Appendix

Capital Investment Decisions: An Overview

Solutions to Review Questions

The *timing* is important because cash received earlier has a greater economic value than cash received later. There is an opportunity cost and risk involved by having funds tied up in capital investment projects. Determining the *amount* is important in estimating the future cash flows. The timing and amount together are used to determine the economic value of the project.

The time value of money merely states that cash received earlier has a greater value than cash received later because the dollar received today can be earning interest between now and later.

Revenues represent the accounting measure of inflows to the firm. Revenues might be recognized when, before, or after cash is received. Revenues are recognized based on generally accepted accounting principles.

Expenses represent the accounting measure of outflows from the firm. Expenses are matched with revenues and, therefore, might be recognized when, before, or after cash is spent.

Depreciation is an accounting measure of the use of a capital asset and is not a cash flow. The tax shield on depreciation is the savings in taxes associated with the depreciation expense recorded for tax purposes and is a cash flow.

Solutions to Critical Analysis and Discussion Questions

To determine which, if either, project should be approved, the net present value of each project should be determined. Once the timing and amount of cash flows has been determined, they should be discounted to the present by determining and applying appropriate discount rates. Any project with a positive net present value could be justified and the project with the greater net present value should be approved under normal circumstances.

The four types of cash flows are:

(1) investment cash flows,

(2) periodic operating flows,

(3) depreciation tax shield, and

(4) disinvestment flows.

We consider them separately because each type of flow results from different activities and gives rise to different tax consequences.

No. Depreciation is not a cash flow item. However, the tax shield which arises from depreciation deductions for tax purposes is a cash flow item and is included.

The total amount depreciated over the life of the machine (and, therefore, often the tax savings associated with that depreciation) is the same regardless of the depreciation method used. However, for capital investment decisions, the timing of the savings is important because it affects the net present value of the depreciation tax shield.



Although the working capital might be assumed to be returned to the firm at the end of the project, the firm does not have the use of those funds during that time. Therefore, the present value of the working capital returned is less than the present value of the working capital contributed.

The net present value analysis for a new plant considered in this appendix considers the cash flows from the entire life of the plant and compares the present value of those cash flows to the initial investment in the plant. Accounting measures of income use a measure of plant cost (depreciation), which is an allocation of the plant cost to the individual years. This allocation often does not depend on the actual usage of the plant. Therefore, plants that are built with the intention of growing output to future demand will have insufficient cash inflows in the first year to cover the depreciation cost. Accounting income, therefore will be low (or negative).

Solutions to Exercises

1. (20 min.) Present Value of Cash Flows: Star City.

a. At 20%

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Time* |  | *Year* | | | | | | | | |
|  | *0* |  | *1* |  | *2* |  | *3* |  | *4* |  | *5* |
| Net cash flow | ($200,000 | ) | $20,000 |  | $50,000 |  | $80,000 |  | $80,000 |  | $100,000 |
| PV factor (20%) | 1.000 |  | .833 |  | .694 |  | .579 |  | .482 |  | .402 |
| Present values | ($200,000 | ) | $16,660 |  | $34,700 |  | $46,320 |  | $38,560 |  | $ 40,200 |
| Net PV of project | ($ 23,560 | ) |  |  |  |  |  |  |  |  |  |

b. At 12%

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Time* |  | *Year* | | | | | | | | |
|  | *0* |  | *1* |  | *2* |  | *3* |  | *4* |  | *5* |
| Net cash flow | ($200,000 | ) | $20,000 |  | $50,000 |  | $80,000 |  | $80,000 |  | $100,000 |
| PV factor (12%) | 1.000 |  | .893 |  | .797 |  | .712 |  | .636 |  | .567 |
| Present values | ($200,000 | ) | $17,860 |  | $39,850 |  | $56,960 |  | $50,880 |  | $ 56,700 |
| Net PV of project | $ 22,250 |  |  |  |  |  |  |  |  |  |  |

1. (25 min.) Present Value of Cash Flows: Rush Corporation.

a.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Year* |  | *Depreciation* | | |  | *Tax Shield  at 25%* | | |  | *PV Factor (8%)* | | |  | *Present Value* |
| 1 |  |  | $120,000 |  |  |  | $ 30,000 |  |  |  | .926 |  |  | $ 27,780 |
| 2 |  |  | 210,000 |  |  |  | 52,500 |  |  |  | .857 |  |  | 44,993 |
| 3 |  |  | 90,000 |  |  |  | 22,500 |  |  |  | .794 |  |  | 17,865 |
| 4 |  |  | 90,000 |  |  |  | 22,500 |  |  |  | .735 |  |  | 16,538 |
| 5 |  |  | 90,000 |  |  |  | 22,500 |  |  |  | .681 |  |  | 15,323 |
|  |  |  | $600,000 |  |  |  | $150,000 |  |  |  |  |  |  | $122,498 |

The present value of the tax shield is $122,498.

b.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Year* |  | *Depreciation* | | |  | *Tax Shield  at 25%* | | |  | *PV Factor (8%)* | | |  | *Present Value* |
| 1 |  |  | $120,000 |  |  |  | $ 30,000 |  |  |  | .926 |  |  | $ 27,780 |
| 2 |  |  | 120,000 |  |  |  | 30,000 |  |  |  | .857 |  |  | 25,710 |
| 3 |  |  | 120,000 |  |  |  | 30,000 |  |  |  | .794 |  |  | 23,820 |
| 4 |  |  | 120,000 |  |  |  | 30,000 |  |  |  | .735 |  |  | 22,050 |
| 5 |  |  | 120,000 |  |  |  | 30,000 |  |  |  | .681 |  |  | 20,430 |
|  |  |  | $600,000 |  |  |  | $150,000 |  |  |  |  |  |  | $119,790 |

The present value of the tax shield is $119,790. Note the total depreciation taken is the same under straight-line and accelerated, but the timing under accelerated methods increase the present value of the tax shield over the straight-line method.

In part b, we can also use the annuity table (Exhibit A.9), because the annual cash flows are equal. The present value is $119,790 (= $30,000 × 3.993).

1. (30 min.) Present Value Analysis in Nonprofit Organizations: Johnson Research Organization.

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | *Year* | | | | | | | | | | | | | | |
|  | *0* |  | *1* |  | *2* |  | *3* |  | *4* |  | *5* |  | *6* |  | *7* |
| Investment flows | $(6,000,000 | ) |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Periodic operating flows: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Annual cash savings |  |  | $1,400,000 |  | $1,400,000 |  | $1,400,000 |  | $1,400,000 |  | $1,400,000 |  | $1,400,000 |  | $1,400,000 |
| Additional cash outflow |  |  | (200,000) |  | (200,000) |  | (200,000) |  | (200,000) |  | (200,000) |  | (200,000) |  | (200,000) |
| Disinvestment flows |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 400,000 |
| Net annual cash flow | $(6,000,000 | ) | $1,200,000 |  | $1,200,000 |  | $1,200,000 |  | $1,200,000 |  | $1,200,000 |  | $1,200,000 |  | $1,600,000 |
| PV factor 10% | 1.000 |  | .909 |  | .826 |  | .751 |  | .683 |  | .621 |  | .564 |  | .513 |
| Present value | $(6,000,000 | ) | $1,090,800 |  | $  991,200 |  | $  901,200 |  | $  819,600 |  | $  745,200 |  | $  676,800 |  | $  820,800 |
| Net present value | $45,600 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |

Yes, the organization should buy the equipment. It is important to note, though, that the net present value is small relative to the investment and so the decision is sensitive to our estimates of the cash flows.

1. (25 min.) Present Value of Cash Flows: Cervantes Company.

5 years is the minimum economic life.

Because the cash flows are uniform, we can use the annuity table (Exhibit A.9) to evaluate the net present value. We do not know the economic life. We do know that if A(n) is the annuity factor for n annual cash flows discounted at 10 percent, the net present value of a series of cash flows of $300,000 with an initial investment of $1,000,000 would be:

NPV = $300,000 × A(n) – $1,000,000.

The investment is worth taking if the NPV is positive, so we can solve this equation (like a breakeven problem) for the value of A(n) such that NPV is zero:

A(n) = $1,000,000 ÷ $300,000 = 3.333.

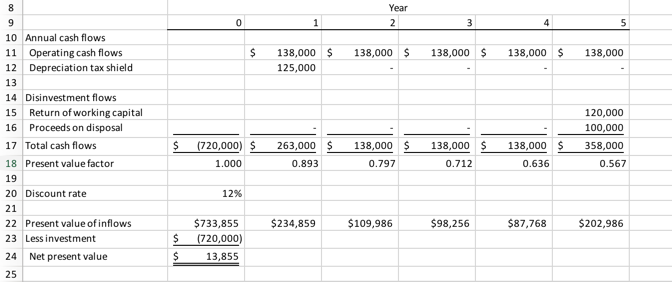
Referring to the annuity table (Exhibit A.9), we see that the annuity value (at a discount rate of 10 percent) for four years is 3.170 and for five years it is 3.791. Therefore, the economic life must be a minimum of five years for it to have a positive net present value.

Solutions to Problems

1. (35 min.) Compute Net Present Value; Expense Investment for Taxes: Mezzo Diner.

a. $13,855.

In this case, the “depreciation” is recorded entirely in year 1, so there is no depreciation in years 2-5. The following spreadsheet, similar to Exhibit A.2 in the text, shows the calculations:

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b. In this case, the managers at Mezzo Diner are likely to invest in the equipment as the net present value is positive. The comparison of the situation in this problem (immediate expensing for tax purposes of the investment expenditure) with the one in the text (depreciation over the life of the investment) illustrates how tax policy can change investment decisions.

1. (35 min.) Compute Net Present Value; Compare to Accounting Income: Lucas Company.

a. Accounting income each year will be $500. The total over four years is $2,000.

For each year, accounting income is calculated as follows:

|  |  |  |
| --- | --- | --- |
| Cash flows | (Cash revenues – cash expenses) | $3,000 |
| Depreciation | ($10,000 ÷ 4 years) | 2,500 |
| Accounting income |  | $ 500 |

b.

The present value of cash flows is (four years @ 10%):

($10,000) × 1.000 + ($3,000 × 3.170) = ($490).

c. The total accounting income is positive ($2,000) over the four years, but the net present value is negative (–$490). The difference arises, because accounting income does not consider the time value of money in depreciating the investment.

1. (35 min.) Sensitivity Analysis in Capital Investment Decisions: Square Manufacturing.

The schedule of cash flows is ($000 omitted):

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Year* |  | *Best Case* |  | *Expected* | | |  | *Worst Case* |  |
| 0 |  | ($9,000 | ) |  | ($9,000 | ) |  | ($9,000 | ) |
| 1 |  | 0 |  |  | 0 |  |  | 0 |  |
| 2 |  | 0 |  |  | 0 |  |  | 0 |  |
| 3 |  | 0 |  |  | 0 |  |  | 0 |  |
| 4 |  | 6,000 |  |  | 4,200 |  |  | 1,800 |  |
| 5 |  | 6,000 |  |  | 4,200 |  |  | 1,800 |  |
| 6 |  | 6,000 |  |  | 4,200 |  |  | 1,800 |  |
| 7 |  | 6,000 |  |  | 4,200 |  |  | 1,800 |  |
| Net Present Value @ 14% |  | $  2,802 | a |  | ($  738 | )b |  | ($5,460 | )c |

Note: In the following calculations, the present value factors are from Exhibit A.8. If you use Excel or a financial calculator, the net present values might differ slightly.

a$2,802 = $(9,000) + ($6,000 × (0.592 + 0.519 + 0.456 + 0.400))

b$(738) = $(9,000) + ($4,200 × (0.592 + 0.519 + 0.456 + 0.400))

c$(5,460) = $(9,000) + ($1,800 × (0.592 + 0.519 + 0.456 + 0.400))

Under the expected scenario, the project has a negative net present value. Therefore, it would probably be rejected. However, under the best case, the project’s net present value is positive, which may make it suitable if there are additional reasons to believe this scenario is more likely or if the company is willing to take the risk on the project for other reasons.

1. (40 min.) Compute Net Present Value: Dungan Corporation.

a. Equipment removal net of tax effects = $3,750 = $5,000 × (1 – 25%).

b. Depreciation schedule:

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| *Year* |  | *Depreciation* | | |  | *Tax Shield at 25%* | | |  | *Present Value Factor (16%)* |  | *Present  Value* |
| 1 |  |  | $ 40,000 |  |  |  | $10,000 |  |  | .862 |  | $8,620 |
| 2 |  |  | 70,000 |  |  |  | 17,500 |  |  | .743 |  | 13,003 |
| 3 |  |  | 30,000 |  |  |  | 7,500 |  |  | .641 |  | 4,808 |
| 4 |  |  | 30,000 |  |  |  | 7,500 |  |  | .552 |  | 4,140 |
| 5 |  |  | 30,000 |  |  |  | 7.500 |  |  | .476 |  | 3,570 |
| Totals |  |  | $200,000 |  |  |  | $50,000 |  |  |  |  | $34,141 |

c. Forgone tax benefits: $2,500 = ($100,000 ÷ 10 years) × 25%

d. Gain from salvage of new equipment:

$45,000 = $60,000 × (1 – 25%)

e. Tax benefit arising from loss on old equipment:

$15,000 = ($100,000 book value – $40,000 salvage value) × .25 tax rate

f. Differential cash flows (years 1 – 10):

$24,750 = [($30,000 + $48,000) – ($25,000 + $20,000)] × (1 – 25%)

A-19. (continued)

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| g. | *Year* | | | | | | | | | | | | | | | | | | | | |  |
|  | *0* |  | *1* |  | *2* |  | *3* |  | *4* |  | *5* |  | *6* |  | *7* |  | *8* |  | *9* |  | *10* |  |
| Investment flows: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Equipment cost | $(200,000 | ) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Removal | (3,750 | ) |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Salvage of old equipment | 40,000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Tax benefit—sale of old equip | 15,000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Periodic operating cash flows |  |  | $24,750 |  | $24,750 |  | $24,750 |  | $24,750 |  | $24,750 |  | $24,750 |  | $24,750 |  | $24,750 |  | $24,750 |  | $24,750 |  |
| Tax shield from   depreciation:  New equipment: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Year 1 |  |  | 10,000 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Year 2 |  |  |  |  | 17,500 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Years 3–5 |  |  |  |  |  |  | 7,500 |  | 7,500 |  | 7,500 |  |  |  |  |  |  |  |  |  |  |  |
| Old equipment (forgone) |  |  | (2,500 | ) | (2,500 | ) | (2,500 | ) | (2,500 | ) | (2,500 | ) | (2,500 | ) | (2,500 | ) | (2,500 | ) | (2,500 | ) | (2,500 | ) |
| Disinvestment: |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Proceeds of disposal |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | 60,000 |  |
| Tax on gain |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  | (15,000 | ) |
| Total cash flows | $(148,750 | ) | $32,250 |  | $39,750 |  | $29,750 |  | $29,750 |  | $29,750 |  | $22,250 |  | $22,250 |  | $22,250 |  | $22,250 |  | $67,250 |  |
| PV factor at 16% | 1.000 |  | .862 |  | .743 |  | .641 |  | .552 |  | .476 |  | .410 |  | .354 |  | .305 |  | .263 |  | .227 |  |
| Present values | $(148,750 | ) | $27,800 |  | $29,534 |  | $19,070 |  | $16,422 |  | $14,161 |  | $ 9,123 |  | $ 7,877 |  | $6,786 |  | $ 5,852 |  | $15,266 |  |
| Net present value | $   3,141 |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |