

Capital Costs: Capitalization, Depreciation and Taxation

February 23, 2004
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From an accounting perspective, there are two categories of costs:

- ‘Expensed’ costs
 - Items that are used up quickly; costs recovered out of current revenues
- ‘Capitalized’ costs
 - Long lifetime items; costs recovered progressively throughout the expected lifetime

Depreciation Example: Pizza Delivery Business

Sales: \$20,000/yr

Car purchase: \$6,000

Operating expenses: \$10,000

Car lifetime: 4 yrs

Net salvage value: \$0

Definitions

Operating Revenues: revenues that a company receives as a result of its operation (sales for instance.)

Operating Expenses: labor expenses, supply purchases, utility costs etc.

Operating Income: Operating Revenues - Operating Expenses.

Net Cash Flow: Total Cash Inflow - Total Cash Outflow = Operating Income – Capital expenditures

Net Income: Operating Income – Depreciation Allowance

Income Statements

I: Expensing the car purchase

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Operating Revenues	20,000	20,000	20,000	20,000
Operating Expenses	10,000	10,000	10,000	10,000
Car Purchase	6,000	--	--	--
Operating Income (=operating revenues – operating expenses)	4,000	10,000	10,000	10,000
Net Cash Flow	4,000	10,000	10,000	10,000

II: Capitalizing the car purchase & straight-line depreciation

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Operating Revenues	20,000	20,000	20,000	20,000
Operating Expenses	10,000	10,000	10,000	10,000
Operating Income	10,000	10,000	10,000	10,000
Depreciation allowance	1500	1500	1500	1500
Net income (before taxes) = Operating income – depreciation allowance	8,500	8,500	8,500	8,500
Net cash flow	4000	10,000	10,000	10,000

Income statements (III): Expensing the car purchase; taxes included

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Op. Revenues (OR)	20000	20,000	20,000	20,000
Op. Expenses (OE)	10000	10,000	10,000	10,000
Car Purchase	6000			
Op. Income (OI)	4000	10000	10000	10000
Taxable Income (TI) (= OR-OE-'other deductible items')	4000	10000	10000	10000
Taxes (T= TI* τ) ($\tau = 30\%$)	1200	3000	3000	3000
Net Income After Taxes (=TI - T)	2800	7000	7000	7000
Net Cash Flow (= Total cash in - total cash out)	2800	7000	7000	7000

Income Statements (IV): Capitalizing and depreciating the
car purchase; taxes included
(Straight-line depreciation assumed)

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Op. Revenues (OR)	20000	20,000	20,000	20,000
Op. Expenses (OE)	10000	10,000	10,000	10,000
Op. Income (OI)	10000	10000	10000	10000
Depreciation Allowance (D)	1500	1500	1500	1500
Taxable Income (TI = OR-OE-D)	8500	8500	8500	8500
Taxes (T= TI* τ) ($\tau = 30\%$)	2550	2550	2550	2550
Net Income After Taxes (ATNI =TI - T)	5950	5950	5950	5950
Net Cash Flow (NCF = Total cash in - total cash out)	1450	7450	7450	7450

Expensing the car cost

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Op. Revenues (OR)	20000	20,000	20,000	20,000
Op. Expenses (OE)	10000	10,000	10,000	10,000
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Net Income After Taxes (=TI - T)	2800	7000	7000	7000
Net Cash Flow (= Total cash in - total cash out)	2800	7000	7000	7000

Total taxes = \$10200

Depreciating the car cost

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Op. Revenues (OR)	20000	20,000	20,000	20,000
Op. Expenses (OE)	10000	10,000	10,000	10,000
Op. Income (OI)	10000	10000	10000	10000
Depreciation Allowance (D)	1500	1500	1500	1500
Taxable Income (TI = OR-OE-D)	8500	8500	8500	8500
Taxes (T= TI* τ) ($\tau = 30\%$)	2550	2550	2550	2550
Net Income After Taxes (ATNI =TI - T)	5950	5950	5950	5950
Net Cash Flow (NCF = Total cash in - total cash out)	1450	7450	7450	7450

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Expensing the car cost

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Op. Income (OI)	4000	10000	10000	10000
Taxable Income (TI) (= OR-OE-'other deductible items')	4000	10000	10000	10000
Taxes (T= TI*τ) (τ = 30%)	1200	3000	3000	3000
Net Income After Taxes (=TI - T)	2800	7000	7000	7000
Net Cash Flow (= Total cash in - total cash out)	2800	7000	7000	7000

$$\begin{aligned} \text{NPV}(@10\%/yr) &= -6000 + 8800/1.1 + 7000/1.1^2 + 7000/1.1^3 + 7000/1.1^4 \\ &= \mathbf{\$17,825} \end{aligned}$$

Depreciating the car cost

	<u>Year 1</u>	<u>Year 2</u>	<u>Year 3</u>	<u>Year 4</u>
Op. Revenues (OR)	20000	20,000	20,000	20,000
Op. Expenses (OE)	10000	10,000	10,000	10,000
Op. Income (OI)	10000	10000	10000	10000
Depreciation Allowance (D)	1500	1500	1500	1500
Taxable Income (TI = OR-OE-D)	8500	8500	8500	8500
Taxes (T= TI*τ) (τ = 30%)	2550	2550	2550	2550
Net Income After Taxes (ATNI =TI - T)	5950	5950	5950	5950
Net Cash Flow (NCF = Total cash in - total cash out)	1450	7450	7450	7450

$$\begin{aligned} \text{NPV}(@0\%/yr) &= -6000 + 7450/1.1 + 7450/1.1^2 + 7450/1.1^3 + 7450/1.1^4 \\ &= \mathbf{\$17,615} \end{aligned}$$

Conclusion: On an after-tax NPV basis, the business would prefer to expense the car cost. But this is not permitted by the IRS!

Example: Capitalizing and depreciating the car; debt financing

Sales: \$20,000/yr

Car purchase: \$6,000

Operating expenses: \$10,000

Car lifetime: 4 yrs

Net salvage value: \$0

Car loan: \$4000

Loan term: 4 years

Repayment: Equal principal repayments
at end of year

Income Statement: Capitalization and (straight line) depreciation of the car + debt financing

	T=0	End of Year 1	End of Year 2	End of Year 3	End of Year 4
Operating Revenue (OR)		20000	20000	20000	20000
Operating Costs (OC)		10000	10000	10000	10000
Operating Income (OI = OR-OC)		10000	10000	10000	10000
Depreciation allowance (D)		1500	1500	1500	1500
Interest payment (IP)		400	300	200	100
Taxable income (TI = OI - D - IP)		8100	8200	8300	8400
Taxes (@ 30% of TI)		2430	2460	2490	2520
After-tax net income		5670	5700	5730	5760
Principal repayment (PR)		1000	1000	1000	1000
Net cash flow (NCF = OR - OC - IP - PR)	-2000	6170	6240	6310	6380

Sunset Inc.

INCOME STATEMENT & RETAINED EARNINGS

(For Year Ended December 31, 20xx)

Income statement

Net sales		
Sales & other operating revenue		\$303,000
Less sales return & allowances		<u>(3,000)</u>
		300,000
Cost of goods sold		
Labor	120,000	
Materials	60,000	
Overhead	8,000	
Depreciation	<u>20,000</u>	
Total		<u>(208,000)</u>
Gross profit		92,000
Operating expenses		
Selling	15,720	
General administration	29,000	
Lease payments	<u>14,000</u>	
Total	58,720	<u>(58,720)</u>
Net operating profit		33,280
Nonoperating revenues		0
Nonoperating expenses		
Interest payments		<u>(5,200)</u>
Net income before taxes		28,080
Income taxes (30%)		<u>(8,424)</u>
Net income		\$19,656
<i>Statement of retained earnings</i>		
Cash dividends		
Preferred stock (per share, \$6)		600
Common stock (per share, \$.95)		<u>9,456</u>
Total dividends		\$10,056
<i>Retained earnings</i>		
Beginning of year (1/1/20xx)		32,800
Current year		<u>9,600</u>
End of year		\$42,400
Earnings per share of common stock		
Net applicable income, (19,656 - 600)/10,000		<u>\$1.91</u>

Derivation of composite income tax rate:
Non-deductibility of federal taxes from state taxes

Let:

τ = composite tax rate

τ_F = federal tax rate

τ_s = state tax rate

T_F = federal taxes due

T_s = state taxes due

R = revenues received

X = operating and maintenance expenses

B = bond interest due

D = depreciation allowance

Then:

$$T_F = \tau_F(R - X - D - B - T_s)$$

$$T_s = \tau_s(R - X - D - B)$$

Thus,

$$T_F = \tau_F(1 - \tau_s)(R - X - D - B)$$

And total taxes, $T = T_F + T_s = (R - X - D - B)[\tau_F(1 - \tau_s) + \tau_s]$

And if we define the total tax rate, τ , as

$$T = \tau(R - X - D - B)$$

We have that

$$\tau = [\tau_F(1 - \tau_s) + \tau_s]$$

Recap

- Two reasons for depreciation
 - Financial reporting
 - Tax calculations
- Depreciation allowance is a non-cash expense -- fictitious -- but if companies don't make adequate provision for depreciation, their income statements won't reflect actual loss of value of capital assets over time.
- Difference between net income(NI) and net cash flow (NCF)
 - NCF: Actual flows of money associated with investment
 - NI: 'Theoretical' financial result of the investment
- Deductible items for purposes of computing taxable income include, in addition to operating expenses and depreciation, interest payments on debt, but not principal repayments or dividends on stock

Depreciation Methods

Let:

I_0 = initial investment cost

I_N = net salvage value

N = depreciation lifetime (specified by tax authorities)

D_n = depreciation allowance in year n

BV_n = book value (or accounting value) at end of year n

= initial value - accumulated depreciation charges

$$= I_0 - \sum D_i$$

market value(in general)

A. Straight-line depreciation method

$$D_n = (I_0 - I_N)/N$$

Depreciation Methods (contd.)

B. Sum-of-the-years'-digits (SYD) method

$$\text{Sum of digits } 1, 2, \dots, N = \sum_{n=1}^N n = \frac{N(N+1)}{2}$$

Then,

$$D_1 = \frac{N}{N(N+1)/2} [I_0 - I_N]$$

$$D_2 = \frac{N-1}{N(N+1)/2} [I_0 - I_N]$$

and, in general,

$$D_n = \frac{N-n+1}{N(N+1)/2} [I_0 - I_N]$$

Depreciation Methods (cont.)

C. Declining Balance Method

Depreciation charge = fixed fraction of BV at end of previous year

i.e., in year n,

$$D_n = \alpha BV_{n-1}$$

Usually, $\alpha = 1.5/N$ or $2.0/N$

If $\alpha = 2/N$, the method is referred to as the 'double-declining balance' (DDB) method.

Note that the formula doesn't include a term for the salvage value

i.e.,

$$D_n = \alpha (1 - \alpha)^{n-1} I_0$$

yields an 'implied' salvage value after N years, which in general will differ from I_N .

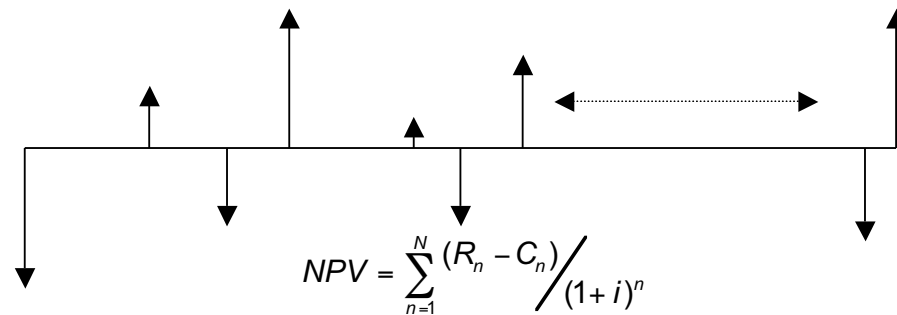
D. Modified Accelerated Cost Recovery System (MACRS)

- Introduced by Tax Reform Act of 1986 (last major overhaul of tax code)
- See handout

ACCELERATION IS FAVORABLE TO THE TAXPAYER

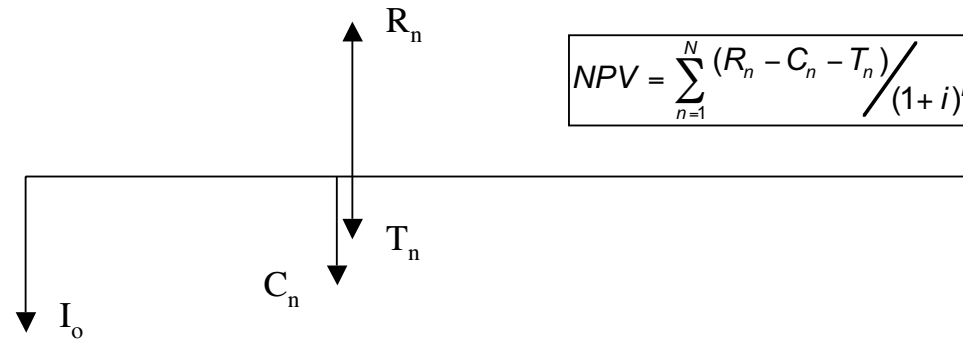
Taxes complicate the economic analysis of projects

- In the absence of taxes, it is straightforward to set up a cash flow diagram for a project and solve the present worth balance equation



- We can solve the balance equation to calculate (a) the NPV, or (b) the rate of return, or (c) an unknown cash flow given the required rate of return and all other cash flows.
- Note: In this simple case, depreciation -- **a non-cash expense** -- isn't included in the cash flow diagram.

- With taxes, there are several complications:



- The taxes in each year depend on all other cash flows in that year.
- For projects with capitalized costs, we must specify the depreciation allowance in each year in order to calculate the taxes.
- The taxes also depend on the financing structure -- i.e., debt and equity capital is treated different from a tax point of view.

Why bother with taxes at all?

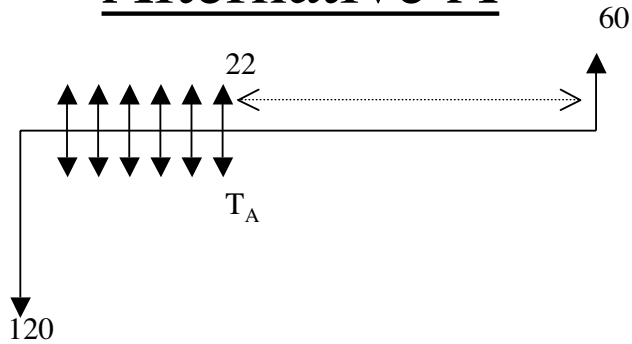
Comparison of two alternatives, identical except for net salvage value*

	ALTERNATIVE A	ALTERNATIVE B
Investment cost	\$120,000	Same as A
Net salvage value	\$60,000	Zero
Project life	30 years	Same as A
Financing	100% by equity	Same as A
Income tax rate	50%	Same as A
Before-tax operating income	\$22,000/yr	Same as A
Depreciation method	Straight-line	Same as A
Required rate of return	10%/yr	Same as A

*From: G.W. Smith, Engineering Economy

Comparison of alternatives A and B, with taxes

Alternative A



$$T_A = [22000 - (120000 - 60000) / 30] \times 0.5$$

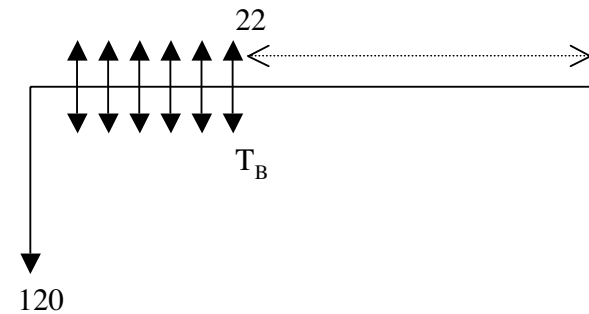
$$= 10000$$

$$NPV_A = -120000 + [22000 - 10000](P / A, 10\%, 30)$$

$$+ 60000(P / F, 10\%, 30)$$

$$= -\$3438$$

Alternative B



$$T_B = [22000 - 120000 / 30] \times 0.5$$

$$= 9000$$

$$NPV_B = -120000 + [22000 - 9000](P / A, 10\%, 30)$$

$$= +\$2551$$

Summary

1. Depreciation is an accounting procedure, not a cash expense.
2. Depreciation is supposed to reflect in the income statement the loss of value of capital assets with time.
3. Depreciation schedules only really matter for tax calculations. Possible depreciation schedules for a given class of investment are determined by law.
4. In a given year, higher depreciation allowances mean lower taxes. Since companies prefer to postpone taxes, they prefer depreciation schedules with high depreciation allowances during the early years of the project.
5. Companies are required by law to capitalize their capital investments. They can (and do) expense any other expenditure.
6. Net cash flows describe the actual flows of money associated with the investment during a given period, whereas net incomes describe the "theoretical" financial result of the investment during this period, by taking depreciation into account.