Learning Module 5: Capital Investments and Capital Allocation

LOS 5a: describe types of capital investments

Capital investments (or capital projects) are investments with a life of one or more years. They are presented on the balance sheet as long-term assets.

There are four main types of capital investments:

1. Going concern (or maintenance) projects.
2. Regulatory or compliance projects.
3. Expansion projects.
4. New lines of business and other projects.

While growth projects and other projects are initiated to develop a firm strategically, going concern (or maintenance) projects and regulatory or compliance projects ensure business continuation.

Going Concern Projects

These are projects required to sustain current operations, keep a firm at its current size, or boost business efficiency. Infrastructure improvement is an example of a going concern project. Firm management quickly assesses going concern projects since the expenses they attract are mostly lower than the production or business interruption costs that may arise from failure to invest.

Managers frequently attempt to align financing to an asset's lifespan to pay for these projects (match funding). For instance, to finance equipment replacement with a 20-year projected useful life, a business may issue a 20-year bond.

Corporations do not disclose capital expenditure costs related to going concern projects in financial statements. Analysts often use the depreciation and amortization expense shown on the income statement as a proxy for going concern capital expenditure.

Regulatory or Compliance Projects

These projects are usually undertaken due to a requirement by a governmental agency, insurance company, or some other external party. They often do not generate revenue for a company. Instead, however, they generate regulatory or compliance expenditures. This can be an obstacle to entry into a market, which could benefit incumbents. Nevertheless, in some instances, it may be more prudent to shut down part of the business related to the project, e.g., factory pollution control installation.

Expansion Projects

Projects that increase a firm's size come with higher risk and uncertainty than going-concern projects. An example would be a merger and acquisition. There are two significant risks with acquisitions: the difficulty in integrating the business operations of the acquirer and the target. In addition, there is the risk of overpaying.

Companies with a track record of successful expansions are more likely to use debt to finance their expansion projects. Capital investment is necessary when an established company expands its size by introducing a new product line, service, etc.. The business scope expansion often takes advantage of the existing ability to take care of the needs of different customers.

When gauging the probability of success, analysts and investors look at the past performance of peers executing the same strategy and the company's competitive position.

New Lines of Business and Other Projects

Projects beyond a company's traditional business areas include high-risk investments and new growth efforts, e.g., innovation projects. These initiatives are probably on the riskier end of the capital investment spectrum.

Question

Which of the following projects is *most likely* considered the riskiest?

A. Other projects.
B. Regulatory projects.
C. Going concern projects.

The correct answer is A.

Other projects are considered the riskiest. These projects are beyond a company's traditional business area and include high-risk investments and new growth efforts, e.g., exploration investments into innovations.

B is incorrect. Regulatory or compliance projects are undertaken due to a regulator or government agency requirement. They do not generate any revenue for a company. However, it incurs compliance expenditure.

C is incorrect. Going concern projects are required to sustain current operations. This involves keeping the firm at its current size or boosting efficiency. These projects are not risky since they are already in operation.

LOS 5b: describe the capital allocation process, calculate net present value (NPV), internal rate of return (IRR), and return on invested capital (ROIC), and contrast their use in capital allocation

Capital allocation describes the process companies use to make decisions on capital projects, i.e., projects with a lifespan of one year or more. It is a cost-benefit exercise that seeks to produce results and benefits greater than the costs of capital allocation efforts.

There are several steps involved in the capital allocation process. However, the specificity of the procedures a manager adopts depends on factors such as the manager's position in the company, the size and complexity of the project being evaluated, and the company's size.

Capital Allocation Process

The typical steps involved in the capital allocation process are:

1. **Idea generation:** Ideas can come from any source, but management must have a concrete grasp of the competitive environment in which the potential investment exists, along with the company's current operations, competencies, and competitive position.
2. **Investment analysis:** Information is gathered, which helps forecast cash flows for each project and evaluate a project's profitability.
3. **Planning and prioritization:** This involves looking at project timing, scheduling, prioritizing, and coordinating.
4. **Monitoring and post-investment review:** A project's performance is assessed, and actual results (revenues, expenses, cash flows, etc.) are compared with planned or projected results.

Methods of Evaluating Capital Investments

Several essential decision criteria are used to evaluate capital investments. The two most comprehensive and well-understood measures of whether or not a project is profitable are the net present value (NPV) and the internal rate of return (IRR).

Moreover, Analysts can utilize consolidated financial statements to compute and evaluate the return on invested capital (ROIC). ROIC serves as a valuable overall return metric instead of a project-specific return measure.

Net Present Value (NPV)

The net present value (NPV) of a project is the potential change in wealth resulting from the project after accounting for the time value of money. The NPV for a project with one investment outlay made at the start of the project is defined as the present value of the future after-tax cash flows minus the investment outlay.

$$NPV = CF_0 + \frac{CF_1}{(1+r)^1} + \frac{CF_2}{(1+r)^2} + \ldots + \frac{CF_T}{(1+r)^T}$$

$$NPV = \sum_{t=0}^{T} \frac{CF_t}{(1+r)^t}$$

Where:

CF_T = After-tax cash flow at time t

r = Required rate of return for the investment

CF_0 = Investment cash flow at time zero

Many projects have cash flow patterns in which outflows occur at the start of the project (at time = 0) and future dates. In these instances, a better formula to use is:

- to invest in the project if $NPV > 0$;
- not to invest in the project if $NPV < 0$; and
- stay indifferent if $NPV = 0$.

In other words, positive NPV investments increase wealth, while negative NPV investments decrease wealth.

Example: Net Present Value of a Project

Suppose Company A is considering an investment of $100 million in a capital expansion project that will return after-tax cash flows of $20 million per year for the first three years and another $33 million in year 4, the project's final year. If the required rate of return for the project is 8%, what would the NPV be, and should the company undertake this project?

$$\begin{aligned} \text{NPV} &= -100 + \frac{20}{1.08^1} + \frac{20}{1.08^2} + \frac{20}{1.08^3} + \frac{20}{1.08^4} \\ \text{NPV} &= -100 + 18.519 + 17.147 + 15.877 + 24.256 \\ &= -\$24.202 \text{ million} \end{aligned}$$

Since the $\text{NPV} < 0$, the project should not be undertaken.

Internal Rate of Return

The internal rate of return (IRR) is the discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. For a project with one initial outlay, the IRR is the discount rate that makes the present value of the future after-tax cash flows equal to the investment outlay.

The IRR solves the equation:

$$\text{NPV} = \sum_{t=0}^{T} \frac{\text{CF}_t}{(1+\text{IRR})^t} - \text{Outlay} = 0$$

It looks very much like the NPV equation except that the discount rate is the IRR instead of r, the required rate of return. Discounted at the IRR, the NPV is equal to zero.

The decision rule for the IRR is:

- to invest in the project if the IRR exceeds the required rate of return for the project, i.e., invest if $\text{IRR} > \text{r}$; and
- not to invest if $\text{IRR} < \text{r}$.

In instances where the outlays for a project occur at times other than time 0, a more general form of the IRR equation is:

$$\sum_{t=0}^{T} \frac{CF_t}{(1+IRR)^t} = 0$$

Example: IRR of a project

Here is a follow-up on the above NPV example. If company A is considering an investment of $100 million in a capital expansion project that will return after-tax cash flows of $20 million per year for the first three years and another $33 million in year 4, the final year of the project, what is the IRR for this project and should it be undertaken given that the required rate of return for the project is 8%?

Solve IRR in the following equation:

$$-100 + \frac{20}{(1+IRR)^1} + \frac{20}{(1+IRR)^2} + \frac{20}{(1+IRR)^3} + \frac{33}{(1+IRR)^4} = 0$$

The solution can be arrived at through trial and error. However, a more straightforward approach is to use a financial calculator using the following steps:

Step 1: Entering the Initial Cash Outlay

Press the Cash Flow [CF] key to open the cash flow register. The calculator should read CF0=, which tells you to enter the cash flow for time 0. Since you need to send cash out of the company to make the initial $100 investment, this value has to be negative. Type in -100 for CF0, and hit the [ENTER] key.

Step 2: Entering the Cash Inflows

Next, enter the cash flow values for the subsequent periods. This is done by hitting the down arrow *once*. The calculator should read CF1=. Type in the first cash flow amount, 20, and hit [ENTER]. The calculator should now say C01=20.

To enter cash flow from Year 2, hit the down arrow *twice*. The calculator should read CF2=. If it says F1=, hit the down arrow one more time.

Type in the second year's cash flow, 20, and hit [Enter]. The calculator should read CF2=20. Hit the down arrow *twice* again and do the same thing for the third cash flow period, CF3.

Do this once more and enter the last cash flow for the last time, 33.

Step 3: Calculating the IRR

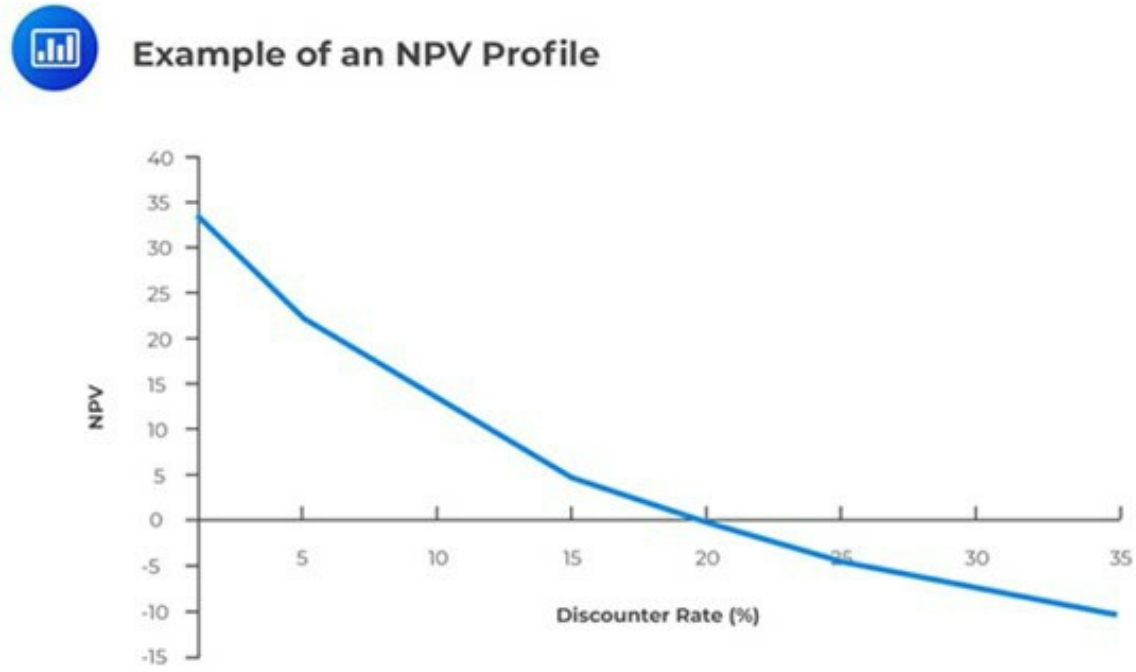
Once the cash flow values have been fed into the calculator, you can calculate the IRR.

To do this, press the [IRR] key. The screen will read IRR=0.000. To display the IRR value for the data set, press the [CPT] key at the top left corner of the calculator. If you have followed this process correctly, the calculator will display the correct IRR. The IRR is computed to be -2.626%. Since $-2.626\% < 8\%$, the project should not be undertaken.

Simply computing a project's NPV and IRR to determine which of several projects to undertake is not always as straightforward as it seems. The IRR and NPV can produce different ranking outcomes whenever mutually exclusive projects are involved. Other challenges may occur.

Graphical Illustration

The NPV Profile illustrates a project's NPV graphed as a function of various discount rates. The NPV values are graphed on the vertical or y-axis, while the discount rates are graphed on the horizontal or x-axis.



- The graph crosses the y-axis (vertical axis) when the discount rate = 0%; and
- The graph crosses the x-axis (horizontal axis) when the NPV = 0 and the discount rate is the IRR.

NPV and IRR Comparison

For independent, conventional projects, the NPV and IRR decision rules will draw the same conclusion on whether to invest. However, in the case of two mutually exclusive projects, sometimes the decision rules will draw different conclusions. For example, project X might have a more significant NPV than Project Y, but Project Y might have a larger IRR. This conflict usually stems from differences in the cash flows of the two projects, which leads to a different ranking between the NPV and IRR. Whenever this conflict arises, the NPV, not the IRR, should be used to select which project to invest in.

Another circumstance that may cause mutually exclusive projects to be ranked differently according to NPV and IRR criteria is the scale or size of the project.

Multiple IRR and No IRR Problem

Although rare, a project can have more than one IRR or no IRR at all. Multiple IRRs, however, cannot occur for conventional projects with outlay followed by cash inflows. Still, they may occur for non-conventional projects with cash flows that change signs (negative, positive) more than once during the project's life.

The net present value (NPV) and the internal rate of return (IRR) are both techniques that can be used by financial institutions or individuals when making major investment decisions. Each method has its strengths and weaknesses. However, the net present value method comes out on top, and here's why. NPV and IRR yield the same investment decisions when dealing with independent projects. By independent, we mean that deciding to invest in one project does not rule out or affect investment in the other project.

However, the challenge comes when the projects are mutually exclusive. If two or more projects are mutually exclusive, the decision to invest in one project precludes investment in all the others. With such projects, the IRR method may provide misleading results if used in isolation.

Shortcomings of IRR

As seen, there are some problems associated with the IRR method:

- The method assumes that all proceeds from a project are immediately reinvested in projects offering a rate of return equal to the IRR – this is very difficult in practice.
- It gives different rankings when the projects under comparison have different scales.
- Sometimes, the method may not provide a unique solution, especially when a project has a mixture of positive and negative cash flows during its productive life.

Return on Invested Capital

Return on capital invested (ROIC), also known as return on capital employed (ROCE), is a measure of profitability for total capital invested by management.

The formula is as follows.

$$\begin{aligned}\text{ROIC} &= \frac{\text{After-tax operating profit}_t}{\text{Average invested capital}} \\ &= \frac{(1 - \text{Tax rate}) \times \text{Operating profit}_t}{\text{Average total Long Term liabilities and equity}_{t-1,l}}\end{aligned}$$

Working capital is not included in the total capital investment. Invested capital includes long-term liabilities and equity.

Benefits of ROIC

- It can be calculated by independent investment analysts because the data is readily available, unlike IRR and NPV.
- ROIC considers the amount of capital the company needs to generate returns, unlike other profitability measures such as operating profit margin.

The link between ROIC is as follows:

$$\begin{aligned}\text{ROIC} &= \frac{\text{After-tax operating profit}_t}{\text{Average invested capital}} \\ &= \frac{\text{After-tax operating profit}_t}{\text{Sales}} \times \frac{\text{Sales}}{\text{Average invested capital}} \\ &= \text{After-tax operating margin} \times \text{Capital turnover}\end{aligned}$$

Therefore, two factors that influence ROIC are profit margin and turnover. This implies that a company with a high margin can have a low ROIC if the turnover is low and vice versa.

Example: Calculating ROIC

Consider the following excerpt of the balance sheet information of a company:

Liabilities and Equity	20X1	20X2
Accounts payable	37,500	52,800
Short-term debt	22,000	6,500
Long-term debt	113,000	107,500
Share capital	16,000	16,000
Retained earnings	150,000	162,500
Total liabilities and equity	338,500	345,300

If the company reported an operating profit in year 20X2 of 30,500, the ROIC for the year 20X2 if the tax rate is 30% is closest to:

$$\begin{aligned}\text{ROIC} &= \frac{\text{After-tax operating profit}_t}{\text{Average invested capital}} \\ &= \frac{(1-\text{Tax rate}) \times \text{Operating profit}_t}{\text{Average total Long Term liabilities and equity}_{t-1,l}} \\ &= \frac{(1-0.3) \times 30,500}{\frac{(113,000+16,000+150,000)+(107,000+16,000+162,000)}{2}} = 0.07570 \approx 7.60\%\end{aligned}$$

Comparison between ROIC, IRR, and NPV

- Unlike IRR and NPV, ROIC allows analysts to measure the firm's ability to create value across all investments, not just individual projects. This is important because only the company can invest in individual project and not the investors.
- ROIC can be compared to the required rate of return of the investors. If the ROIC of a corporate issuer is higher than the required rate of return, then the issuer is creating value for investors. On the other hand, if the investors' required rate of return is less than an issuer's ROIC over time, then it suggests that investors might have benefited more from investing in other opportunities.In such cases, the issuer should consider enhancing turnover or profit margins, divesting from underachieving sectors, redistributing capital, or exploring other investment opportunities with higher yields.
- ROIC can be compared to the required rate of return for both equity and debt investors because it measures the return that an issuer will earn by investing in both equity and debt.

Limitations of ROIC

- Unlike IRR and NPV, ROIC is an accounting measure and not a cash-based measure. Thus, cash flows and operating profit can be materially different because of differences between capital expenditures and depreciation and the recognition rules of certain items.

- ROIC is backward-looking and can vary from year to year, depending on investment activity and business conditions.
- Due to its high aggregation, ROIC can obscure unprofitable or profitable areas of the issuer.

Question 1

You have been provided with the following cash flows for a capital project:

Year	0	1	2	3	4	5
Cash flow ($)	−50,000	10,000	10,000	15,000	15,000	15,000

Given a required rate of return of 8 percent, the NPV and IRR of the project are *closest* to:

A. NPV: $1,023; IRR: 10.64%.

B. NPV: $974; IRR: 8.68%.

C. NPV: $2,400; IRR: 7.12%.

Solution

The correct answer is B.

$$\text{NPV} = -50,000 + \frac{10,000}{1.08^1} + \frac{10,000}{1.08^2} + \frac{15,000}{1.08^3} + \frac{15,000}{1.08^4} + \frac{15,000}{1.08^5}$$

$$\text{NPV} = -50,000 + 9259.26 + 8573.39 + 11,907.48 + +11,025.45 + 10,208.75$$

$$= \$974.33 \text{ million}$$

Question 2

In an NPV profile, the point at which the profile crosses the x-axis is best described as:

A. The project's IRR.

B. The point at which the NPV is highest.

C. The point at which the discount rate = 0% and the NPV is the sum of the undiscounted cash flows for the project.

Solution

The correct answer is A.

At the horizontal axis, the NPV = 0, and by definition, this occurs whenever the discount rate is the IRR.

Question 3

Suppose you have three independent projects – X, Y, and Z. Assume the hurdle rate is 12% for all three projects. Their NPVs and IRRs are shown below.

	Project X	Project Y	Project Z
NPV	$\$20,000$	$\$21,400$	$\$23,000$
IRR	20%	32%	18%

Assuming the projects are mutually exclusive, which of the following is the *most* economically feasible project?

A. Z

B. X

C. Y

Solution

The correct answer is A.

	Project X	Project Y	Project Z
NPV	$\$20,000$	$\$21,400$	$\$23,000$
IRR	20%	32%	18%
Decision	Accept	Accept	Accept

If the IRR criteria is used, all three projects would be accepted because they would all increase shareholders' wealth. Their NPVs are all positive, and the three are all acceptable.

However, only one would be chosen if the projects are mutually exclusive. If one were to pick one project based on internal rates of return of the projects, one would go for

Y. This is because its IRR is the highest compared to the other projects.

This decision would be wrong when we consider the sizes of the NPVs of the projects. While Y has the highest IRR, its NPV is lower than Z's. The best decision would be to go for the project with the highest NPV, and that is project Z. Therefore, if projects are mutually exclusive, the NPV method should be applied.

LOS 5c: describe principles of capital allocation and common capital allocation pitfalls

Capital Allocation Principles

Although the known analytical tools and investment decision criteria are quantitative and clear-cut, there is significant room for errors and misjudgments. To enhance the decision-making process, it is essential to adhere to certain fundamental capital allocation principles when employing these tools. They include:

- **Focus on additional cash flows with a broad perspective**: It's essential to consider only the extra cash flows generated by an investment while also taking into account their wider impact on the company. This means excluding any expenses that have already been incurred, known as sunk costs, but including both positive and negative effects on other parts of the business.
- **Importance of cash flow timing:** The timing, duration, variability, and potential changes in the direction of expected cash flows are critical factors to consider. These aspects can significantly influence the net present value (NPV) and internal rate of return (IRR) of a capital investment.
- **Consideration of after-tax cash flows:** When making capital allocation decisions, it's important to analyze cash flows on an after-tax basis. This approach ensures that the tax implications, including benefits from non-cash deductions like depreciation, are properly accounted for in the analysis.

Capital Allocation Pitfalls

Some of the common capital allocation pitfalls or mistakes are:

Cognitive errors in capital allocation

1. **Internal Forecasting Errors:** Companies may make internal forecasting errors that are

hard, if not impossible, for external analysts to spot. Consequently, this might lead to unsuccessful investment results. A common one is using a company's overall cost of capital rather than an investment's required rate of return.

2. **Ignoring costs of internal financing:** Cash flows from operations are the primary financing source for investments by large corporate issuers. Management treats internally generated funds as scarce but accessible, and the funds are allocated according to the budget. External financing is only used to fund large transactions such as acquisitions. The management's viewpoint is flawed because internally generated capital is equity financing since it would be returned to equity investors as dividends. While a share issue does not raise it, the funds are withheld from equity investors, incurring their opportunity costs.
3. **Inconsistent treatment of or ignoring inflation:** In several ways, capital allocation is affected by inflation. It should be stated if investment analysis uses real or nominal terms. Companies are at liberty to perform analysis in real or nominal terms, but they should use a consistent approach for cash flows, and discount rates should be used.

Behavioral biases in capital allocation

1. **Inertia:** By comparing the current capital investment to the amount from the previous year and the return on investment, analysts can determine the presence of inertia. An analyst should evaluate an issuer’s justification for its capital investment. Further, they should consider if the management should contemplate alternate uses if capital spending each year is either stagnant or rising despite declining returns on investment.
2. **Basing Investment Decisions on EPS, Net Income, or ROE:** Even for those with a high NPV, many investments do not increase earnings per share (EPS), net income, or return on equity (ROE) in the short run. Since managers often have short-term incentives, they may choose projects not aligning with the company's long-term interests.
3. **Pushing Pet Projects:** These are projects that influential managers want the company to invest in even though they may not be profitable. Often, managers exaggerate these projects' profitability to ensure they are selected.
4. **Failing to Consider Investment Alternatives or Alternative States:** The most basic

phase in the capital allocation process is the generation of solid investment ideas. In some organizations, however, many good alternatives are never even explored. Furthermore, many businesses overlook real-world conditions, which should be considered through breakeven, scenario, and simulation analyses.

Question

Which of the following statements is *most likely* accurate?

A. In capital allocation, only pre-tax cash flows should be considered.
B. The timing of cash flows is crucial to the capital allocation process.
C. A non-conventional cash flow pattern has an initial cash outflow followed by a series of cash inflows.

The correct answer is B.

Capital allocation analysts make an extraordinary effort to detail precisely when cash flows occur.

A is incorrect. Cash flows are analyzed after tax; taxes must be fully reflected in capital allocation decisions.

C is incorrect. A conventional cash flow pattern (not a non-conventional cash flow pattern) has an initial cash outflow followed by a series of cash inflows.

LOS 5d: describe types of real options relevant to capital investments;

Options are financial derivatives that give buyers the right, but not the obligation, to buy or sell an underlying asset at an agreed-upon price and date. In the same vein, real options are capital allocation options that allow managers the right, but not the obligation, to undertake specific business initiatives in the future. Such initiatives may include deferment, abandonment, or project expansion. Fundamentally, these initiatives can impact the value of capital investments.

The following are types of real options:

- **Timing options:** A company delays investing now with the hopes that improved information in the future could help improve the NPV of a project.
- **Sizing options:** An abandonment option allows a company to abandon a project with discouraging results. This option can be exercised when the cash flow of abandoning a project exceeds the present value of continuing the project. On the other hand, a growth option allows a company to make additional investments based on the prospects of future solid financial results.
- **Flexibility options:** The price-setting option permits a company to increase its prices. A company can take advantage of excess demand, which it cannot meet by increasing its production due to low capacity. The company can also use production-flexibility options to profit from additional shifts and overtime to meet the additional demand.
- **Fundamental options:** Payoffs from a project, such as mining minerals, increase or decrease the value of an investment depending on whether they will find the mineral. Many research and development projects are examples of fundamental options.

There are three common approaches to evaluating capital projects with real options:

1. Investment analysis without considering options. If the NPV is positive without considering real options, a firm goes ahead with an investment.
2. Calculation of NPV with the real options and adding the real options value using the formula:

$$\text{Project's NPV} = \text{NPV (without options)} - \text{Option cost} + \text{Option value}$$

3. Decision trees and option pricing models. Depending on the nature of the investment, firms may use either approach when determining the value of a capital investment that involves future sequential decisions and alternative outcomes. Calculating the project's NPV often involves assigning a probability and an expected timing to future outcomes.

Example: Project NPV with a Real Option

McGill Automotive estimates the NPV of a new assembly plant to be -$600,000. The firm is evaluating an additional investment of $700,000 (present value). This firm will enable the management to pay overtime wages to workers in the new assembly plant if the new product crosses over to global markets. The option has an estimated present value of $2 million.

What is the value of the new assembly plant, including the real option?

Solution

$$\begin{aligned}\text{Project's NPV} &= \text{NPV (based on discount cash flows alone)} - \text{Cost of options} \\ &\quad + \text{value of options} \\ &= -600,000 - 700,000 + 2,000,000 \\ &= \$700,000\end{aligned}$$

The project has a positive NPV after considering the costs and benefits of the real options. The company should invest in the project.

Question

Gatsby Solutions is considering a capital project with the following information:

- The initial outlay is $190,000.
- The annual after-tax operating cash flows have a 40% probability of being $20,000 for five years and a 60% probability of $70,000 for the same five years.
- The project's life is five years.
- The salvage value at the project end is 0.
- The required rate of return (RRR) is 12%.
- In one year, the company has an abandonment option out of which Gatsby Solutions would receive the salvage value of $100,000.

The NPV of the project, assuming the optimal abandonment strategy, is *closest to*:

A. -$9,761.
B. $4,257.
C. $62,334.

The correct answer is B.

If higher cash flows occur and Gatsby does not abandon the project, the NPV is:

$$\text{NPV} = -190,000 + \sum_{t=1}^{5} \frac{70,000}{(1.12)^5} = \$62,334$$

If Gatsby abandons the project when lower cash flows occur, it receives the first-year cash flow and the abandonment value:

$$\text{NPV} = -190,000 + \frac{20,000 + 100,000}{1.12} = \$82,857$$

The expected NPV is:

$$\text{NPV} = 0.4\,(-82,857) + (0.6)\,(62,334) = \$4,257$$