belt system will be continually replaced, we should choose System B since it has the more positive EAC.

#7:

As the manager of The Homey Depot, you are tasked with upgrading a computerized inventory system at a retail outlet. The remaining period of the lease of this outlet is 10 years and management has no intention of renewing the lease. The required return is 12.5% and the tax rate is 34%. The expected life and incremental cash flows for the two models of computerized inventory systems are as follows:

New project life is 10 years

Current Computerized Inventory System:

Initial cost outlay: $1.2m

Annual depreciation: $100,000

Accumulated depreciation: $400,000

Current Book value =$1,200,000 – $400,000 = $800,000

Remaining useful life: 10 years

Annual operating costs (excluding depreciation): $450,000

Current Salvage Value: $400,000

If it is sold today, it can fetch this price

Estimated salvage value at year 10: $50,000

New Computerized Inventory System:

Initial cost outlay: $1.5m

Useful life: 10 years (same as the remaining lease)

Annual depreciation: Straight-line full depreciation

Annual operating costs (excluding depreciation): $215,000

Estimated salvage value at year 10: $180,000

$$\text{Depr} = \frac{1{,}500{,}000}{10} = 150{,}000$$

a. What is the initial cash outlay associated with this project?
b. What are the net cash flows associated with this project for years 1 through 10?
c. What is the terminal cash flow in year 10?
d. What is the project's NPV? Would you replace the current inventory system with the new one?

a. What is the initial cash outlay associated with this project?

Initial cost of new system = $1,500,000
Book Value of old system = $1.2m – $400,000 = $800,000
Net Salvage Value of Old System = $400,000 – 34%(400,000-800,000) = $536,000
Initial cost outlay = $1,500,000 - $536,000 = $964,000

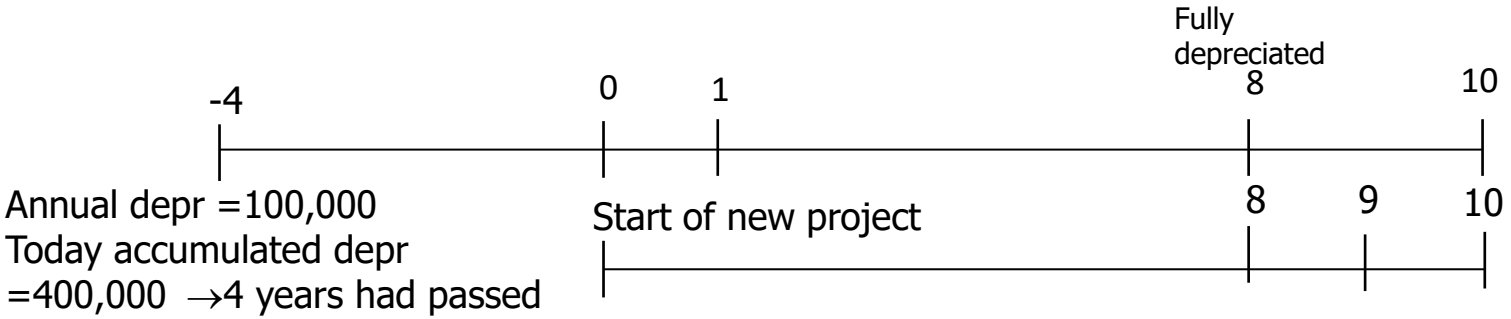
b. What are the net cash flows associated with this project for years 1 through 10?

Since annual depreciation of old system is $100,000 and book value is $800,000, the old system will be depreciated for another 8 years.

Depreciation of new system = $1,500,000/10 = $150,000
For years 1-8,
Operating cost Savings = 450,000-$215,000 = $235,000 (see question)
After tax cost savings = $235,000*(1-34%) = $155,100
Difference in Depreciation expense = $150,000-$100,000 = $50,000
Incremental Depreciation Tax Shield = $50,000*34% = $17,000
Net Cash Flow = after-tax operating costs saving+ incremental depreciation tax shield =$155,100 + $17,000 = $172,100

NCF = OCF (1-0.34)+ Δ(Depr. X 0.34)

For years 9-10,
Difference in depreciation expense = $150,000-$0 = $150,000
Depreciation tax shield = $150,000*34% = $51,000
Net Cash Flow = $155,100+$51,000 = $206,100



c. What is the terminal cash flow in year 10?

Old system after –tax salvage value at year 10

Opportunity Cost of salvaging old system = $50,000 – 34%*($50,000-$0) = $33,000
Net Salvage Value of new system = $180,000 – 34%*($180,000-$0) = $118,800
Terminal Cash Flow = $118,800-$33000 = $85,800

d. What is the project's NPV? Would you replace the current inventory system with the new one?

The OCF for year 9 is calculated as after-tax cost savings + depreciation tax shield. After-tax cost savings = $450,000 - $215,000 = $235,000, so the OCF = $235,000(1-0.34) + $150,000*34% =$206,100

Year 0:	-$964,000	
Year 1-8:	$172,100	
Year 9:	$206,100	
Year 10:	$291,900	($206,100 + $85,800)

NPV@12.5% = $37,491. Since NPV is positive, I would replace the inventory system.

Additional Question

A project will produce operating cash flows of $120,000 a year for four years. During the life of the project, inventory will be increased by $30,000 and accounts receivable will increase by $25,000. Accounts payable will increase by $65,000. The project requires the purchase of equipment at an initial cost of $325,000. The equipment will be depreciated straight-line to a zero-book value over the life of the project. The equipment will be salvaged at the end of the project creating a $10,000 after-tax cash flow. At the end of the project, net working capital will return to its normal level. Assume a marginal tax rate of 34%.

1. What is the net present value of this project given a required rate of return of 18%?

2. What is the IRR of this project?

This capital budgeting question is a bit different from the one that you often encountered. In a standard capital budgeting question,
CF_o = –(equipment cost + increase in NOWC)
Terminal year cash flow = recovery of NOWC + after-tax salvage value.

For this question ,
The increase in NWC is calculated as:
Increase in NWC = increase in current assets – increase in current liabilities
Increase in NWC = (30,000 +25,000) – 65,000 = –10,000. In a normal case, the answer should be positive. Increase in NWC is positive means you actually invest NWC. But here you get –10,000. In other words, you do not come out the money to invest in NWC. The NOWC is funded by supplier since AP> current assets. Hence the CF_o = –325,000–(–10,000) = –315,000

Terminal year cash flow = after-tax salvage value + pay off of 10,000 provided by supplier instead of recovery of NOWC
Terminal year cash flow =$10,000 – 10,000 (this is negative since we are payoff the fund provided by supplier)
Terminal year cash flow = 0.

Use cash flow keys:

	CF 2nd CE/C
C00	-315,000 ENTER ↓
C01	120,000 ENTER ↓
F01	1 ENTER ↓
C02	120,000 ENTER ↓
F02	1 ENTER ↓
C03	120,000 ENTER ↓
F03	1 ENTER ↓
C04	120,000 ↓
F04	1 ENTER ↓
	NPV
I	18 ENTER ↓ CPT

7,807.42

IRR

19.3%