

Overview of Lecture 9

■ Taxes

- The Tax Code
- Calculating after-tax cash flows
- What Discount Rate to Use?

■ Materials covered:

- Reader, Lecture 7
- BM Chapter 6, pp. 121-134.

Review:

Internal Rate of Return (IRR)

- IRR is the most popular alternative to NPV.
- It is intuitive and **usually** gives the right result.
- A project's IRR is defined as the interest rate that sets the NPV of cash flows equal to zero. Given C_0, C_1, \dots, C_t the IRR is the r solving the equation:

$$0 = C_0 + \frac{C_1}{(1+r)} + \frac{C_2}{(1+r)^2} + \frac{C_3}{(1+r)^3} + \dots$$

The U.S. Tax Code

- In valuing a project or firm, we need to know its cash flows.
- Only **after-tax** cash flows can be distributed to shareholders.
- We need to understand the basics of how taxes are calculated, and how this affects
 - A project's cash flows.
 - The appropriate discount rate that firms should use.


Depreciation

- A company purchases a car for \$25,000.
- Because a car is a depreciable asset, the company cannot deduct the \$25,000 immediately.
 - The government specifies a “tax life” for the asset.
 - The cost of the car is “written off” as a **depreciation** expense each year during the tax life.
- **Warning:** Depreciation is not a cash flow.
- What are the cash flows associated with buying the car?
 - Initial capital expenditure (outflow)
 - **Tax shields** in future years due to depreciation (inflow)
 - » Tax shield = depreciation x tax rate

Straight Line Depreciation

- Under this rule the firm deducts a depreciation expense equal to
$$\frac{\text{Purchase Price}}{\text{Tax Life}}$$
from its income every year during the asset's tax life.
- In our example, suppose tax life is 5 years.
- Annual depreciation = $25,000/5 = \$5,000$ per year.
- For tax purposes, rather than straight line depreciation, companies typically use the IRS's **Modified Accelerated Cost Recovery Schedule (MACRS)**.
 - See BM pp. 130 – 131, Table 6.4.

Deductible vs. Non-deductible Operating Expenses

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- ***Tax deductible current operating expense:*** Any expenditure that is deductible in the period it is incurred.
 - Salaries
 - Rent
 - ***Non-deductible current operating expense:*** Any expenditure which is not deductible, and does not result in a depreciation allowance.
 - Entertainment/meals are only partially deductible

Example

- A company produces light bulbs and earns \$50,000 a year in sales.
- To do so it spends \$20,000 a year on salaries, \$1,000 a year on meals to entertain clients.
- In addition it purchases a new delivery truck every 4 years.
- Each new truck costs \$50,000, and each old truck can be traded in for \$30,000.

Example, continued

- Assume that the truck has a 5 year life, and is depreciated on a straight line basis.
- Assume that in year 9 the truck is sold for \$45,000.
- What are the firm's cash flows if it lasts for 9 years, and the tax rate is 30%?
- To answer the question we need to set up a spreadsheet that tracks all of the cash flows.

Non-Tax Cash Flows



Year	0	1	2	3	4	5	6	7	8	9
Revenues	0	50	50	50	50	50	50	50	50	50
Salaries	0	-20	-20	-20	-20	-20	-20	-20	-20	-20
Meals	0	-1	-1	-1	-1	-1	-1	-1	-1	-1
Truck	-50	0	0	0	-20	0	0	0	-20	45
Total	-50	29	29	29	9	29	29	29	9	74

The -20 for the truck in years 4 and 8 equals +30,000 for the trade in, and -50,000 for the purchase of a new truck

Calculating taxes

- The truck is a depreciable asset that generates a tax deduction (depreciation expense) of \$10,000 per year.
- Note that in years 4 and 8 when the truck is sold it has a “book value” of
$$\$50,000 - 4(\text{Depreciation Per Year}) = \$10,000$$
- The government considers the difference between this and the sale price of \$30,000 to be taxable income of \$20,000.
 - Gain on sale of property, plant and equipment

Calculating taxes

- In year 9, the truck has a book value of \$40,000, and sells for \$45,000, producing additional taxable income of \$5,000.
- While salaries are fully deductible, only 50% of the meals can be deducted. The total deduction is therefore $20,000 + .5(1,000) = 20,500$.

Calculating Taxes

Year	0	1	2	3	4	5	6	7	8	9
Revenues	0	50	50	50	50	50	50	50	50	50
Ded. current exp	0	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5	-20.5
Depreciation	0	-10	-10	-10	-10	-10	-10	-10	-10	-10
Gain from sale	0	0	0	0	20	0	0	0	20	5
Taxable income	0	19.5	19.5	19.5	39.5	19.5	19.5	19.5	39.5	24.5
Taxes	0	5.85	5.85	5.85	11.85	5.85	5.85	5.85	11.85	7.35

Free Cash Flow Calculation

- To calculate free cash flow, subtract tax payment from pre-tax cash flow:

Year	0	1	2	3	4	5	6	7	8	9
Pre-tax CF	-50	29	29	29	9	29	29	29	9	74
Taxes	0	5.85	5.85	5.85	11.85	5.85	5.85	5.85	11.85	7.35
Free Cash Flow	-50	23.15	23.15	23.15	-2.85	23.15	23.15	23.15	-2.85	66.65

Selecting a Discount Rate With Taxes

- **The rule:** In deciding on the discount rate, think from the perspective of the firm's *investors*.
- Example: A firm pays a \$10 dividend per year forever.
- Investors pay 25% tax on their dividend income.
- In the financial markets investors can purchase a risk equivalent alternative taxable investment.
 - Pretax return is 8% per year
 - Investors pay 40% tax on these earnings.
- What is the stock worth?

What Discount Rate to Use?

- The discount rate reflects the return available to investors on an equivalently risky alternative investment.
- Since investors only keep what's left over after paying taxes, we care about their *after-tax* returns.
- Investors earn 8% but keep only 60% of this, i.e.
 $0.6 \times .08 = 4.8\%$ *after tax*.
- This is the appropriate discount rate.

Cash Flows

- After taxes the investors keep 75% of the dividend.
 - So they get $.75 \times 10 = \$7.50$ per year.
- To calculate the stock's value, discount the *after-tax* cash flows using the *after-tax* discount rate.
- The stock's value equals
$$7.5 / .048 = \$156.25.$$