

CHAPTER 11

CAPITAL BUDGETING DECISIONS

Key Terms and Concepts to Know

Capital budgeting:

- The process of planning significant investments in projects that have long lives and affect more than one future period, such as the purchase of new equipment.

Cash Flows:

- Actual cash inflows received and actual cash outflows made for out-of-pocket costs such as salaries, advertising, repairs and similar costs.
- Net cash flows are cash inflows less cash outflows.
- Net cash flows are not the same as operating income:
 - Cash flow – depreciation expense = operating income
 - Operating income + depreciation expense = cash flow.

Time Value of Money or Present Value:

- A dollar received today is worth more than a dollar received sometime in the future. Since the dollar cannot be invested until it is received, the sooner it is received, the sooner it can be invested and earning a return and the more it will be worth at any time in the future.
- Compound interest and present value are mirror images of each other:
 - Compound interest assumes that the current investment (present value) and interest rate are known and the future value is to be calculated. The future value is calculated as follows: $FV = PV (1+i)^n$ where i is the interest rate and n is the number of periods.
 - Present value assumes that the future value(s) and discount rate are known and the present value is to be calculated. The present value is calculated as follows: $PV = FV / (1+i)^n$ where i is the interest rate and n is the number of periods.
 - In other words, multiply to solve for future value because future value will be larger and divide to solve for present value because present value will be smaller.
- Present value table converts $1 / (1+i)^n$ into a decimal to simplify the calculations.
- An annuity is a series of equal payments received or made with equal frequency. To eliminate the present value calculations for each payment in the series, the

present value of an annuity table was developed. Using the distributive property $[AB + AC = A(B+C)]$ the annuity tables sums the present value factors [B and C] for the number of periods to create an annuity factor which is multiplied by any one of the series of payments [A]. While this illustration has only two payments, the annuity table works for any number of periods and payments.

- The factor from the present value table will always be less than 1. The factor from the annuity table will be the same as the factor from the present value table for period 1 and will be greater than 1 for every period thereafter.

Key Topics to Know

Discounted Cash Flow Model

- Always considers the time value of money which makes this model superior to other methods of evaluating capital projects.
- Two separate approaches to capital investment analysis: Net Present Value method and Internal rate of Return method.
- Net Present Value method computes the difference between the present value of an investment project's future net cash flows and net initial cash outflows using a known discount rate.
- Internal Rate of Return solves for the discount rate which makes the net present value of an investment project's future net cash flows equal to net initial cash outflows, i.e., the internal rate of return sets the net present value = 0.
- The discounted cash flow model always uses cash flows, not operating income.
- Choosing an appropriate discount rate is crucial and may significantly impact the final decision. Typically, the discount rate is based on the cost of capital, the average rate of return a company must pay to its long-term creditors and shareholders for the use of their funds.

Net Present Value Method

- Net Present Value method computes the difference between the present value of an investment project's future net cash flows and net initial cash outflows using a known discount rate.
- The net present value method always uses cash flows, not operating income.
- When project require investments of significantly different amounts, the project profitability index is computed and used to compare various investment alternatives.
- Project profitability index is the ratio of the net present value of a project's cash flows to the investment required.

Example #1

The management of Ocala Company is considering the purchase of a \$25,000 machine that would reduce operating costs by \$4,000 per year. At the end of the machine's 10 year useful life, it will have a zero salvage value. The company requires a 14% on all investment projects.

Required:

- a) Net present value of the investment
- b) Difference between the total, undiscounted, cash inflows and cash outflows, over the entire life of the machine.

Solution #1

	<u>Years</u>	<u>Cash Flows</u>	<u>PV Factor</u>	<u>Present Value</u>
Purchase of machine	Now	(\$25,000)	1.000	(\$25,000)
Annual cost savings	1 – 10	4,000	5.216	20,864
Net Present Value				<u>(\$4,136)</u>
Total annual cost savings				\$40,000
Present value of annual cost savings				<u>20,864</u>
Excess of cash flow over present value				<u>\$19,136</u>

Example #2

Miami Company has \$15,000 to invest. Management is trying to decide between two alternative uses for the funds as follows. The company's discount rate is 16%.

	<u>Project A</u>	<u>Project B</u>
Investment required	\$15,000	\$15,000
Single cash inflow at the end of 10 years	\$0	\$60,000
Annual cash inflows	\$4,000	\$0
Life of the project	10 years	10 years

Required: Which alternative would the company choose?

Solution #2

	Years	Amount	PV Factor	Present Value
<u>Project A</u>				
Cost of equipment	Now	(\$15,000)	1.000	(\$15,000)
Annual cash inflows	1 – 10	4,000	4.833	19,332
Salvage value	10	0	.227	0
Net present value				<u>\$4,332</u>
<u>Project B</u>				
Cost of equipment	Now	(\$15,000)	1.000	(\$15,000)
Annual cash inflows	1 – 10	0	4.833	0
Working capital released	10	60,000	.227	13,620
Net present value				<u>(\$1,380)</u>

Project A should be selected. Project B does not provide the required 16% return, as shown by its negative net present value.

Example #3

Information on four investment proposals at Tampa Corp. is given below:

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Investment required	\$85,000	\$200,000	\$90,000	\$170,000
Present value of cash flows	<u>119,000</u>	<u>250,000</u>	<u>135,000</u>	<u>221,000</u>
Net present value	34,000	50,000	45,000	51,000
Life of the project	5 years	7 years	6 years	6 years

Required: Compute the project profitability index for each proposal and rank the proposals in terms of preference.

Solution #3

	<u>A</u>	<u>B</u>	<u>C</u>	<u>D</u>
Net present value	\$34,000	\$50,000	\$45,000	\$51,000
Investment required	\$85,000	\$200,000	\$90,000	\$170,000
Project profitability index	.40	.25	.50	.30
Ranking	2	4	1	3

Note that proposal D has the highest net present value, but it ranks third in terms of the project profitability index.

Payback Method:

- Ignores the time value of money.
- Calculates the time period to recover the initial net investment through future cash flows.
- The method for determining the payback period differs whether the future cash flows are even (the same each period) or uneven (differ in one or more future periods.)

Example #4

Tallahassee Company is considering an investment in a high-quality blueprint printer with the following cash flows:

<u>Year</u>	<u>Investment</u>	<u>Cash Inflow</u>
1	(\$38,000)	\$2,000
2	(6,000)	4,000
3		8,000
4		9,000
5		12,000
6		10,000
7		8,000
8		6,000
9		5,000

Required:

- Determine the payback period of the investment.
- Would the payback period be affected if the cash inflow in year 8 was \$18,000?

Solution #4

1. The payback period is determined as follows:

<u>Year</u>	<u>Investment</u>	<u>Cash Inflow</u>	<u>Unrecovered Investment</u>
1	(\$38,000)	\$2,000	\$36,000
2	(6,000)	4,000	38,000
3		8,000	30,000
4		9,000	21,000
5		12,000	9,000
6		10,000	0
7		8,000	
8		6,000	
9		5,000	

The investment in the project is fully recovered in the 6th year; the payback period is approximately 6.9 years.

2. Since the investment is recovered prior to the last year, the amount of the cash inflow in years 7 through 9 have no effect on the payback method.

Simple (Accounting) Rate of Return:

- Ignores the time value of money.
- Computed using operating income (accounting income) rather than cash flow divided by the net initial investment.

Example #5

The Marcus Corporation purchased a piece of new equipment in January 2009 for \$120,000. The equipment was depreciated using the straight line method over an 8 year life without a salvage value. In December 2009, Marcus reported 2009 cash inflow from the new equipment of \$51,000.

Required: Compute the simple rate of return for 2009.

Solution #5

$$\frac{\text{Operating income}}{\text{Net investment}} = \frac{\$51,000 - \underline{\$120,000}}{8 \text{ years}} = \frac{\$36,000}{\$120,000} = 30\%$$

Practice Problems

Practice Problem #1

On January 2, 2009, Mr. Orchard paid \$18,000 for 900 shares of common stock in Phoenix Company. Mr. Orchard received an \$.80 per share dividend on the stock at the end of each year for 4 years. At the end of 4 years he sold the stock for \$22,500. Mr. Orchard has a goal of earning a minimum return of 12% on all of his investments.

Required: Did Mr. Orchard earn a 12% return on the stock? Use the present value method to determine the answer.

Practice Problem #2

Service Corporation is investigating four different opportunities. Information on the four projects under study is as follows:

	Project 1	Project 2	Project 3	Project 4
Investment required	\$480,000	\$360,000	\$270,000	\$450,000
Present value of cash inflows	567,270	433,400	336,140	522,970
Net present value	\$87,270	\$73,400	\$66,140	\$72,970
Life of project	6 years	12 years	6 years	3 years

The company's required rate of return is 10%; therefore a 10% discount rate has been used in the present value computations above. Limited funds are available for investment, so the company cannot accept all of the available projects.

Required:

- a) Compute the project profitability index for each investment project.
- b) Rank the four projects according to preference, in terms of:
 - Net present value
 - Project profitability index

Practice Problem #3

SLM Corporation is considering the purchase of a new piece of equipment for laying sod. Relevant information concerning the equipment follows:

Cost of the equipment	\$180,000
Annual cost savings from new equipment	\$37,500
Life of the new equipment	12 years

Required:

1. Compute the payback period for the equipment. If the company requires a payback period of four years or less, would the equipment be purchased?
2. Compute the simple rate of return on the equipment. Use straight-line depreciation based on the equipment's useful life. Would the equipment be purchased if the company's required rate of return is 14%?

Practice Problem #4

Kerr Jewelers has \$300,000 to invest. The company is trying to decide between two alternative uses of the funds:

	Project A	Project B
Cost of equipment required	\$300,000	\$0
Working capital investment required	\$0	\$300,000
Annual cash inflows	\$80,000	\$60,000
Salvage value of equipment in 7 years	\$20,000	\$0
Life of the project	7 years	7 years

The working capital needed for Project B will be released for investment elsewhere at the end of 7 years. Kerr Jewelers uses a 20% discount rate.

Required: Determine which investment alternative (if either) would be best using the net present value method. Prepare separate computations for each project.

Sample True / False Questions

1. Capital budgeting decisions usually involve large investments and often have a significant impact on a company's future profitability.
True False
2. For purposes of capital budgeting, estimated cash inflows and outflows are preferred for inputs into the capital budgeting decision tools.
True False
3. The payback technique is a quick way to calculate a project's net present value.
True False
4. The cash payback period is computed by dividing the cost of the capital investment by the annual cash inflow.
True False
5. The cash payback method is frequently used as a screening tool but it does *not* take into consideration the profitability of a project.
True False
6. Using the net present value method, a net present value of zero indicates that the project would not be acceptable.
True False
7. The net present value method can only be used in capital budgeting if the expected cash flows from a project are an equal amount each year.
True False
8. The profitability index is calculated by dividing the total cash flows by the initial net investment.
True False
9. The profitability index allows comparison of the relative desirability of projects that require differing initial investments.
True False
10. A post-audit is an evaluation of how well a project's actual performance matches the projections made when the project was proposed.
True False

11. The interest yield of a project is a rate that will cause the present value of the proposed capital expenditure to equal the present value of the expected annual cash inflows.
True False
12. Capital budgeting decisions usually involve large investments and often have a significant impact on a company's future profitability.
True False
13. For purposes of capital budgeting, estimated cash inflows and outflows are preferred for inputs into the capital budgeting decision tools.
True False
14. The payback technique is a quick way to calculate a project's net present value.
True False
15. The cash payback period is computed by dividing the cost of the capital investment by the annual cash inflow.
True False
16. The cash payback method is frequently used as a screening tool but it does *not* take into consideration the profitability of a project.
True False

Sample Multiple Choice Questions

1. The capital budget for the year is approved by a company's
 - a) board of directors.
 - b) capital budgeting committee.
 - c) officers.
 - d) stockholders.

2. The capital budgeting decision depends in part on the
 - a) availability of funds.
 - b) relationships among proposed projects.
 - c) risk associated with a particular project.
 - d) all of these.

3. Capital budgeting is the process
 - a) used in sell or process further decisions.
 - b) of determining how much capital stock to issue.
 - c) of making capital expenditure decisions.
 - d) of eliminating unprofitable product lines.

4. Which of the following is *not* a typical cash flow related to equipment purchase and replacement decisions?
 - a) Increased operating costs
 - b) Overhaul of equipment
 - c) Salvage value of equipment when project is complete
 - d) Depreciation expense

5. Which of the following ignores the time value of money?
 1. Internal rate of return
 2. Profitability index
 3. Net present value
 4. Cash payback

6. If project A has a lower payback period than project B, this may indicate that project A may have a
 - a) lower NPV and be less profitable.
 - b) higher NPV and be less profitable.
 - c) higher NPV and be more profitable.
 - d) lower NPV and be more profitable.

7. Brady Corp. is considering the purchase of a piece of equipment that costs \$23,000. Projected net annual cash flows over the project's life are:

<u>Year</u>	<u>Net Annual Cash Flow</u>
1	\$3,000
2	8,000
3	15,000
4	9,000

The cash payback period is:

- a) 2.63 years.
 - b) 2.80 years.
 - c) 2.37 years.
 - d) 2.20 years.
8. If an asset costs \$210,000 and is expected to have a \$30,000 salvage value at the end of its ten-year life, and generates annual net cash inflows of \$30,000 each year, the cash payback period is
- a) 8 years.
 - b) 7 years.
 - c) 6 years.
 - d) 5 years.
9. A disadvantage of the cash payback technique is that it
- a) ignores obsolescence factors.
 - b) ignores the cost of an investment.
 - c) is complicated to use.
 - d) ignores the time value of money.
10. If a company's required rate of return is 10% and, in using the net present value method, a project's net present value is zero, this indicates that the
- a) project's rate of return exceeds 10%.
 - b) project's rate of return is less than the minimum rate required.
 - c) project earns a rate of return of 10%.
 - d) project earns a rate of return of 0%.
11. The primary capital budgeting method that uses discounted cash flow techniques is the
- a) net present value method.
 - b) cash payback technique.
 - c) annual rate of return method.
 - d) profitability index method.

12. When a capital budgeting project generates a positive net present value, this means that the project earns a return higher than the
- internal rate of return.
 - annual rate of return.
 - required rate of return.
 - profitability index
13. Sloan Inc. recently invested in a project with a 3-year life span. The net present value was \$3,000 and annual cash inflows were \$7,000 for year 1; \$8,000 for year 2; and \$9,000 for year 3. The initial investment for the project, assuming a 15% required rate of return, was

<u>Year</u>	<u>Present Value</u>	<u>Present Value of an Annuity</u>
1	.870	.870
2	.756	1.626
3	.658	2.283

- \$15,264.
 - \$15,060.
 - \$9,744.
 - \$12,792.
14. Intangible benefits in capital budgeting would include all of the following *except* increased
- product quality.
 - employee loyalty.
 - salvage value.
 - product safety.

15. Johnson Corp. has an 8% required rate of return. It's considering a project that would provide annual cost savings of \$20,000 for 5 years. The most that Johnson would be willing to spend on this project is

<u>Year</u>	<u>Present Value</u>	<u>Present Value of an Annuity</u>
1	.926	.926
2	.857	1.783
3	.794	2.577
4	.736	3.312
5	.681	3.993

- a) \$50,364.
 b) \$66,240.
 c) \$79,860.
 d) \$13,620.
16. The profitability index is computed by dividing the
- total cash flows by the initial investment.
 - present value of cash flows by the initial investment.
 - initial investment by the total cash flows.
 - initial investment by the present value of cash flows.
17. The capital budgeting method that takes into account both the size of the original investment and the discounted cash flows is the
- cash payback method.
 - internal rate of return method.
 - net present value method.
 - profitability index.

Solutions to Practice Problems

Practice Problem #1

	<u>Years</u>	<u>Cash Flows</u>	<u>PV Factor</u>	<u>Present Value</u>
Purchase of stock	Now		1.000	(\$18,000)
		(\$18,000)		
Annual dividends	1 – 4	720	3.037	2,187
Sale of stock	4	22,500	.636	14,310
Net Present Value				<u>(\$1,503)</u>

*900 shares X \$.80 per share per year = \$720 per year.

Mr. Orchard did not earn a 12% return on the stock. The negative net present value indicates that the rate of return on the investment is less than the minimum required rate of 12%.

Practice Problem #2

1.

	<u>Net Present Value</u>	<u>Net Investment</u>	<u>Project Profitability Index</u>
Project 1	\$87,270	\$480,000	.18
Project 2	\$73,400	\$360,000	.20
Project 3	\$66,140	\$270,000	.24
Project 4	\$72,970	\$450,000	.16

2.

	<u>Net Present Value</u>	<u>Project Profitability Index</u>
1 st Preference	Project 1	Project 3
2 nd Preference	Project 2	Project 2
3 rd Preference	Project 3	Project 1
4 th Preference	Project 4	Project 4

Project Profitability Index method is preferred because it properly considers the amount of investment. For example, the PPI method ranks project #3 first as it is has the highest cash inflow generated for each dollar of investment fourth yet the NPV method ranks this project last because of it low net present value.

Practice Problem #3

1.

$$\frac{\text{Net investment required}}{\text{Annual cash flow}} = \frac{\$180,000}{\$37,500} = 4.8 \text{ years}$$

The equipment would not be purchased, since the 4.8 year payback period exceeds the company's maximum 4 year payback period.

2.

Annual cash flow		\$37,500	
Less: depreciation expense (\$180,000/12 yrs)		<u>15,000</u>	
Annual incremental operating income		<u>\$22,500</u>	
Annual incremental operating income	=	<u>\$22,500</u>	= 12.5%
Net investment required		\$180,000	

The equipment would not be purchased since its 12.5% rate of return is less than the company's 14% required rate of return.

Practice Problem #4

Item	Years	Amount	PV Factor	Present Value
Project A				
Cost of equipment	Now	(\$300,000)	1.000	(\$300,000)
Annual cash inflows	1 – 7	80,000	3.605	288,400
Salvage value	7	20,000	.279	<u>5,580</u>
Net present value				<u>(\$6,020)</u>
Project B				
Working capital investment	Now	(\$300,000)	1.000	(\$300,000)
Annual cash inflows	1 – 7	80,000	3.605	216,300
Working capital released	7	20,000	.279	<u>83,700</u>
Net present value				<u><u>\$0</u></u>

The \$300,000 should be invested in Project B rather than in Project A. Project B has a zero net present value, which means that it promises exactly a 20% rate of return. Project A is not acceptable at all, since it has a negative net present value.

Solutions to True / False Problems

1. True
2. True
3. False - The payback method and the net present value method are two alternative methods for evaluating capital investments
4. True
5. True
6. False - Unacceptable projects have a negative net present value.
7. False - The net present value method can accommodate both even and uneven cash flows.
8. False - The profitability index is calculated as net present value divided by net initial investment.
9. True
10. True
11. True

Solutions to Multiple Choice Questions

1. A
2. D
3. C
4. D
5. D
6. C
7. B
8. B
9. D
10. C
11. A
12. C
13. B
14. C
15. C
16. B
17. D
- 18.
- 19.
- 20.

AUDITNCA.COM