Corporate Finance, Module 5: Investment Decisions and Net Present Value

Illustrative Test Questions and Practice Problems

(The attached PDF file has better formatting.)

Question 5.1: Incremental Cash Flows

Which of the following should be treated as incremental cash flows?

1. A portion of existing corporate overhead.
2. Future tax benefits from the purchased business.
3. Depreciation of the new company's assets.

A. 2
B. 3
C. 1, 2
D. 1, 3
E. 1, 2, 3

Answer 5.1: A

Question: This problem says that depreciation is not a cash flow; but other problems ask for the net present value based on the depreciation schedule. Which is correct?

Answer: Book depreciation (i.e., GAAP depreciation) is not a cash flow, but tax depreciation affects the tax liability and causes a cash flow change.

Question: Insurance policies have no depreciation; must we be concerned about this?

Answer: Amortization of deferred policy acquisition costs is like depreciation of fixed assets. For pricing, we use the tax amortization schedule, not the GAAP amortization schedule. Tax amortization is the DAC tax for life insurance and health insurance and revenue offset for property-casualty insurance. We also use the deferred tax assets based on statutory accounting principles; this last item is not covered in the corporate finance course.

Question: This problem says that we don't consider allocation of fixed overhead, but we always consider fixed expenses in policy pricing. Which is correct?

Answer: Actuarial policy pricing evaluates the long-run equilibrium price. In the long-run, we can shut down the insurer and not pay overhead expenses, we can use only part of the home office and lease out the rest, or we can substitute other operations. In the long-run, all expenses are variable.

Question: If all expenses are variable, when do we not include allocation of fixed expenses?

Answer: Suppose the cost of a policy is $1,000, including $100 of fixed expenses. If we do not expect to collect $1,000 per policy, we do not write the line of business and never incur the fixed expenses. If we expect to collect $1,000, but at the point of underwriting we find that we can sell the policy for no more than $950, we issue the policy for $950. At the underwriting date, the $100 of fixed overhead expenses are a sunk cost and do not affect the sale.

Question: If we do this, we will lose money on average. Sometimes we sell the policy for $1,000, and sometimes we sell the policy for $950.

Answer: At the point of underwriting, our past pricing studies are not relevant. If we can sell the policy for

$1,200, we do so, and we make an extra $200 profit. The final price depends on supply and demand, not on actuarial pricing studies.

Question: If this is true, why do actuaries say they charge the equitable price? Why don't they say they price based on supply and demand?

Answer: The public doesn't trust insurance companies. If actuaries said they priced to maximize profits based on supply and demand, self-styled consumers' advocates would say that insurers are fleecing the public and would call for government price regulation.

Question 5.2: Cash Flows

Which of the following are true for calculating net present value?

1. All cash flows should be estimated on an incremental basis.
2. All cash flows should be discounted on an after-tax basis.
3. Accounting profits should be included as cash flows.

A. 2
B. 1, 2
C. 1, 3
D. 2, 3
E. 1, 2, 3

Answer 5.2: B

Question: I price auto insurance at my company, and we use pre-tax numbers, with no treatment of taxes. We've been doing this as long as anyone at my company can remember. Why is this?

Answer: Before 1986, auto insurers paid little (if any) federal income taxes, and pre-tax pricing was the same as after-tax pricing. When the tax law changed in 1986, some older actuaries did not know the law and did not adjust to after-tax pricing. Many property-casualty actuaries continue with pre-tax pricing, even though the methods are not correct. Slowly, actuaries are learning to include taxes with their pricing studies, but it may take a generation before the change is complete.

Question: Do life insurance actuaries also use pre-tax pricing studies?

Answer: Taxes have always been a major component of life insurance pricing, even before 1986, and actuary always used after-tax pricing studies. The tax law changes in 1982, 1984, and 1986 were incorporated into actuarial practice.

{*Note:* For insurance pricing, we use statutory accounting as a proxy for potential dividends to stockholders, so we use accounting returns, not cash flows. This is covered on SOA Course 5 and CAS Exam 9, not in this corporate finance VEE course.}

Exercise 5.3: Real Dollar Cash Flows

A firm has an option to undertake a project whose cash flows, in real terms (current dollars), are as follows:

Year	Real Cash Flow
0	-500
1	200
2	225
3	175

If the firm's nominal discount rate is 20% per annum, and inflation is 10% per annum, should this project be undertaken?

Solution 5.3: The real discount rate is 1.20 / 1.10 = 1.091. The present value of the cash flows is

Year	Real Cash Flow	PV (cash flows)
0	-500	(500.00)
1	200	183.32
2	225	189.03
3	175	134.76
Total		7.11

Illustration: $200 / 1.091 = $183.32; $225 / 1.091^2 = $189.03.

The present value of the real cash flows is just about equal to the initial investment. This is a zero NPV project; it may be accepted or rejected without changing the firm's worth.

Question: Using deflated cash flows makes sense; why don't we use it in practice?

Answer: Taxes are based on nominal income, not deflated income. For insurance pricing, which depends heavily on tax cash flows, we use nominal interest rates and explicit taxes.

Exercise 5.4: Sunk Costs

A firm plans to expand into a new product line. In preparation, it has spent $275,000 in unrecoverable planning and systems work and another $225,000 on land and improvements, which could be sold now for $200,000. The future cash flows of the division were originally estimated to have a present value of $580,000, well worth the original $500,000 investment. Now, with new information, it estimates that an additional $150,000 must be spent and the project will be delayed six months. Estimates of returns once the new product line is available have not changed. Should the company continue the project? What costs and returns would you compare and what considerations would you include?

Solution 5.4:

$300,000 are spent and cannot be recovered: $275,000 + ($225,000 – $200,000); these costs are not relevant for the NPV analysis. The relevant costs are the $150,000 of new spending and the $200,000 of recoverable value on land and improvements, for a total of $350,000. This is considerably less than the $580,000 in estimated revenue, so the project should be completed.

Question 5.5: Cash Flows

Which of the following should be included with cash flows?

1. The opportunity cost of resources
2. Net working capital
3. Cost of research performed before the current analysis

A. 1
B. 3
C. 1, 2
D. 2, 3
E. 1, 2, 3

Answer 5.5: C (Statement 3 is a sunk cost.)

Question: How does net working capital affect discounted cash flow analysis?

Answer: Suppose an insurer gets a premium of $11,000, pays expenses of $1,000, and pays benefits of $20,000 ten years later. If the discount rate is 8%, is the policy profitable?

Question: At an 8% discount rate, $10,000 grows to $10,000 × 1.08^{10} = $21,589. The benefits are less than the accumulated value of the premium, so the policy is profitable.

Answer: We have not considered net working capital. Suppose the insurer must hold cash of $2,000 each year that is not invested. The insurer gets the cash back at the end of the ten years. The cost of holding cash is $160 each year at an 8% discount rate. Over ten years, this exceeds the profit, so the policy is not profitable.

This illustration is what Brealey and Myers intend, but the actual pricing is complex. Stuart Myers has written several papers on insurance pricing, examining the tax effects and the cost of holding capital. Explaining his procedures would be overkill for this course. But the concept is correct: if cash must be held during the life of the project, the *opportunity cost* of that cash is a cash outflow for the project.

Exercise 5.6: Net Present Value

Company X invests $1,000 in a project (in year 0). It expects to receive nominal cash flows of $400 in year 1, $500 in year 2, and $600 in year 3, received at the end of each year. Assume inflation is projected at 5% per year and the real discount rate equals 10%. What is the project's net present value? Assume the initial investment and all cash flows occur at the end of the year.

Solution 5.6:

The nominal discount rate is 1.10 × 1.05 = 1.155. The net present value of the project is

$$-\$1,000 + \$400 / 1.155 + \$500 / 1.155^2 + \$600 / 1.155^3 = \$110.53.$$