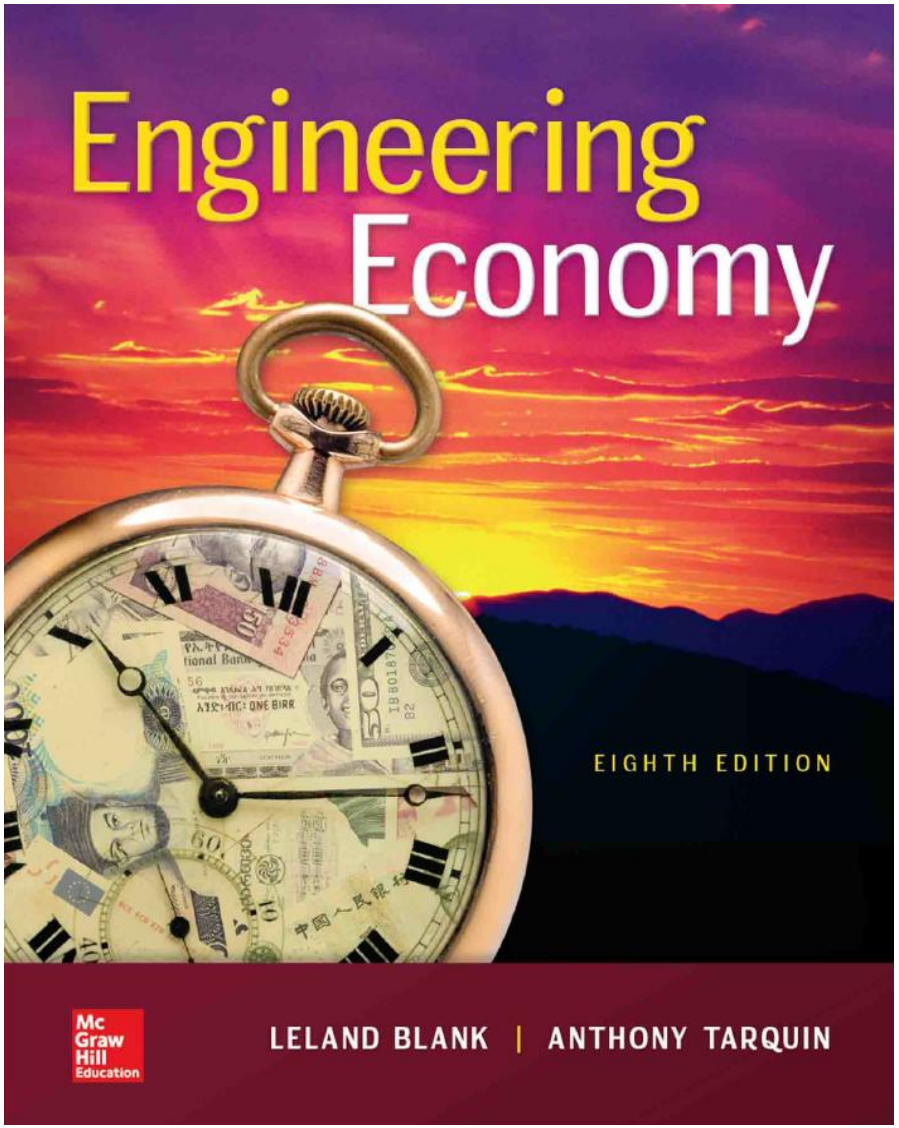

Chapter 17

After-tax Economic Analysis

Lecture slides to accompany

Engineering Economy

8th edition

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Mc Graw Hill Higher Education

LEARNING OBJECTIVES

1. Terminology and rates; marginal tax tables
2. Determining cash flows before taxes(CFBT) and after taxes (CFAT)
3. Effects of depreciation on taxes
4. Depreciation recapture and capital gains
5. Performing an after-tax analysis
6. Performing after-tax replacement studies
7. Economic value-added analysis
8. Tax structures outside the United States
9. Understanding value-added tax (VAT)

Tax Terms and Relations - Corporations

- Gross Income ***GI*** or operating revenue ***R*** -- Total income for the tax year realized from all revenue producing sources

- Operating expenses ***OE*** -- All annual operating costs (AOC) and maintenance & operating (M&O) costs incurred in transacting business; these are tax deductible; **depreciation not included** here

- Income Taxes and tax rate ***T*** -- Taxes due annually are based on taxable income *TI* and tax rates, which are commonly **graduated** (or **progressive**) by TI level.

$$\text{Taxes} = \text{tax rate} \times \text{taxable income}$$
$$= T \times (\text{GI} - \text{OE} - \text{D})$$

- Net operating profit after taxes ***NOPAT*** – Money remaining as a result of capital invested during the year; amount left after taxes are paid.

$$\text{NOPAT} = \text{taxable income} - \text{taxes} = \text{TI} - T \times (\text{TI})$$
$$= \text{TI} \times (1 - T)$$

Income Tax Terms and Relations (Corporations)

Income taxes are real cash flow payments to governments levied against income and profits. The (noncash) allowance of asset depreciation is used in income tax computations.

Two fundamental relations: NOI and TI

Net operating income = gross revenue – operating expenses

$$NOI = GI - OE$$ ***(only actual cash involved)***

NOI is also called **EBIT(DA)** (earnings before interest, taxes and depreciation)

Taxable income = gross revenue – operating expenses – depreciation

$$TI = GI - OE - D$$ ⟸ ***(involves noncash item)***

Note: **All terms and relations are calculated for each year t, but the subscript is often omitted for simplicity**

Profit and Loss Statements	
Gross Income (GI)	3,000,000
Operating Expense (OE)	2,000,000
Net Operating Income (NOI)	1,000,000
Depreciation	150,000
Taxable Income (TI)	850,000
Tax	200,000
Net Operating Profit After Tax (NOPAT)	650,000

Average and Effective Tax Rates

Marginal tax rates change as TI increases. Calculate an **average tax rate** using:

$$\textbf{Average tax rate} = \frac{\text{total taxes paid}}{\text{taxable income}} = \frac{\text{taxes}}{\text{TI}}$$

To approximate a **single-figure tax rate** that combines local (e.g., state) and federal rates calculate the **effective tax rate T_e**

$$T_e = \text{local rates} + (1 - \text{local rates}) \times \text{federal rate}$$

Then, $\textbf{Taxes} = T_e \times TI$

See Example 17.1

TABLE 17–1 U.S. Corporate Income Tax Rate Schedule

If Taxable Income ($) Is:			
Over	But Not Over	Tax Is	Of the Amount Over
0	50,000	15%	0
50,000	75,000	7,500 + 25%	50,000
75,000	100,000	13,750 + 34%	75,000
100,000	335,000	22,250 + 39%	100,000
335,000	10,000,000	113,900 + 34%	335,000
10,000,000	15,000,000	3,400,000 + 35%	10,000,000
15,000,000	18,333,333	5,150,000 + 38%	15,000,000
18,333,333	—	35%	0

EXAMPLE 17.1

REI (Recreational Equipment Incorporated) sells outdoor equipment and sporting goods through retail outlets, the Internet, and catalogs. Assume that for 1 year REI has the following financial result

Solution

T (*a*) Calculate TI by Equation [17.2] and use Table 17–1 rates for federal taxes due.

O

D

$$\text{Kentucky state TI} = \text{GI} - \text{OE} - \text{D} = 19.9 \text{ million} - 8.6 \text{ million} - 1.8 \text{ million}$$
$$= \$9.5 \text{ million}$$

(*a*) D

$$\text{Kentucky state taxes} = 0.06(\text{TI}) = 0.06(9{,}500{,}000) = \$570{,}000$$

(*b*) F

$$\text{Federal TI} = \text{GI} - \text{OE} - \text{D} - \text{state taxes} = 9{,}500{,}000 - 570{,}000$$

(*c*) D

$$= \$8{,}930{,}000$$

ta

$$\text{Federal taxes} = 113{,}900 + 0.34(8{,}930{,}000 - 335{,}000) = \$3{,}036{,}200$$

(*d*) E

$$\text{Total federal and state taxes} = 3{,}036{,}200 + 570{,}000 = \$3{,}606{,}200 \qquad [17.8]$$

tc

(*b*) From Equation [17.5], the average tax rate paid is approximately 32% of TI.

$$\text{Average federal tax rate} = 3{,}036{,}200/9{,}500{,}000 = 0.3196$$

(*c*) By Equation [17.6], T_e is slightly over 36% per year for combined state and federal taxes.

$$T_e = 0.06 + (1 - 0.06)(0.3196) = 0.3604 \quad (36.04\%)$$

(*d*) Use the effective tax rate and TI = \$9.5 million from part (*a*) in Equation [17.7] to approximate total taxes.

$$\text{Taxes} = 0.3604(9{,}500{,}000) = \$3{,}423{,}800$$

Compared to Equation [17.8], this approximation is \$182,400 low, a 5.06% underestimate.

Cash Flow After Taxes (CFAT)

- NCF is cash inflows – cash outflows. Now, **consider taxes and deductions**, such as **depreciation**
- Cash Flow Before Taxes (CFBT)

CFBT = gross income – expenses – initial investment + salvage value

= GI – OE – P + S

- Cash Flow After Taxes (CFAT)

CFAT = CFBT – taxes

= GI – OE – P + S – (GI – OE – D)(T_e)

A **negative TI** value is considered as **tax savings** for the project

The **negative** tax will **offset** taxes for the same year in other income-producing areas of the corporation
OR Carry-forward and carry-back rules

See Example 17.2

TABLE 17–2 Suggested Column Headings for Calculation of CFAT

Year	Gross Income GI	Operating Expenses OE	Investment and Salvage *P* and *S*	CFBT	Depreciation *D*	Taxable Income TI	Taxes	CFAT
	(1)	(2)	(3)	(4) = (1) - (2) + (3)	(5)	(6) = (1) - (2) – (5)	(7) = T_e(6)	(8) = (4) – (7)

EXAMPLE 17.2

Wilson Security has received a contract to provide additional security for corporate and government personnel along the international border between two countries in South America. Wilson plans to purchase listening and detection equipment for use in the 6-year contract. The equipment is expected to cost $550,000 and have a resale value of $150,000 after 6 years. Based on the incentive clause in the contract, Wilson estimates that the equipment will increase contract revenue by $200,000 per year and require an additional M&O expense of $90,000 per year. MACRS depreciation allows recovery in 5 years, and the effective corporate tax rate is 35% per year. Tabulate and plot the CFBT and CFAT series.

Depreciation Recapture (DR) and Capital Gain (CG)

DR, also called **ordinary gain,** in year t occurs when an asset is **sold for <u>more than</u> its BV_t**

DR = selling price – book value = SP – BV_t

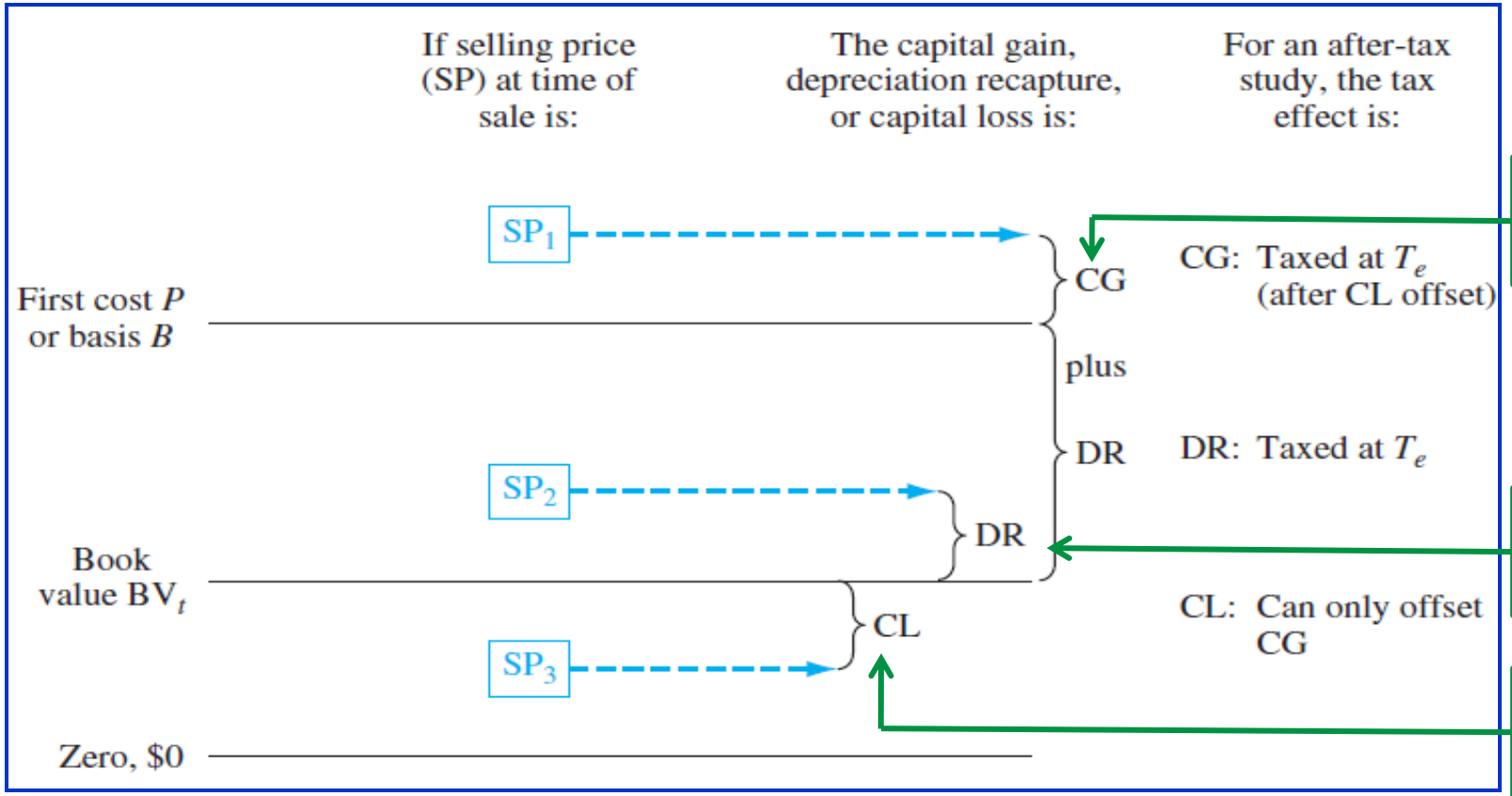
CG occurs when an asset is **sold for <u>more than</u> its unadjusted basis *B*** (or first cost *P*)

CG = selling price – basis = SP – *B*

CL occurs when an asset is **sold for <u>less than</u> its current BV_t**

CL = book value – selling price = BV_t – SP

Effects of DR, CG and CL on TI and Taxes



Update of TI relation: **TI = GI – OE – D + DR + net CG – net CL**

After-Tax Evaluation

- ✓ **Use CFAT values to calculate PW, AW, FW, ROR, B/C or other measure of worth using after-tax MARR**
- ✓ Same guidelines as before-tax; e.g., using PW at after-tax MARR:
  - **One project**: PW ≥ 0, project is viable
  - **Two or more alternatives**: select one ME alternative with best (numerically largest) PW value
- ✓ For costs-only CFAT values, use + sign for OE, D, and other savings and use same guidelines
- ✓ Remember: **equal-service requirement** for PW-based analysis
- ✓ ROR analysis is same as before taxes, except use CFAT values:
  - **One project**: if i* ≥ after-tax MARR, project is viable
  - **Two alternatives**: select ME alternative with Δi* ≥ after-tax MARR for incremental CFAT series

Approximating After-Tax ROR Value

To adjust a before-tax ROR without details of after-tax analysis, an **approximating** relation is:

After-tax ROR ≈ before-tax ROR × $(1 - T_e)$

Example: P = $-50,000 GI – OE = $20,000/year

n = 5 years D = $10,000/year T_e = 0.40

→ Estimate after-tax ROR from before-tax ROR analysis

Solution: Set up **before-tax PW** relation and solve for i*

0 = - 50,000 + 20,000(P/A,i*%,5)

i* = 28.65%

After-tax ROR ≈ 28.65% × (1 – 0.40) = 17.19%

(Note: Actual after-tax analysis results in i* = 18.03%)

Example: After-Tax Analysis

Asset: B = \$90,000 S = 0 n = 5 years

Per year: R = \$65,000 OE = \$18,500 D = \$18,000

Effective tax rate: $T_e = 0.184$

Find ROR (a) before-taxes, (b) after-taxes actual and (c) approximation

G16

	A	B	C	D	E	F	G	H	I
1		Revenue,	Operating	Basis, B and		Depreciation,	Taxable	Taxes	
2	Year	R	Expenses, OE	Salvage, S	CFBT	D	Income, TI	at T_e = 0.184	CFAT
3	0			90,000	-90,000				-90,000
4	1	65,000	18,500		46,500	18,000	28,500	5,244	41,256
5	2	65,000	18,500		46,500	18,000	28,500	5,244	41,256
6	3	65,000	18,500		46,500	18,000	28,500	5,244	41,256
7	4	65,000	18,500		46,500	18,000	28,500	5,244	41,256
8	5	65,000	18,500	0	46,500	18,000	28,500	5,244	41,256
9									
10			(a) Before-tax ROR:		43%		(b) After-tax ROR:		36%

Solution: (a) Using IRR function, i* = 43% (b) Using IRR function, i* = 36%

(c) By approximation: **after-tax ROR = 43% × (1 – 0.1840) = 35%**

EXAMPLE 17.5

Biotech, a medical imaging and modeling company, must purchase a bone cell analysis system for use by a team of bioengineers and mechanical engineers studying bone density in athletes. This particular part of a 3-year contract with the NBA will provide additional gross income of $100,000 per year. The effective tax rate is 35%. Estimates for two alternatives are summarized below.

Analyzer 1 Analyzer 2

TABLE 17–4 Comparison of Total Taxes for Two Alternatives, Example 17.5*a*

Year	Gross Income GI, $	Operating Expenses OE, $	Basis *B*, $	MACRS Depreciation *D*, $	Book Value BV, $	Taxable Income TI, $	Taxes at 0.35TI, $
			Analyzer 1				
0			150,000		150,000		
1	100,000	30,000		30,000	120,000	40,000	14,000
2	100,000	30,000		48,000	72,000	22,000	7,700
3	100,000	30,000		28,800	43,200	41,200	14,420
							36,120
			Analyzer 2				
0			225,000		225,000		
1	100,000	10,000		45,000	180,000	45,000	15,750
2	100,000	10,000		72,000	108,000	18,000	6,300
3	100,000	10,000		43,200	64,800	46,800	16,380
							38,430

Answe

(*a*) The
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(*b*) Ass
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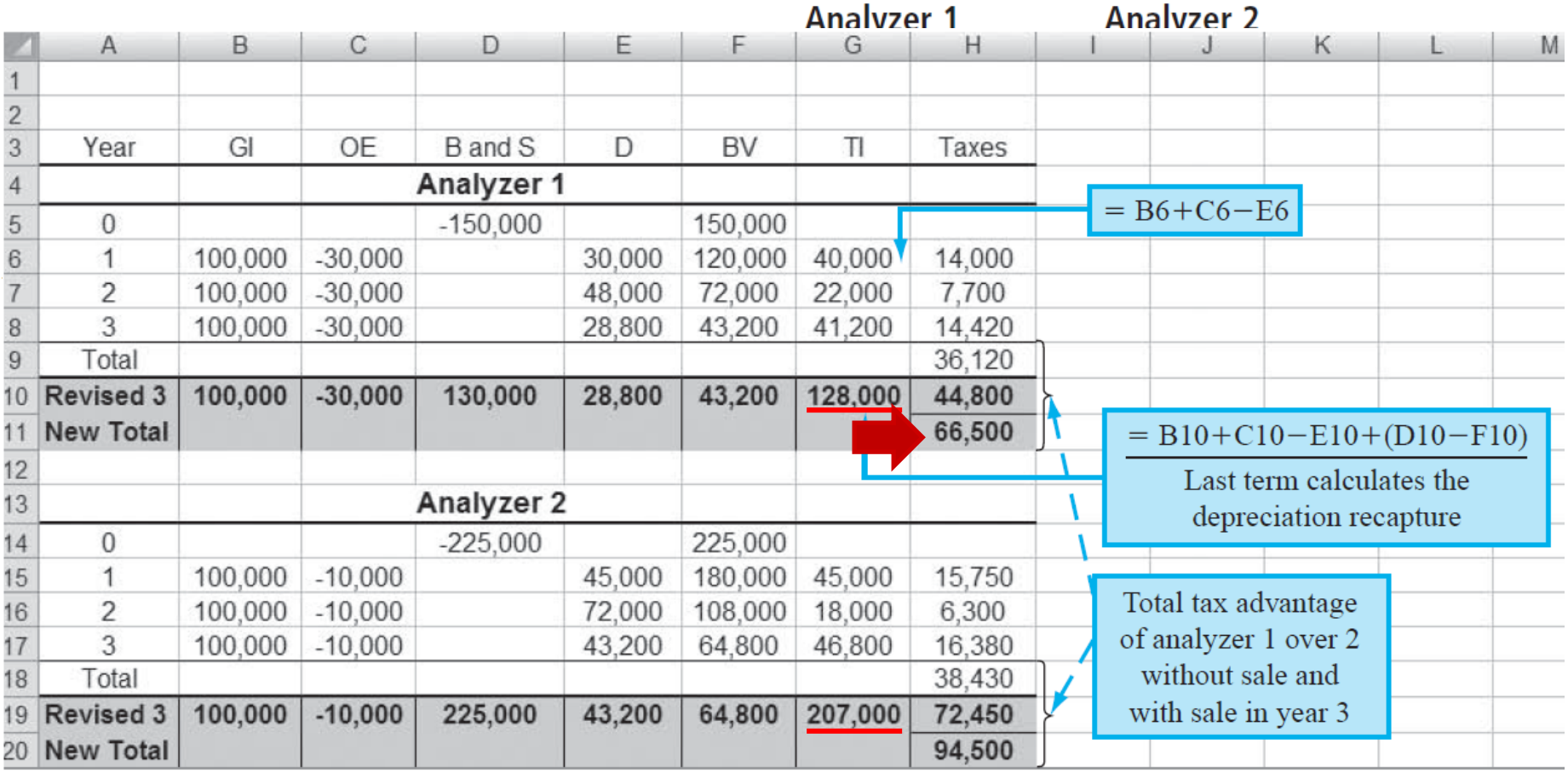
pric

EXAMPLE 17.5

Biotech, a medical imaging and modeling company, must purchase a bone cell analysis system for use by a team of bioengineers and mechanical engineers studying bone density in athletes. This particular part of a 3-year contract with the NBA will provide additional gross income of $100,000 per year. The effective tax rate is 35%. Estimates for two alternatives are summarized below.



	A	B	C	D	E	F	G	H
1								
2								
3	Year	GI	OE	B and S	D	BV	TI	Taxes
4				**Analyzer 1**				
5	0			-150,000		150,000		
6	1	100,000	-30,000		30,000	120,000	40,000	14,000
7	2	100,000	-30,000		48,000	72,000	22,000	7,700
8	3	100,000	-30,000		28,800	43,200	41,200	14,420
9	Total							36,120
10	**Revised 3**	**100,000**	**-30,000**	**130,000**	**28,800**	**43,200**	**128,000**	**44,800**
11	**New Total**							**66,500**
12								
13				**Analyzer 2**				
14	0			-225,000		225,000		
15	1	100,000	-10,000		45,000	180,000	45,000	15,750
16	2	100,000	-10,000		72,000	108,000	18,000	6,300
17	3	100,000	-10,000		43,200	64,800	46,800	16,380
18	Total							38,430
19	**Revised 3**	**100,000**	**-10,000**	**225,000**	**43,200**	**64,800**	**207,000**	**72,450**
20	**New Total**							**94,500**

Figure 17–4
Impact of depreciation recapture on total taxes, Example 17.5.

EXAMPLE 17.9

In Example 17.5 an after-tax analysis of two bone cell analyzers was initiated due to a new 3-year NBA contract. The criterion used to select analyzer 1 was the total taxes for the 3 years. The complete solution is in Table 17–4 (hand) and Figure 17–4 (spreadsheet).

Continue the spreadsheet analysis by performing an after-tax ROR evaluation, assuming the analyzers are sold after 3 years for the amounts estimated in Example 17.5: $130,000 for analyzer 1 and $225,000 for analyzer 2. The after-tax MARR is 10% per year.

	A	B	C	D	E	F	G	H	I	J	K
1	Year	GI	OE	B and S	D	BV	TI	Taxes	CFAT		
2					**Analyzer 1**						
3	0			-150,000		150,000			-150,000		
4	1	100,000	-30,000		30,000	120,000	40,000	14,000	56,000		
5	2	100,000	-30,000		48,000	72,000	22,000	7,700	62,300		
6	3	100,000	-30,000	130,000	28,800	43,200	128,000	44,800	155,200		
7	i*								**30.2%**		
8	PW at 10%								$69,001		
9										Incremental	
10					**Analyzer 2**					CFAT	
11	0			-225,000		225,000			-225,000	-75,000	
12	1	100,000	-10,000		45,000	180,000	45,000	15,750	74,250	18,250	
13	2	100,000	-10,000		72,000	108,000	18,000	6,300	83,700	21,400	
14	3	100,000	-10,000	225,000	43,200	64,800	207,000	72,450	242,550	87,350	
15	i*								**27.9%**		
16	PW at 10%								$93,905		
17	Incr i*									**23.6%**	
18											
19											
20											
21											
22											

Overall i*

= B14+C14−E14+(D14−F14)

This term calculates DR = $160,200

CFAT calculation = B14+C14+D14−H14

Incremental i* = IRR(J11:J14)

Figure 17–7
Incremental ROR analysis of CFAT with depreciation recapture, Example 17.9.

After-Tax Replacement Analysis

- Consider depreciation recapture (DR) or capital gain (CG), if challenger is selected over defender
- Can include capital loss, if trade occurs at very low ('sacrifice') trade-in for defender
- An after-tax analysis can reverse the selection compared to before-tax analysis, but more likely it will provide information about differences in PW, AW or ROR value when taxes are included
- Apply same procedure as before-tax replacement evaluation once CFAT series is estimated

EXAMPLE 17.10

Midcontinent Power Authority purchased emission control equipment 3 years ago for $600,000. Management has discovered that it is technologically and legally outdated now. New equipment has been identified. If a market value of $400,000 is offered as the trade-in for the current equipment, perform a replacement study using (*a*) a before-tax MARR of 10% per year and (*b*) a 7% per year after-tax MARR. Assume an effective tax rate of 34%. As a simplifying assumption, use classical straight line depreciation with $S = 0$ for both alternatives.

	Defender	Challenger
Market value, $	400,000	
First cost, $		−1,000,000
Annual cost, $/year	−100,000	−15,000
Recovery period, years	8 (originally)	5

Example 17.10: Before- and After-Tax Replacement Study

	Defender	Challenger
Market value, $	400,000	
First cost, $		−1,000,000
Annual cost, $/year	−100,000	−15,000
Recovery period, years	8 (originally)	5

Purchased 3 years ago
Before-tax MARR = 10%
After-tax MARR = 7%
T_e = 34%
SL depreciation; S = 0

SOLUTION

Defender Age	Year	Before Taxes: Expenses OE, $	Before Taxes: P and S, $	Before Taxes: CFBT, $	After Taxes: Depreciation D, $	After Taxes: Taxable Income TI, $	After Taxes: Taxes* at 0.34TI, $	After Taxes: CFAT, $
				Defender				
3	0		−400,000	−400,000				−400,000
4	1	−100,000		−100,000	75,000	−175,000	−59,500	−40,500
5	2	−100,000		−100,000	75,000	−175,000	−59,500	−40,500
6	3	−100,000		−100,000	75,000	−175,000	−59,500	−40,500
7	4	−100,000		−100,000	75,000	−175,000	−59,500	−40,500
8	5	−100,000	0	−100,000	75,000	−175,000	−59,500	−40,500
AW at 10%				−205,520	AW at 7%			−138,056
				Challenger				
	0		−1,000,000	−1,000,000		+25,000†	8,500	−1,008,500
	1	−15,000		−15,000	200,000	−215,000	−73,100	+58,100
	2	−15,000		−15,000	200,000	−215,000	−73,100	+58,100
	3	−15,000		−15,000	200,000	−215,000	−73,100	+58,100
	4	−15,000		−15,000	200,000	−215,000	−73,100	+58,100
	5	−15,000	0	−15,000	200,000	−215,000‡	−73,100	+58,100
AW at 10%				−278,800	AW at 7%			−187,863

* Minus sign indicates a tax savings for the year.
† Depreciation recapture on defender trade-in.
‡ Assumes challenger's salvage actually realized is $S = 0$; no tax.

Select defender both ways

Defender Age	Year	OE	P or S	CFBT	Depre.C.	TI	Tax	CFAT	
Defender									
3	0								
4	1	- 100,000		- 100,000	75,000	- 175,000	- 59,500	- 40,500	
5	2	- 100,000		- 100,000	75,000	- 175,000	- 59,500	- 40,500	
6	3	- 100,000		- 100,000	75,000	- 175,000	- 59,500	- 40,500	
7	4	- 100,000		- 100,000	75,000	- 175,000	- 59,500	- 40,500	
8	5	- 100,000		- 100,000	75,000	- 175,000	- 59,500	- 40,500	
AW at 10%				- 100,000				- 40,500	AW at 7%
Challenger									
	0		- 600,000	- 600,000		25,000	8,500	- 608,500	
	1	- 15,000		- 15,000	200,000	- 215,000	- 73,100	58,100	
	2	- 15,000		- 15,000	200,000	- 215,000	- 73,100	58,100	
	3	- 15,000		- 15,000	200,000	- 215,000	- 73,100	58,100	
	4	- 15,000		- 15,000	200,000	- 215,000	- 73,100	58,100	
	5	- 15,000		- 15,000	200,000	- 215,000	- 73,100	58,100	
AW at 10%				- 173,278				- 102,421	AW at 7%

Economic Value Added (EVA)™ Analysis

- **Definition:** The **economic worth added** by a product or service from the perspective of the consumer, owner or investor
- In other words, it is the contribution of a capital investment to the net worth of a corporation **after taxes**

Example: The average consumer is willing to pay significantly more for potatoes processed and served at a fast-food restaurant as fries (chips) than as raw potatoes in the skin from a supermarket.

- Value-added analysis is performed in a different way than CFAT analysis, however…
- Selection of the better economic alternative is the same for EVA and CFAT analysis, because it is always correct that …

AW of EVA estimates = AW of CFAT estimates

™ At this time, the term EVA is a registered trademark of Stern Stewart & Co.

EVA Analysis: Procedure

DIFFERENCE BETWEEN CFAT AND EVA APPROACHES

- CFAT estimates (describes) how actual **cash will flow**
- EVA estimates **extra worth** that an alternative adds
- EVA is a measure of worth that **mingles actual cash flows and noncash flows**

PROCEDURE FOR EVA ANALYSIS

Each year *t* determine the following for each alternative:

$$\begin{aligned} EVA_t &= \mathbf{NOPAT_t} - \text{cost of invested capital} \\ &= \mathbf{NOPAT_t} - (\text{after-tax MARR})(BV_{t-1}) \\ &= \mathbf{TI_t \times (1 - T_e)} - i \times (BV_{t-1}) \end{aligned}$$

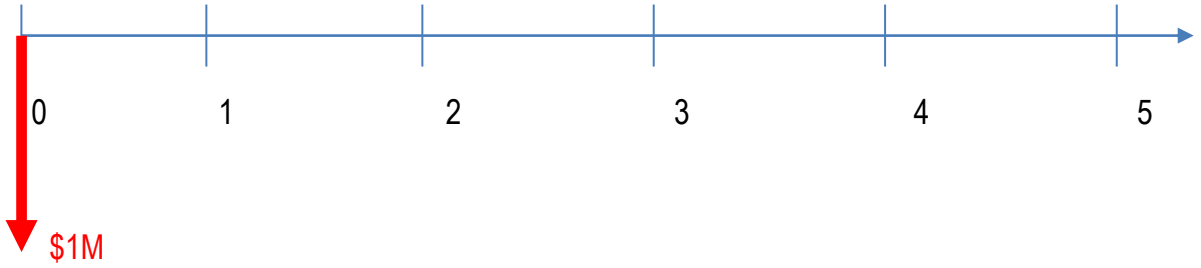
Selection: **Choose alternative with better AW of EVA series**

Remember: Since AW of EVA series will always = AW of CFAT series, the same alternative is selected by either method

Concept

Assume A Co. purchase $1M machine that has 5 years of life with SL(or DB) depreciation.

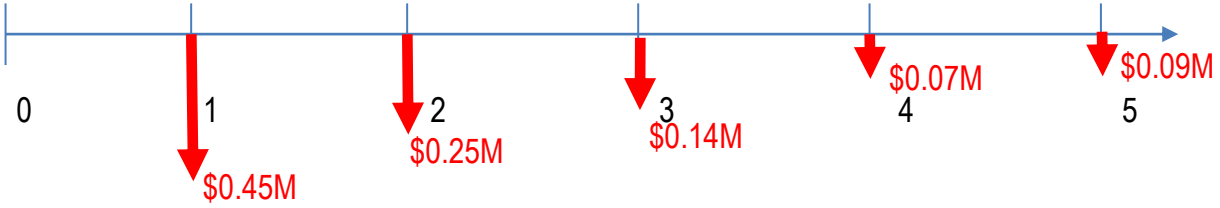
- Actual Cash Flows



- Accounting Depreciation Cost (SL)

OR

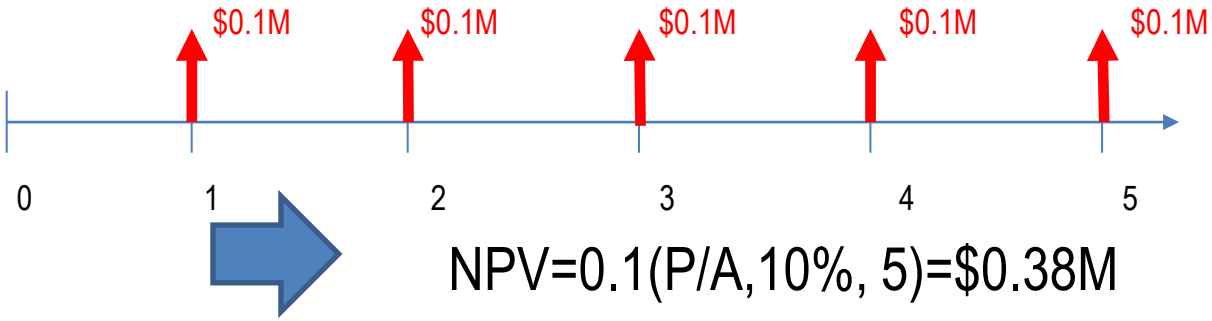
- Accounting Depreciation Cost (DB)



Concept

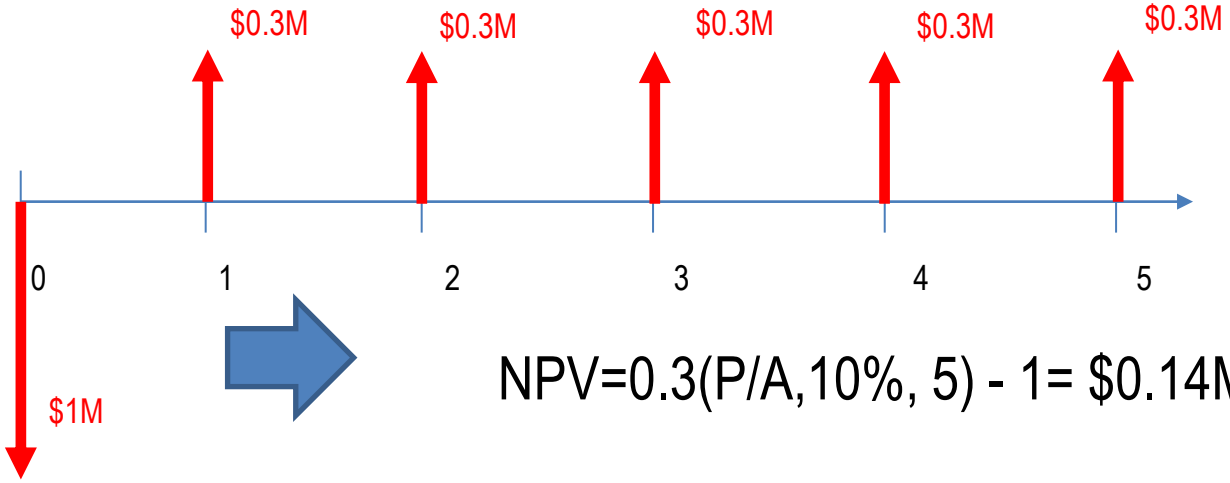
Assume A Co. purchase $1M machine that has 5 years of life with SL depreciation. Assuming NOPAT is $0.1M, compare Accounting analyses and Actual cash flows with i=10%.

- Accounting Depreciation Cost (SL)



NPV=0.1(P/A,10%, 5)=$0.38M

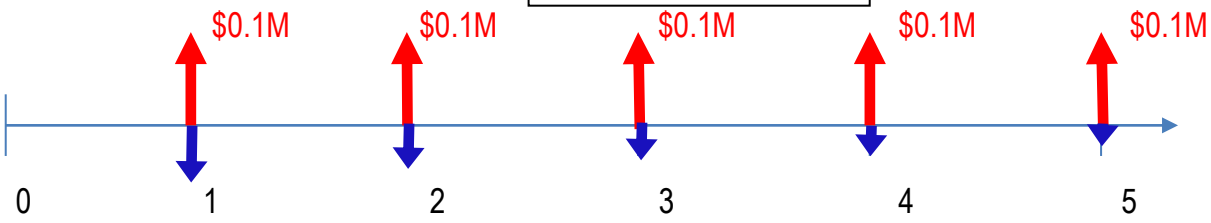
- Actual Cash Flows



NPV=0.3(P/A,10%, 5) - 1= $0.14M

How to Make Them Equal?

- EVA=NOPAT – (i)x(BV_{t-1}) **PW = 0.14M**



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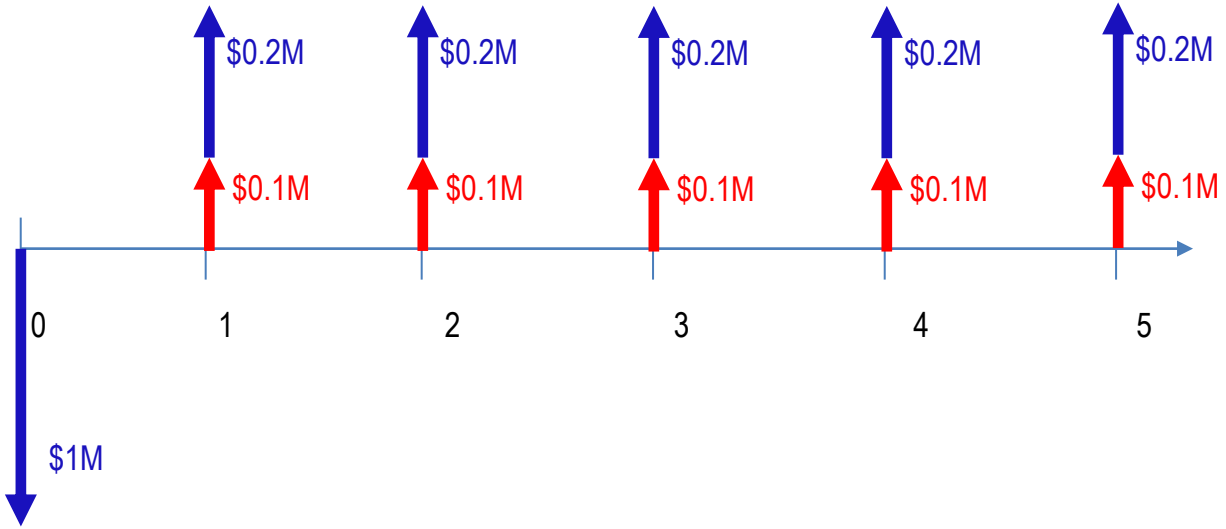
- Actual Cash Flows **PW = 0.14M**



EXAMPLE 17.12

Biotechnics Engineering has developed two mutually exclusive plans for investing in new capital equipment with the expectation of increased revenue from its medical diagnostic services to cancer patients. The estimates are summarized below. (*a*) Use classical straight line depreciation, an after-tax MARR of 12%, and an effective tax rate of 40% to perform two annual worth after-tax analyses: EVA and CFAT. (*b*) Explain the fundamental difference between

	A	B	C	D	E	F	G	H	I	J	K
1						**PLAN A**					
2								EVA analysis			CFAT analysis
3			Investment P	SL	Book value	Taxable			Cost of		
4	Year	GI - OE	(Basis B)	Depreciation	BV	income, TI	Taxes	NOPAT	inv. capital	EVA	CFAT
5	0		-500,000		500,000						-500,000
6	1	170,000		125,000	375,000	45,000	18,000	27,000	-60,000	-33,000	152,000
7	2	170,000		125,000	250,000	45,000	18,000	27,000	-45,000	-18,000	152,000
8	3	170,000		125,000	125,000	45,000	18,000	27,000	-30,000	-3,000	152,000
9	4	170,000		125,000	0	45,000	18,000	27,000	-15,000	12,000	152,000
10	**AW values**									**-$12,617**	**-$12,617**
11						**PLAN B**					
12								EVA analysis			CFAT analysis
13			Investment P	SL	Book value	Taxable			Cost of		
14	Year	GI - OE	(Basis B)	Depreciation	BV	income, TI	Taxes	NOPAT	inv. capital	EVA	CFAT
15	0		-1,200,000		1,200,000						-1,200,000
16	1	600,000		300,000	900,000	300,000	120,000	180,000	-144,000	36,000	480,000
17	2	500,000		300,000	600,000	200,000	80,000	120,000	-108,000	12,000	420,000
18	3	400,000		300,000	300,000	100,000	40,000	60,000	-72,000	-12,000	360,000
19	4	300,000		300,000	0	0	0	0	-36,000	-36,000	300,000
20	**AW values**									**$3,388**	**$3,388**
21											
22	Functions for Plan B, year 3			`= -C15/4	`= E17-D18	`= B18-D18	`= F18*0.4	`= F18-G18	`=-0.12*E17	`= H18+I18	`= B18+C18-G18

Figure 17–9
Comparison of two plans using EVA and CFAT analyses, Example 17.12.

International Tax Structures

- **Tax related questions for internationally located projects concentrate on items such as:**
  - **Depreciation methods approved by host country**
  - **Capital investment allowances**
  - **Business expense deductibility**
  - **Corporate tax rates**
  - **Indirect tax rates – Value-Added Tax / Goods and Service Tax (VAT/GST)**

- **Rules and laws vary considerably from country to country**

Summary of International Corporate Tax Rates

Tax Rate Levied on TI, %	For These Countries
≥ 40	**United States, Japan**
35 to < 40	Pakistan, Sri Lanka
32 to < 35	France, India, South Africa
28 to < 32	Australia, United Kingdom, Canada, New Zealand, Spain, Germany, Mexico
24 to < 28	China, Indonesia, **South Korea**, ~~Israel~~
20 to < 24	Russia, Turkey, Saudi Arabia
< 20	Singapore, Hong Kong, Taiwan, Chile, Ireland, Iceland, Hungary

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Source: KPMG *Corporate and Indirect Tax Rate Survey, 2010*

Value-Added Tax (VAT)

VAT is an **indirect tax placed on goods and services**, not on people and corporations like an income tax. The VAT is charged sequentially throughout the process of manufacturing a good or providing a service. The VAT is also called **Goods and Service Tax (GST).**

VAT CHARACTERISTICS

- A percent, e.g., 10%, of current value, of **unfinished** goods or service (G/S) is charged to the purchaser and sent to taxing entity by manufacturer or provider
- VAT charged to buyer at purchase time whether buyer is an end user or intermediate business
- As next transfer occurs, VAT previously paid on unfinished G/S is **subtracted from VAT currently due**

SALES TAX CHARACTERISTICS

- Charged only **once** at final product sale to the **end user or consumer**
- Selling merchant sends tax to taxing entity
- Businesses do **not** pay sales tax on raw materials or unfinished goods or service
- Businesses **do pay** sales tax on items for which they are the end user

Example: How a 10% VAT Could Work

1. **Mining company** sells $100,000 of iron ore to **Steel company** and charges Steel company 10% VAT, or $10,000. **Mining company** sends **$10,000** to US Treasury.
2. **Steel company** sells steel for $300,000 to **Refrigerator company** and charges Refrigerator company 10% VAT, or $30,000. **Steel company** sends $30,000 – 10,000 = **$20,000** to US Treasury.
3. **Refrigerator company** sells refrigerators to **Retail company** for $700,000 and charges Retailer 10% VAT, or $70,000. **Refrigerator company** sends $70,000 – 30,000 = **$40,000** to US Treasury.
4. Finally, **Retailer** sells refrigerators to **end users/consumers** - for $950,000 and collects 10% VAT, or $95,000, from consumers. **Retailer** sends $95,000 – 70,000 = **$25,000** to US Treasury.

Conclusion: US Treasury received $25,000 + 40,000 + 20,000 + 10,000 = $95,000, which is 10% of final sales price of $950,000

Less Evasion of Taxes than Sales Tax

Summary of Important Points

- For a corporation's taxable income (TI), operating expenses and asset depreciation are **deductible items**
- Income tax rates for corporations and individuals are **graduated** by increasing TI levels
- CFAT indirectly includes **(noncash) depreciation** through the TI computation
- Depreciation recapture (DR) occurs when an asset is **sold for more than the book value**; DR is taxed as regular income in all after-tax evaluations
- After-tax analysis uses **CFAT values** and the **same guidelines** for alternative selection as before-tax analysis
- EVA estimates **extra worth** that an alternative adds to net worth after taxes; it **mingles actual cash flows and noncash flows**
- A **VAT system** collects taxes progressively on **unfinished goods and services;** different than a sales tax system where only end users pay

HOMEWORK

1. Please solve every Examples in your textbook. You do not have to submit your works.

2. Please upload following “PROBLEMS” solution file on “Assignment” menu in e-Class.
   - ① 17.28
   - ② 17.42
   - ③ 17.52
   - ④ 17.56(00)
   - ⑤ 17.59(XX)
   - ⑥ 17.66
   - ⑦ 17.67