Economic Feasibility Studies

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by

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Acknowledgment

On behalf of Pathways to Higher Education Management Team in Egypt, the Project Coordinator wishes to extend his thanks and appreciation to the Ford Foundation (FF) for its full support to reform higher education, postgraduate studies and research activities in Egypt. The Management Team extend their special thanks and appreciation to Dr. Bassma Kodmani, Senior Project Officer at the Ford Foundation office in Cairo, who helped initiate this endeavor, and who spared no effort to support the Egyptian overall reform activities, particularly research and quality assurance of the higher education system. Her efforts were culminated by the endorsement to fund our proposal to establish the Egyptian Pathways to Higher Education project by the Ford Foundation Headquarters in New York.

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The contribution of our partner, The National Council for Women (NCW), is appreciated. It is worth mentioning that the percentage of females graduated from Pathways programs has exceeded 50%, which is in line with FF and NCW general objectives. The second phase of the project will witness a much more forceful contribution from the NCW, particularly when implementing the program on the governorates level as proposed by CAPSCU in a second phase of the program.

We also appreciate the efforts and collaborative attitude of all colleagues from Cairo University, particularly the Faculties of Commerce, Art, Mass Communication, Law, Economics and Political Sciences, and Engineering who contributed to the success of this project.

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CU	**Cairo University**	**NCW National Council for Women**
FF	**Ford Foundation**	**FGF Future Generation Foundation**
CAPSCU	**Center for Advancement of Postgraduate Studies and Research in Engineering Sciences, Faculty of Engineering - Cairo University**	

Publisher Introduction

The Faculty of Engineering, Cairo University is a pioneer in the field of learning and continual education and training. The Center for Advancement of Postgraduate Studies and Research in Engineering Sciences, Faculty of Engineering - Cairo University (CAPSCU) is one of the pillars of the scientific research centers in the Faculty of Engineering. CAPSCU was established in 1974 in cooperation with UNIDO and UNESCO organizations of the United Nations. Since 1984, CAPSCU has been operating as a self-financed independent business unit within the overall goals of Cairo University strategy to render its services toward development of society and environment.

CAPSCU provides consultation services for public and private sectors and governmental organizations. The center offers consultation on contractual basis in all engineering disciplines. The expertise of the Faculty professors who represent the pool of consultants to CAPSCU, is supported by the laboratories, computational facilities, library and internet services to assist in conducting technical studies, research and development work, industrial research, continuous education, on-the-job training, feasibility studies, assessment of technical and financial projects, etc.

Pathways to Higher Education (PHE) Project is an international grant that was contracted between Cairo University and Ford Foundation (FF). During ten years, FF plans to invest 280 million dollars to develop human resources in a number of developing countries across the world. In Egypt, the project aims at enhancing university graduates' skills. PHE project is managed by CAPSCU according to the agreement signed in September 22nd, 2002 between Cairo University and Ford Foundation, grant No. 1020 - 1920.

The partners of the project are Future Generation Foundation (FGF), National Council for Women (NCW) and Faculties of Humanities and Social Sciences at Cairo University. A steering committee that includes representatives of these organizations has been formed. Its main tasks are to steer the project, develop project policies and supervise the implementation process.

Following the steps of CAPSCU to spread science and knowledge in order to participate in society development, this training material is published to enrich the Egyptian libraries. The material composes of 20 subjects especially prepared and developed for PHE programs.

Dr. Mohammad M. Megahed
CAPSCU Director
April 2005

Foreword by the Project Management

Pathways to Higher Education, Egypt (PHE) aims at training fresh university graduates in order to enhance their research skills to upgrade their chances in winning national and international postgraduate scholarships as well as obtaining better job.

Pathways steering committee defined the basic skills needed to bridge the gap between capabilities of fresh university graduates and requirements of society and scientific research. These skills are: mental, communication, personal and social, and managerial and team work, in addition to complementary knowledge. Consequently, specialized professors were assigned to prepare and deliver training material aiming at developing the previous skills through three main training programs:
  1. Enhancement of Research Skills
  2. Training of Trainers
  3. Development of Leadership Skills

The activities and training programs offered by the project are numerous. These activities include:
  1. Developing training courses to improve graduates' skills
  2. Holding general lectures for PHE trainees and the stakeholders
  3. Conducting graduation projects towards the training programs

Believing in the importance of spreading science and knowledge, Pathways management team would like to introduce this edition of the training material. The material is thoroughly developed to meet the needs of trainees. There have been previous versions for these course materials; each version was evaluated by trainees, trainers and Project team. The development process of both style and content of the material is continuing while more courses are being prepared.

To further enhance the achievement of the project goals, it is planned to dedicate complete copies of PHE scientific publications to all the libraries of the Egyptian universities and project partners in order to participate in institutional capacity building. Moreover, the training materials will be available online on the PHE website, www.Pathways-Egypt.com.

In the coming phases, the partners and project management team plan to widen project scope to cover graduates of all Egyptian universities. It is also planned that underprivileged distinguished senior undergraduates will be included in the targeted trainees in order to enable their speedy participation in development of society.

Finally, we would like to thank the authors and colleagues who exerted enormous efforts and continuous work to publish this book. Special credit goes to Prof. Fouad Khalaf for playing a major role in the development phases and initiation of this project. We greatly appreciate the efforts of all members of the steering committee of the project.

Dr. Sayed Kaseb   **Dr. Mohsen Elmahdy Said**

Project Manager   **Project Coordinator**

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Summary of the Training Material

Summary

This training material covers the feasibility study of new investment projects. The material illustrates the different types of feasibility studies with an emphasis on the economic appraisal of any new investment project. The material is divided into three main units, proceeding from the basic to the advanced. All units emphasize the firms' goal of wealth maximization, and deal with aspects of capital budgeting which help to achieve this goal. Each Unit is designed to include some training goals to be achieved by the end of the unit. In addition, each unit contains some real life examples. The material ends with a guideline for project analysis.

Chapter 1: Feasibility Studies: An Overview

Introduction

1.1   Introduction

Every long term decision the firm makes is a *capital budgeting decision* whenever it changes the company's cash flows. Consider launching a new product. This involves a phase where the new product is advertised and distributed. Hence, the firm will have cash outflows for paying advertising agencies, distributors, transportation services etc. Then, *for a long period of time,* the firm has cash inflows from the sale of the product in the future. Alternatively, consider the decision to make or buy a certain component the firm needs as an input it currently purchases from another company. Making the input requires payments for labor and materials, but saves payments to the supplier, and all these cash inflows and outflows are affected by that decision.

Many decisions affect the cash flows

Many other decisions affect the company's cash flows such as:
- **Choice of** distribution channel
- **Purchases** of buildings
- **Choice of** geographical location
- **Purchase of another** company or sale of a division
- **Leasing or buying a certain** piece of equipment
- **Reducing dividend payments** in order to pay down bank debt

The difficulty with making these decisions is that typically, many cash flows are affected, and they usually extend over a long period of time. *Investment appraisal* criteria help us in analyzing capital budgeting decisions by aggregating the multitude of cash flows into one number.

Investment projects start with the identification of an investment idea and or investment opportunity. Project ideas may arise from studies of the product-consumption pattern of the country, market studies, surveys of existing industrial establishments, import schedules…..etc. All ideas for projects are valuable and may prove to be the beginning of the project. However, each investment idea should be first studied. This study is called a *pre-feasibility study* or *preliminary feasibility study.* The purpose of this stage is to determine whether the project idea should be studied in more details and the scope of future studies; i.e.

purpose of the
pre-feasibility
study

The purpose of the pre-feasibility study is to answer the following questions:

Is it feasible to continue to study this investment project?
Is it feasible to spend more resources (money, time) to extend this feasibility study?
Are there any constraints (legal, technological, environmental, and ethical) over the investment project?

The pre-feasibility study is prepared on the basis of available data in published form that can be easily collected and worked out. If the pre-feasibility study indicates that the proposed project appears to be a promising one, the decision may be taken to proceed further with the complete or integrated feasibility study.

Types of
Feasibility
Studies

1.2 Types of Feasibility Studies

To implement any project, the investor needs to carry out different types of *feasibility studies*. These feasibility studies evaluate all the *risks* and *returns related to that project* and try to balance them and help the investor to finalize his/her plans. Different feasibility studies include:

Market
Feasibility

1.2.1 Market Feasibility

This is a critical analysis because the output of any factory has to sell in the market place for the promoter to earn revenues. Very often demand analysis and projections are optimistic leading to problems in the future. Another observation has been that products that sell abroad may not have a market locally. Egypt, in general is a cost conscious market and the investor has to keep this in the back of his mind.

The main purpose of the marketing study is to determine the market share of the investment project. This will be determined first by calculating the *market gap*, then determining the percentage of that gap that the project will cover.

The market gap

The market gap = Total demand on the product or service **–**Total supply (fully imported goods, fully local produced goods, and mix between imported and local suppliers).

Usually at the preliminary point the market share will be less than the market gap, however after introducing the new product the market share may be greater than the market gap.

However, *in assessing the marketability of the projected products and services, one should distinguish between those categories:*

- − *New to the world products* (New products that create new market).
- − *New products lines* (New products that allow a company to enter an established market).
- − Additions to existing product lines. New products that supplement a company's established product lines.
- − *Improvements in or revisions in existing products* (New products that provide improved performance or greater value and replace existing products).
- − *Repositioning* (Existing products that are targeted to new markets or market segments).
- − *Cost reduction* (New products that provide similar performance at lower cost).

Managerial Feasibility

1.2.2 Managerial Feasibility

Every business has different requirements from the management. Businesses, which are complex require significant experience on part of top management to run it. Management expertise is not only in technical know-how but also in understanding market dynamics, ability to distribute product effectively, manage manpower and environment.

In cases where a multi-national company (MNC), which has a long track record and significant experience, is implementing a project, it would be an added comfort about management feasibility. In businesses, which are technologically driven based on intellectual capital, technocrats would be preferred.

Economic Feasibility
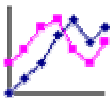
1.2.3 Economic Feasibility

The project has to generate an acceptable *rate of return*, which adequately covers its *cost of capital*. The expected rate of return depends on the risk profile of the project. In a rational economic world, nobody implements a project to make losses. In other words, net present value has to be positive if you discount the cash flows by the desired rate of return.

Commercial Feasibility

1.2.4 Commercial Feasibility (Availability of Key Factors)

Commercial feasibility refers to availability of raw material, skilled labor, infrastructure, and other factors of production. A number of projects have run into rough weather due to poor commercial viability.

Financial
Feasibility

1.2.5 Financial Feasibility

The ability to raise money to implement the project is of paramount importance. The promoter (investor) should be capable of raising funds either from his own sources or from banks and institutions. One area that often gets overlooked is contingency planning. In most cases, the first generation entrepreneur has problems in raising funds to implement his project, and even if he does so, he lacks staying power and is not able to withstand unforeseen problems like delays and overruns.

Technical
Feasibility

1.2.5 Technical Feasibility

An investor should have the requisite number of technically capable people as well as technology required to set up and run the plant. The technology should be such that is can adapt to local conditions. Technology transfer from overseas often fails in this regard. The conditions in USA and Europe are quite different from Egypt. Most parts of Egypt are hot and dusty. Sophisticated process controls have known to fail. Therefore, knowledge and suitability to local conditions is very important.

Social Feasibility

1.2.6 Social Feasibility

Many a time plants may be viable economically and financially but would be socially undesirable. In the last 5 years, Egypt is slowly becoming environment conscious and friendly. Therefore, using hazardous chemicals or polluting industries may not get the necessary clearances.

Long-Term
Investment
Analysis

1.3 Long-Term Investment Analysis

Long-term investment decisions represent sizable outlays of funds that commit a firm to some course of action. Thus, the firm needs procedures to analyze and properly select its long-term investments. It must be able to measure the cash flows and apply appropriate decision techniques. The process of making such long-term investment decisions is referred to as *Capital Budgeting*.

Capital
budgeting

Capital budgeting is the process of evaluating and selecting long-term investments that are consistent with the firm's goal of maximizing owners' wealth. Capital budgeting involves choosing among various capital projects to find the one(s) that will maximize the return on the capital invested.

The important points are:
- *Capital budgeting* is the most significant financial activity of the firm.
- *Capital budgeting* determines the core activities of the firm over a long-term future.
- *Capital budgeting* decisions must be made carefully and rationally.
- *Long-term investments* may be in the form of a new project, or to expand an existing firm, or to acquire a new fixed asset. In all cases, the capital budgeting decision is related to the future thus it may contain many uncertainties.
- *Capital budgeting* emphasizes the firm's goal of wealth maximization, which is expressed as maximizing an investment's Net Present Value.

Capital
Budgeting Within
the Firm

1.3.1 Capital Budgeting Within the Firm

Many companies follow a carefully prescribed process in capital budgeting. At least once a year, proposals for new projects are requested from each department and plant. The proposals are screened by a capital budgeting committee, which submits its findings to the officers of the company. The officers, in turn, select the projects they believe to be most worthy of funding and submit them to the board of directors. The directors approve the investment decision for the next period. The involvement of top management and the board of directors in the process demonstrate the importance of capital budgeting decisions. These decisions often have a significant impact on the future returns, as shown in Figure 1.1.
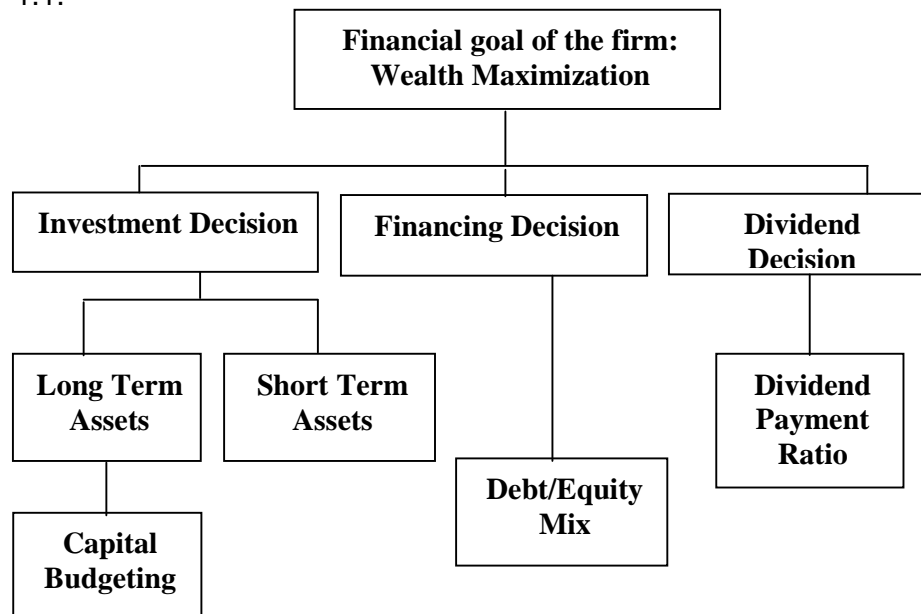

Figure 1.1: The position of capital budgeting

Aspects of
Capital
Budgeting

1.3.2 Aspects of Capital Budgeting

Capital budgeting involves:
- Committing significant resources
- Planning for the long term: 5 to 50 years.
- Decision making by senior management.
- Forecasting long term cash flows.
- Estimating long term discount rates.
- Analyzing risks.
- Calculating a project's relevant cash flows

Capital
budgeting uses

Capital budgeting uses:

- Sophisticated forecasting techniques.
- Time series analysis by the application of simple and multiple regression, and moving averages
- Qualitative forecasting by the application of various techniques, such as the Delphi method
- Application of time value of money formulae
- Application of Net Present Value (NPV) analysis to forecasted cash flows
- Application of Sensitivity and Break Even analyses to analyze risk
- Application of Simulation and Monte Carlo Analysis as extra risk analysis
- Application of long term forecasting and risk analysis to projects with very long lives

1.4   Cash Flows

Cash Flows

1.4.1 Why Cash Flows?

Cash flows, and not accounting estimates, are used in capital budgeting, project analysis because:
- They measure actual economic wealth.
- They occur at identifiable time points.
- They have identifiable directional flow.
- They are free of accounting definitional problems.

But which cash flows? If we decide to make a component, should the cost of the factory building where it is made be included? What about the salary of the sales manager if a new product is launched?

The answer to this question is clear and simple: All cash flows have to be included in our analysis whenever they are affected by the decision! Hence, if launching a new product implies hiring a new sales manager, then his/her salary is included. If the sales manager

would continue to be employed anyway, then his/her salary is a cash outflow the company would incur even if the product were not launched, and then his/her salary is not included.

Similarly, the factory building may have been there already without any other use for the firm (then don't include it), or it could have been sold (then include foregone cash inflow from not selling it). Alternatively, it may exist, but using it for making a component may force us to lease another building (then include these lease payments). These cash flows are also called incremental cash flows, since they always compare the cash flows for a base scenario (do not launch product, do not make component) with an alternative scenario.

The differences of the cash flows in the base and the alternative scenario are the incremental cash flows. We denote these incremental cash flows by Xt,

Where,
$X_t > 0$ indicates that the firm's cash inflow increases in time t as a result of the decision, and
$X_t < 0$ indicates the opposite.

Hence, from a point of view of capital budgeting procedures, a decision is completely characterized by the stream of incremental cash flows. Analytically, characterizing the decision by a stream of cash flows presents us with two challenges:

1. We have to estimate these cash flows X for all periods in the future where the decision under consideration has an impact on the cash flows. This implies forecasting.
2. We have to use some investment appraisal method in order to analyze decisions where X is positive for some periods, and negative for others. We have to understand the time value of money in order to proceed correctly. We discuss the solution to this problem in the following sections. The incremental cash flows estimated here are typically uncertain, and we have to take into account that some cash flows are certain, whereas others depend on the state of the economy. We return to the problem of risk later in the course. There we shall see that we can take care of the riskiness of projects by using adequate discount rates.

The Meaning of RELEVANT Cash Flows

1.4.2 The Meaning of RELEVANT Cash Flows.

1. A relevant cash flow is one, which will *change* as a direct result of the decision about a project.
2. A relevant cash flow is one, which will occur in the future. A cash flow incurred in the past is irrelevant. It is sunk.
3. A relevant cash flow is the difference in the firm's cash flows with the project, and without the project.

Relevant cash flows are also known as: Marginal cash flows.
1. Incremental cash flows.
2. Changing cash flows
3. Project cash flows.
4. However, all titles have the same meaning.

1.4.3 Project Cash Flows: Yes and No.

YES

YES: These are relevant cash flows
• Incremental future sales revenue.
• Incremental future production costs.
• Incremental initial outlay.
• Incremental future salvage value.
• Incremental working capital outlay.
• Incremental future taxes.

NO

NO: These are not relevant cash flows
• Changed future depreciation.
• Reallocated overhead costs.
• Adjusted future accounting profit.
• Unused idle capacity cost.
• Outlays incurred in the past

Cash Flows and Depreciation

1.4.4 Cash Flows and Depreciation: Always a Problem

– Depreciation is NOT a cash flow.
– Depreciation is simply the accounting amortization of an initial capital cost.
– Depreciation amounts are only accounting journal entries.
– Depreciation is measured in project analysis only because it reduces taxes.

Summary

1.4.5 Project Cash Flows: Summary

Only future, incremental, cash flows are Relevant. Relevant Cash Flows are entered into a yearly cash flow table. Net Annual Cash Flows are discounted to give the project's <u>N</u>et <u>P</u>resent <u>V</u>alue. Thus when examining an investment proposal one should be interested only in the marginal or incremental cash flows associated with the project in question.

The incremental net cash flow of an investment proposal is defined to be the difference between the firm's cash flows if the investment project is undertaken and the firm's cash flows if the investment project is not undertaken.

Net Cash Flow = Cash Inflow - Cash Outflow

Cash Inflows include:

- Cash operating revenues,
- Cash proceeds from selling assets,
- Residual value of the investment at the end of its useful life.

  Cash outflows include:
  - The investment cost (the initial investment)
  - Cash operating cost
  - Increase in working capital
    Income tax on taxable income

The income tax paid is determined by:
Taxes = t*(Revenue - Expenses - Depreciation)

where t is the corporate tax rate. Note that depreciation is not a cash expense and only affects cash flows through its effect on taxes.

1.4.6 Project Cash Flows: Example 1

Example

Egyptian Investors Company is considering an immediate investment of LE. 200000 in new equipment. The new equipment is expected to last for 5 years and have LE. 50000 salvage value at the end of its useful life. The annual net cash inflows are LE. 200000, and the annual net cash outflows are LE. 100000. The company's net income is subject to 40% income tax. The company uses the straight-line method in calculating the annual depreciation.

Required: calculate the annual net cash flows for the new equipment.

1. The annual depreciation = The investment cost – Salvage value/Number of Years in the useful life
2. The annual depreciation = (200000 – 50000/5) = LE. 30000 (non cash item)
   5 years
3. The annual accounting net income = Total annual revenues (cash and non cash) – Total operating expenses (cash and non cash)
4. The annual accounting net income = 200000 – (100000 + 30000) = 70000
   The annual income tax = The accounting net income * The income tax rate
5. The annual income tax = 70000 * 40% = 28000
   The annual net cash flows = The annual net cash inflows – The net cash outflows including income tax
6. The annual net cash flows = 200000 – (100000 + 28000) = LE. 72000

These information can be summarized as follows
Net Cash Flows Estimation (amounts in LE.)

Item	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
Cash inflows Current Operating Revenue Residual (salvage value)	0	200000	200000	200000	200000	200000 50000
A-Total cash inflows	0	200000	200000	200000	200000	250000
Cash outflows Investment cost Current operating cash outflows Income tax	200000	100000 28000	100000 28000	100000 28000	100000 28000	100000 28000
B-Total cash outflows	200000	128000	128000	128000	128000	128000
Net Cash flows (NCF) A-B	- 200000	72000	72000	72000	72000	132000

Example

1.4.7 Project Cash Flows: Example 2

2

A corporation is considering installing a machine that costs $60,000 plus installation costs of $2,000. It will generate revenues of $155,000 annually and cash expenses annually of $100,000. It will be depreciated to a salvage of $6,000 over a seven-year life using the straight-line method. Assuming the firm has a marginal cost of capital of 12 percent and is in the 34 percent marginal tax bracket, determine the incremental cash flows of this investment project. What is the annual net cash flow of this project?

Year 0: The incremental cash flows associated with the project in year 0 are:
Cost of new machine: $60,000 + Installation Cost: $2,000 = $62000

Years 1-7:
Yearly revenues: $155,000
Yearly expenses: $100,000
Yearly tax expense = Tax rate * [taxable income]
Where taxable income = revenues –expenses - depreciation.

In this case depreciation is computed using the straight line method,
D = (62,000-6,000)/7 = $8,000.
Therefore, yearly tax expense is 0.34(155,000-100,000-8,000) =$15,980.

Year 7
Salvage value: $6,000.

The results can be summarized in two tables.
The first computes taxable income and the tax expense. The second table computes the net cash flow.

1. Computation of Taxable Income:

Year	Revenues	Expenses	Depreciation	Taxable Income	Income Tax
1	155,000	100,000	8,000	47,000	15,980
2	155,000	100,000	8,000	47,000	15,980
3	155,000	100,000	8,000	47,000	15,980
4	155,000	100,000	8,000	47,000	15,980
5	155,000	100,000	8,000	47,000	15,980
6	155,000	100,000	8,000	47,000	15,980
7	155,000	100,000	8,000	47,000	15,980

2. Computation of Net Cash Flows:

| Item	Year Zero	Year 1	Year 2	Year 3	Year 4	Year 5
Cash inflows Current operating revenues Residual (salvage) value	0	155000	155000	155000	155000	155000 6000
A- Total cash inflow	0	155000	155000	155000	155000	161000
Cash outflows Investment cost Current operating cash outflows Income tax	62000	100000 15980	100000 15980	100000 15980	100000 15980	100000 15980
B- Total cash outflows	62000	115980	115980	115980	115980	115980
Net Cash Flows (NCF) A- B	- 62000	39020	39020	39020	39020	45020

Essential
Formula in
Project Appraisal

1.5 Essential Formula in Project Appraisal

Recognition of the time value of money can make a significant difference in the long-term impact of the capital; budgeting decision. For example, cash flows that occur early in the life of an investment will be worth more than those that occur later, because of the time value of money. Therefore, it is useful to recognize the timing of cash flows when evaluating projects. This part aims at explaining of the formulae and symbols used to evaluate investment projects

Fundamentals in
Financial
Evaluation
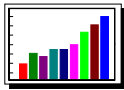
1.5.1 Fundamentals in Financial Evaluation

Money has a time value: a $ or £ or € today, is worth more than a $ or £ or € next year. A risk free interest rate may represent the time value of money. Inflation too can create a difference in money value over time. It is NOT the time value of money. It is a decline in monetary purchasing power.

Moving Money
Through Time

1.5.2 Moving Money Through Time

Investment projects are long lived, so we usually use annual interest rates. With compound interest rates, money moved forward in time is 'compounded', whilst money moved backward in time is 'discounted'.

Financial
Calculations

1.5.3 Financial Calculations

Time value calculations in capital budgeting usually assume that interest is annually compounded.

'Money' in investment projects is known as 'cash flows': the symbol is: Ct Cash flow at end of period t.

The present value of a single sum is:

$$PV = FV (1 + r)^{-t}$$

- The present value of a dollar to be received at the end of period t, using a discount rate of r.

Example:
Calculate the present value of $110 to be received after one year, the discount rate is 10%
PV = 110/ (1.1) = $100,
Thus, the $110 after one year has a value of $100 today.

Cash Flow
Series

1.5.3 Cash Flow Series

The present value of a series of cash flows is:

$$PV = \sum_{1}^{t} {CF_t}\Big/{(1 + r)^t}$$

A payment series in which cash flows are Equally sized   And Equally timed is known as an annuity.

There are three types of annuities:
1. Ordinary annuities; the cash flows occur at the end of each time period.
2. Annuities due; the cash flows occur at the start of each time period.
3. Perpetuities; the cash flows begin at the end of the first period, and go on forever.

The present value calculations may be made manually using tables (appendix 1) or using financial calculators or using spreadsheets (Excel program). The examples illustrated below are based on manual calculations, however, the trainees may use the excel program to recalculate the figure. The formulas are illustrated in the handouts.

PV of Mixed
Stream

1.5.4 PV of Mixed Stream of Future Cash Flows

Example: A project that has a useful life of 4 years and will give a net annual cash flows of 150, 220, 400, 540 respectively during each year of the useful life.

Required:
How much does it worth today if the required rate of return is 14%?
How much does it worth today if the required rate of return is 16%?
Explain the reason for the difference?

Years	Net Cash Flow (1)	PV Factor 14% (use the table) (2)	PV of Cash Flows = (1) * (2)	PV Factor 16%	PV of Cash Flows
1	150	0.877193	131.5789	0.862069	129.3103
2	220	0.769468	169.2829	0.743163	163.4958
3	400	0.674972	269.9886	0.640658	256.2631
4	540	0.59208	319.7233	0.552291	298.2372
Total	1310		890.5738		847.3064

If the net cash flow stream had changed to 540, 150, 400, 220, would it make any difference in the value of the project today, why?

Years	Net Cash Flow (1)	PV Factor 14% (use the table) (2)	PV of Cash Flows = (1) * (2)	PV Factor 16%	PV of Cash Flows
1	540	0.877193	473.6842	0.862069	465.5172
2	150	0.769468	115.4201	0.743163	111.4744
3	400	0.674972	269.9886	0.640658	256.2631
4	220	0.59208	130.2577	0.552291	121.504
Total	1310		989.3506		954.7588

PV of Constant Stream

1.5.5 PV of Constant Stream of Future Cash Flows (Annuity)

Example: A project has a useful life of 4 years and will give constant net annual cash flows of 200 during each year of the useful life. How much does it worth today if the required rate of return is 14%, and 16%

Years	Net Cash Flow (1)	PV Factor 14% (use the table) (2)	PV of Cash Flows = (1) * (2)	PV Factor 16%	PV of Cash Flows
1	200	0.877193	175.4386	0.862069	172.4138
2	200	0.769468	153.8935	0.743163	148.6326
3	200	0.674972	134.9943	0.640658	128.1315
4	200	0.59208	118.4161	0.552291	110.4582
Total	800		582.7425		559.6361

Alternatively, use the present value of an annuity table, look at 14% and 4 years then multiply the present value factor by $ 200.

PV of 200 annuity for 4 years @ 14% = 200 * 2.9137 = 582.7425 (same answer but faster)

PV of Constant Perpetuity

1.5.6 PV of Constant Perpetuity (Constant Amount That Will Last Forever)

Find the present value of $ 20 constant for unlimited period using 14% as the required rate of return

$$PV = \frac{\text{Constant Cash Flow}}{\text{Rate of return}} = \frac{20}{0.14} = \$ 142.85$$

PV of Constant
Growth
Perpetuity

1.5.7 PV of Constant Growth Perpetuity (an Annual Amount That Will Grow With a Constant Rate and Will Last Forever)

Find the present value of an annual dividends of $ 20 that will grow with a constant rate of 4% using 14% as the required rate of return

$$PV = \frac{\text{Constant Cash Flow}}{\text{Rate of return- Growth rate}} = \frac{20}{0.14 - 0.04} = \frac{20}{0.1} = \$\ 200$$

FV of Mixed
Stream

1.5.8 FV of Mixed Stream of Future Cash Flows

Example: A project has a useful life of 4 years and will give net annual cash flows of 150, 220, 400, 540 respectively during each year of the useful life, find the future values of these amounts by the end of the 4 years @ 14%.

Years	Net Cash Flow (1)	Years left to 4	Future value factor @ 14%	FV of Cash Flows
1	150	3	1.4815	222.225
2	220	2	1.2996	285.912
3	400	1	1.14	456
4	540	0	1	540
Total	1310			1504.137

FV of Constant
Stream

1.5.9 FV of Constant Stream of Future Cash Flows (Annuity)

Example: A project has a useful life of 4 years and will give a constant net annual cash flow of 200 during each year of the useful life. How much does it worth after 4 years if the required rate of return is 14%,

Years	Net Cash Flow (1)	Years left to 4	Future value factor @ 14%	FV of Cash Flows
1	200	3	1.4815	296.3
2	200	2	1.2996	259.92
3	200	1	1.14	228
4	200	0	1	200
Total	800			$ 984.22

Alternatively, use the future value of an annuity table, look at 14% and 4 years then multiply it by 200

FV of 200 annuity for 4 years @ 14% = 200 * 4.92 = $ 984 (same answer but faster)

Evaluation
of Project Cash
Flows

1.5.10 Evaluation of Project Cash Flows

Cash flows occurring within investment projects are assumed to occur regularly, at the end of each year. Since they are unlikely to be equal, they will not be annuities.

Annuity calculations apply more to loans and other types of financing.

All future flows are discounted to calculate a Net Present Value, NPV; or an Internal Rate of Return, IRR.

Decision Making
With Cash Flow
Evaluations

1.5.11 Decision Making With Cash Flow Evaluations

- − If the Net Present Value is positive, then the project should be accepted. The project will increase the present wealth of the firm by the NPV amount.
- − If the IRR is greater than the required rate of return, then the project should be accepted. The IRR is a relative measure, and does not measure an increase in the firm's wealth.

Essential
Formula

1.5.12 Essential Formula -- Summary

1. The Time Value of Money is a cornerstone of finance.
2. The amount, direction and timing of cash flows, and relevant interest rates, must be carefully specified.
3. Knowledge of financial formula is essential for project evaluation.
4. NPV and IRR are the primary investment evaluation criteria.

Most financial functions can be automated within Excel program.

Chapter 2: Capital Budgeting Techniques

Introduction

2.1 Introduction

In order to assess the feasibility of any investment project, some capital budgeting techniques should be used to evaluate that project. This part illustrates the most common techniques and the advantages and disadvantages of each one of them.

The Net Present Value Method

2.2 The Net Present Value Method

The primary capital budgeting method that uses discounted cash flow techniques is called the Net Present Value (NPV). Under the NPV net cash flows are discounted to their present value and then compared with the capital outlay required by the investment. The difference between these two amounts is referred to as the NPV. The interest rate used to discount the future cash flows is the required rate of return (will be discussed later). A project is accepted when the net present value is zero or positive.

The Net Present Value (NPV) Rule

Net Present Value (NPV) = Total PV of future CF's - Initial Investment

2.2.1 Why To Use Net Present Value?

Accepting positive NPV projects benefits shareholders, for the following reasons:

NPV uses cash flows
NPV uses all the cash flows of the project
NPV discounts the cash flows properly, and

2.2.2 Estimating NPV

Estimating NPV

Three variables should be considered:
1. Estimate future cash flows: how much? and when?
2. Estimate discount rate
3. Estimate initial costs

Minimum Acceptance Criteria: Accept if NPV > 0
Ranking Criteria: Choose the highest NPV

2.2.3 Good Attributes of the NPV Rule

1. Uses cash flows
2. Uses ALL cash flows of the project
3. Discounts ALL cash flows properly

Reinvestment assumption: the NPV rule assumes that all cash flows can be reinvested at the discount rate.

2.3   The Payback Period Rule

The payback period answers the question of; how long does it take the project to "pay back" its initial investment?

Payback Period = number of years to recover initial costs

The shorter the payback period the more attractive the investment. The reasons are that:

The earlier the investment is recovered, the sooner the cash funds can be used for other purpose.

The risk of loss from obsolesces and changed economic conditions is less in a shorter payback-period

Minimum Acceptance Criteria: set by management
Ranking Criteria: set by management

Disadvantages:
Ignores the time value of money
Ignores cash flows after the payback period
Biased against long-term projects
Requires an arbitrary acceptance criteria
An accepted project based on the payback criteria may not have a positive NPV

Advantages:
Easy to understand
Biased toward liquidity

2.4   The Discounted Payback Period Rule

How long does it take the project to "pay back" its initial investment taking *the time value of money i*nto account?

However, by the time you have discounted the cash flows, you might as well calculate the NPV.

2.5 The Average Accounting Return Rule

Another attractive but fatally flawed approach.

$$AAR \;=\; \frac{Average \quad Net \quad Income}{Average \quad Book \quad Value \quad of \quad Investent}$$

Ranking Criteria and Minimum Acceptance Criteria set by management

Disadvantages:
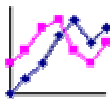Ignores the time value of money
Uses an arbitrary benchmark cutoff rate
Based on book values, not cash flows and market values

Advantages:
Accounting information is usually available
Easy to calculate

2.6 The Internal Rate of Return (IRR) Rule

IRR is the discount rate that sets NPV to zero. The IRR differs from the NPV in that it results in finding the internal yield of the potential investment. The IRR is calculated by discounting the net cash flows using different discount rates till it gives a net present value of zero (Trial and Error). However, it may be easily calculated using financial calculators or Excel Program.

2.6.1 Minimum Acceptance Criteria

Accept if the IRR exceeds the required return.

Ranking Criteria
Select alternative with the highest IRR.
Reinvestment assumption: All future cash flows assumed reinvested at the IRR.

Disadvantages
Does not distinguish between investing and borrowing?
IRR may not exist or there may be multiple IRR
Problems with mutually exclusive investments

Advantages
Easy to understand and communicate

The Profitability
Index

2.7 The Profitability Index (PI) Rule

$$PI = \frac{Total \ \ PV \ of \ Future \ \ Cash \ \ Flows}{Initial \ \ Investment}$$

Minimum Acceptance Criteria: Accept if PI > 1

Ranking Criteria: Select alternative with highest PI

Disadvantages:
Problems with mutually exclusive investments

Advantages:
May be useful when available investment funds are limited
Easy to understand and communicate
Correct decision when evaluating independent projects

Mutually
Exclusive

2.7.1 Mutually Exclusive *vs.* Independent Project

Mutually Exclusive Projects: Only ONE of several potential projects can be chosen, e.g. acquiring an accounting system. The meaning is that if the company accepts one project, it would be impossible to adopt the other proposal even if generates a positive net present value.

RANK all alternatives and select the best one.

Independent
Projects

Independent Projects: accepting or rejecting one project does not affect the decision of the other projects.

Must exceed the MINIMUM acceptance criteria.

The Practice of
Capital Budgeting

2.8 The Practice of Capital Budgeting

Capital budgeting techniques varies by industry, Some firms use payback, others use accounting rate of return. However, the most frequently used technique for large corporations is IRR or NPV.

Selection of
Techniques

2.8.1 Selection of Techniques

Net Present Value is the technique of choice; it satisfies the requirements of: the firm's goal, the time value of money, and the absolute measure of investment.

Internal Rate of Return is useful in a single asset case, where the cash flow pattern is an outflow followed by all positive inflows. In other situations the IRR may not rank mutually exclusive assets properly, or may have zero or many solutions.

Accounting Rate of Return allows many valuations of the asset base, does not account for the time value of money, and does not relate to the firm's goal. It is not a recommended method.

Payback Period does not allow for the time value of money, and does not relate to the firm's goal. It is not a recommended method.

The Notion of Certainty

2.8.2 The Notion of Certainty

A simplified assumption made by many financial analysts is that projected results are known with certainty. The reasons are:

Certainty allows demonstration and evaluation of the capital budgeting techniques, whilst avoiding the complexities involved with risk.

Certainty requires forecasting, but forecasts, which are certain.
Certainty is useful for calculation practice.

Risk is added as an adoption of an evaluation model developed under certainty.

The next unit will illustrate how to account for the risk effect in the capital budgeting decisions.

Summary

2.8.3 Summary

This unit evaluates the most popular alternatives to NPV:
   ♦ Payback period
   ♦ Accounting rate of return
   ♦ Internal rate of return
   ♦ Profitability index

When it is all said and done, they are not the NPV rule; for those of us in finance, it makes them decidedly second-rate.

Case

1

Case 1: (Independent Projects)

The management of the Egyptian investors Plc is evaluating a capital budget decision. The available alternatives are as follows:

Years	NCF (project A)	NCF (Project B)	NCF (Project c)
0	- 500	- 600	- 400
1	150	200	300
2	150	200	100
3	650	100	000
4	0	1200	0000

Required:
Rank these investment alternatives using the payback period, and the NPV. The required rate of return is 18%

The payback period:
To calculate the payback period, the net cash flows for each alternative should be accumulated till it gives a positive value (i.e. till it pays back its initial investment). The one that pays back faster is the best alternative.

Years	NCF (project A)	NCF (Project B)	NCF (Project c)
0	- 500	- 600	- 400
1	150	200	300
2	150	200	100
3	650	100	000
4	0	1200	0000

According to the payback method, project C which pays back after 2 years is No. 1, followed by project A which pays back after 3 years, while project B is No. 3 because it pays back during the fourth year.

Do you agree with this ranking? Why?

The NPV:
According to the net present value method, the net cash flows should be discounted and accumulated to get the NPV, by the end of the useful life. The project that generates the highest NPV is the most feasible one.

Years	(1) NCF (project A)	(2) PV factor @ 18% B)	(3) = (1) * (2) PV of NCF
0	- 500	1	-500
1	150	0.847458	127.1186
2	150	0.718184	107.7277
3	650	0.608631	395.6101
NPV (total)			130.4564

	(1)	(2)	(3) = (1) * (2)
Years	NCF (project B)	PV factor @ 18% B)	PV of NCF
0	- 600	1	-600
1	200	0.847458	169.4915
2	200	0.718184	143.6369
3	100	0.608631	60.86309
4	1200	0.515789	618.9467
NPV (total)			392.9381

	(1)	(2)	(3) = (1) * (2)
Years	NCF (project B)	PV factor @ 18% B)	PV of NCF
0	- 400	1	-400
1	300	0.847458	254.2373
2	100	0.718184	71.81844
NPV (total)			-73.9443

Project B generates the highest positive NPV, thus it is ranked as No. 1, followed by project A. While project C should be rejected as it gives a negative NPV.

Case 2: (Mutually Exclusive Projects)

Case

2

The management of Goldi is evaluating an investment proposal to acquire one of two mutually exclusive production lines to produce motherboards. The following data is available:

Years	NCF (project A)	NCF (Project B)
0	-3000	-2000
1	660	440
2	660	440
3	660	440
4	660	440
5	3660	2440

The company's cost of capital is 12%.

Required: select the best alternative

Answer:
The best method to use in selecting between mutually exclusive projects is the NPV, thus the net cash flows for each project is discounted @ the cost of capital rate (12%) and the project that yield the highest NPV is selected.

Years	NCF (project A)	PV factor @ 12%	NCF (Project B)
0	-3000	1	-3000
1	660	0.8929	589.2857
2	660	0.7972	526.148
3	660	0.7118	469.775
4	660	0.6355	419.4419
5	3660	0.5674	2076.782
NPV			1081.433

Years	NCF (project B)	PV factor @ 12%	NCF (Project B)
0	-2000	1	-2000
1	600	0.8929	392.8571
2	600	0.7972	350.7653
3	600	0.7118	313.1833
4	600	0.6355	279.628
5	2600	0.5674	1384.522
NPV			720.9552

Project A **Project A** gives net present value that is higher than project B, thus it is more feasible (i.e. project A maximizes the shareholders wealth).

Note: The IRR in this case may give a conflicting result, both projects will give an IRR of 22%.

Chapter 3: Risk Analysis

There are many approaches to incorporate risk into project analysis. The first one is use of sensitivity analysis. Sensitivity analysis uses a number of outcome estimates (cash flows estimates) to get a sense of the variability among potential returns. While, the second approach is to deal with risk and uncertainty through adjustments to the discount rate or by the certainty equivalent factor.

Introduction

3.1 Introduction: What is risk?

Risk is the variation of future expectations around an expected value. Risk is measured as the range of variation around an expected value. Risk and uncertainty are interchangeable words. In project analysis, risk is the variation in predicted future cash flows.

Handling Risk

3.2 Handling Risk

There are several approaches to handling risk: In this unit, risk is accounted for by applying a discount rate commensurate with the riskiness of the cash flows, and by using a certainty equivalent factor. However, risk may be also accounted for by evaluating the project under simulated cash flow and discount rate scenarios.

Using a Risky Discount Rate

3.3 Using a Risky Discount Rate

The structure of the cash flow discounting mechanism for risk is:

$$NPV = \frac{(Risky\ cash\ flows)\ 1}{(1 + risky\ rate)^1} + \frac{(Risky\ cash\ flows)\ 2}{(1 + risky\ rate)^2} + \ldots\ldots - Initial\ outlay$$

Defining a Risky Discount Rate

3.4 Defining a Risky Discount Rate

Conceptually, a risky discount rate, k, has three components:
- ♦ A risk-free rate (r), to account for the time value of money
- ♦ An average risk premium (u), to account for the firm's business risk
- ♦ An additional risk factor (a), with a positive, zero, or negative value, to account for the risk differential between the project's risk and the firms' business risk.

3.5   Calculating a Risky Discount Rate

A risky discount rate is conceptually defined as:

$$k = r + u + a$$

Unfortunately, k, is not easy to estimate.

Two approaches to this problem:
1. Use the firm's overall Weighted Average Cost of Capital (WACC), after tax, as k. The WACC is the overall rate of return required to satisfy all suppliers of capital.
2. A rate estimating (r + u) is obtained from the Capital Asset Pricing Model, (CAPM) and then a is added.

1- Calculating the WACC

WACC = Wps*Cps + Wcs*Ccs + (Wd * Cd)
Where:
Wps is the weight of preferred stock.
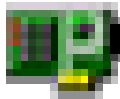Wcs is the weight of common stock.
Wd is the weight of debt.
Cps is the cost of preferred stock
Ccs is the cost of common stock
Cd is the cost of debt = interest * (1-tax rate)

Example:
Assume a firm has a capital structure of:
50% common stock, 10% preferred stock, 40% long-term debt.
Rates of return required by the holders of each are: common, 10%; preferred, 8%; pre-tax debt, 7%. The firm's income tax rate is 30%.

WACC = (0.5 x 0.10) + (0.10 x 0.08) + (0.40 x (0.07x (1-0.30)))
       = 7.76% pa, after tax.

2- The Capital Asset Pricing Model (CAPM)

This model establishes the covariance between market returns and returns on a single security. The covariance measure can be used to establish the risky rate of return, r, for a particular security, given expected market returns and the expected risk free rate.

Calculating *r* from the CAPM
The equation to calculate r, for a security with a calculated Beta is:

E (rit) = RFR + Bi (Rmt – RFR)

Where:
E(rit) is the expected return of the share or the asset (the required rate of return).

RFR is the risk free rate
Rmt is the rate of return on the market portfolio.
Beta is the Slope of an Ordinary Least Squares Regression Line

Example

Example:
If the RFR is 7% and the return on the market portfolio is 12% what is the expected return of share x if the shares beta is 0.5? If the stock beta has increased to one, what is the expected return on that stock?

Erit = 7% + 0.5 (12% - 7%) = 9.5% (this is the discount rate to be used in calculating the NPV)

If the beta is increased to 1 the expected return will be:
Erit = 7% + 1 (12% - 7%) = 12% (this is the discount rate to be used in calculating the NPV)

Note: Beta is a measure of risk i.e. High beta means high risk thus a higher required rate of return.

The Certainty
Equivalent
Method

3.6 The Certainty Equivalent Method: Adjusting the Cash Flows to their 'Certain' Equivalents

The Certainty Equivalent method adjusts the cash flows for risk, and then discounts these 'certain' cash flows at the risk free rate.

$$NPV \quad = \quad \frac{CF_1 \times b}{(1 + r)^1} + \frac{CF_2 \times b}{(1 + r)^2} \, etc \quad - \quad CO$$

Where: b is the 'certainty coefficient' (established by management, and is between 0 and 1); and r is the risk free rate.

Analysis
under Risk

3.7 Analysis under Risk: Summary

Risk is the variation in future cash flows around a central expected value.

Risk can be accounted for by adjusting the NPV calculation discount rate: there are two methods – either the WACC, or the CAPM

Risk can also be accommodated via the Certainty Equivalent Method.

All methods require management judgment and experience.

Project
Decision
Analysis

3.8   Project Decision Analysis (Guide Lines)

3.8.1 Making Go/No-Go Project Decision

Virtually all general managers face capital-budgeting decisions in the course of their careers. The most common of these is the simple "yes" versus "no" choice about a capital investment. The following are some general guidelines to orient the decision maker in these situations.

Focus on *cash flows,* not profits.   One wants to get as close as possible to the economic reality of the project.   Accounting profits contain many kinds of economic fiction. Flows of cash, on the other hand, are economic facts.

Focus on *incremental* cash flows. The point of the whole analytical exercise is to judge whether the firm will be better off or worse off if it undertakes the project. Thus, one wants to focus on the changes in cash flows effected by the project. The analysis may require some careful thought: a project decision identified as a simple go/no-go question may hide a subtle substitution or choice among alternatives. For instance, a proposal to invest in an automated machine should trigger many questions: Will the machine expand capacity (and thus permit us to exploit demand beyond our current limits)? Will the machine reduce costs (at the current level of demand) and thus permit us to operate more efficiently than before we had the machine? Will the machine create other benefits (e.g., higher quality, more operational flexibility)? The key economic question asked of project proposals should be, "How will things change (i.e., be better or worse) if we undertake the project?"

Account for time. *Time is money.* We prefer to receive cash sooner rather than later.   Use NPV as the technique to summarize the quantitative attractiveness of the project. Quite simply, NPV can be interpreted as the amount by which the market value of the firm's equity will change as a result of undertaking the project.

Account for *risk.* Not all projects present the same level or risk. One wants to be compensated with a higher return for taking more risk. The way to control for variations in risk from project to project is to use a discount rate to value a flow of cash that is consistent with the risk of that flow.

These 4 precepts summarize a great amount of economic theory that has stood the test of time. Organizations using these precepts make better investment decisions than organizations that do not use them.

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