

Lecture 21

Inflation



Learning Objectives

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- 1. Analyze situations where costs inflate at different rates**
- 2. Analyze the effects of inflation on debt financing**
- 3. Analyze the effects of inflation on income taxes**

Taxes

- ◆ Note that taxes, depreciation, etc. are based on *nominal* dollars!
- ◆ *Tax rates* are affected:
 - “Bracket creep”
- ◆ Also, depreciation is worth less

Tax Example

◆ First, assume no inflation:

| Year | Before Tax | Deprec. | Taxable Income | Taxes | After Tax |
|----------------|------------|---------|----------------|-------|-----------|
| 0 | -110 | | | | -110 |
| 1-10 | 26.3 | -11 | 15.3 | -6.1 | 20.2 |
| Rate of Return | 20.1% | | | | 12.9% |

Tax Example (continued)

- ◆ **Now assume 6% inflation**
- ◆ **We can either inflate the \$26.3K cash flow**
 - **(Convert to nominal dollars)**
- ◆ **Or deflate the -\$11K depreciation**
 - **(Convert to real dollars)**
- ◆ **We will inflate the cash flows**

Tax Example (continued)

| Year | Before Tax | Deprec. | Taxable Income | Taxes | After Tax | Real \$ |
|-----------|-------------|------------|----------------|-------------|-------------|-------------|
| 0 | -110 | | | | -110 | -110 |
| 1 | 27.9 | -11 | 16.9 | 6.8 | 21.1 | 19.9 |
| 2 | 29.6 | -11 | 18.6 | 7.4 | 22.1 | 19.7 |
| 3 | 31.3 | -11 | 20.3 | 8.1 | 23.2 | 19.5 |
| 4 | 33.2 | -11 | 22.2 | 8.9 | 24.3 | 19.3 |
| 5 | 35.2 | -11 | 24.2 | 9.7 | 25.5 | 19.1 |
| 6 | 37.3 | -11 | 26.3 | 10.5 | 26.8 | 18.9 |
| 7 | 39.5 | -11 | 28.5 | 11.4 | 28.1 | 18.7 |
| 8 | 41.9 | -11 | 30.9 | 12.4 | 29.6 | 18.5 |
| 9 | 44.4 | -11 | 33.4 | 13.4 | 31.1 | 18.4 |
| 10 | 47.1 | -11 | 36.1 | 14.4 | 32.7 | 18.2 |

Observations

- ◆ **Internal rate of return = 11.65%**
 - **Versus 12.9% with no inflation**
- ◆ **Depreciation is a decreasing percentage of revenue!**
- ◆ **Essentially, the average tax rate went up from 40% to 48%:**
 - **Taxable income went up in real terms**
 - **Faster than the rate of inflation!**

Observations

◆ Rapid depreciation still valuable:

- Even with high inflation

| ◆ <u>Inflation</u> | <u>0%</u> | <u>6%</u> | <u>12%</u> |
|--------------------|-----------|-----------|------------|
| ■ 25 years | 10.6% | 9.5% | 8.8% |
| ■ 10 years | 12.9% | 11.7% | 10.8% |
| ■ 5 years | 15.5% | 13.5% | 12.6% |
| ■ Immediate | 20.1% | 20.1% | 20.1% |

Differential Price Changes

- ◆ **If all prices change at same rate:**
 - **Then inflation is irrelevant!**
- ◆ **Inflation matters with loans:**
 - **Since loan repayments do not inflate**

Example

- ◆ Buy a piece of equipment
- ◆ Cost = \$60K, life = 6 years
- ◆ Straight line depreciation, tax rate 40%
- ◆ Salvage value = \$0
- ◆ Annual savings:
 - \$18K labor, \$5K materials (year 0 dollars!)
- ◆ Annual costs:
 - \$3K energy, \$1.2K maintenance

Example (continued)

- ◆ **With no inflation:**
 - Net savings = \$18.8K per year
 - Internal rate of return = 21.7% before tax, 13.6% after tax
- ◆ **This may not remain constant with differential rates of inflation**
- ◆ **For example:**
 - General inflation = 8%
 - Labor = 6%
 - Energy = 15%

Example (continued)

| Year | Labor | Materials | Energy | Maint. | Total |
|------|-------|-----------|--------|--------|-------|
| 0 | 18.0 | 5.0 | -3.0 | -1.2 | 18.8 |
| 1 | 19.1 | 5.4 | -3.5 | -1.3 | 19.7 |
| 2 | 20.2 | 5.8 | -4.0 | -1.4 | 20.7 |
| 3 | 21.4 | 6.3 | -4.6 | -1.5 | 21.7 |
| 4 | 22.7 | 6.8 | -5.2 | -1.6 | 22.6 |
| 5 | 24.1 | 7.3 | -6.0 | -1.8 | 23.6 |
| 6 | 25.2 | 7.9 | -6.9 | -1.9 | 24.6 |

◆ Total before-tax cash flows (nominal \$)

Example (continued)

| Year | Before Tax | Deprec. | Taxable Income | Taxes | After Tax | Constant \$ |
|----------|-------------|-----------|----------------|------------|-------------|-------------|
| 0 | -60 | | | | -60 | -60 |
| 1 | 19.7 | 10 | 9.7 | 3.9 | 15.8 | 14.7 |
| 2 | 20.7 | 10 | 10.7 | 4.3 | 16.4 | 14.1 |
| 3 | 21.7 | 10 | 11.7 | 4.7 | 17.0 | 13.5 |
| 4 | 22.6 | 10 | 12.6 | 5.1 | 17.6 | 12.9 |
| 5 | 23.6 | 10 | 13.6 | 5.5 | 18.2 | 12.4 |
| 6 | 24.6 | 10 | 14.6 | 5.8 | 18.8 | 11.8 |

- ◆ **Rate of return = 9.0% (versus 13.16%)**
 - **Based on 8% inflation generally**

Observations

- ◆ **Why is the internal rate of return = 9.0%**
 - **Versus 13.6% with no inflation?**
- ◆ **Depreciation helps less:**
 - **It is a decreasing percentage of revenue!**
- ◆ **Energy escalates faster than inflation:**
 - **Labor escalates slower than inflation**
 - **Savings increase more slowly than costs!**

Differential Price Changes

- ◆ **Historically, land and labor have escalated faster than inflation**
- ◆ **Total amount of land constant:**
 - **As population grows, price increases!**
- ◆ **Value of labor increases:**
 - **With increasing productivity, skill!**
- ◆ **These things change only slowly:**
 - **May be a qualitative consideration**

Review

- ◆ **We learned how to analyze differential rates of inflation:**
 - E.g., different rates for labor versus energy
- ◆ **If benefits inflate faster than costs:**
 - Inflation makes a project *more* desirable
- ◆ **If costs inflate faster than benefits:**
 - Inflation makes a project *less* desirable