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CHAPTER 3

THE FINANCIAL APPRAISAL OF PROJECTS

3.1 Introduction

The financial analysis of a project helps determine the financial viability and sustainability of the project. Since the integrated project analysis begins with the financial analysis and then the economic analysis, concept and data ought to be organized in a consequential and consistent manner. The comparison of either financial or economic benefits with their corresponding costs requires that all relevant data should be organized into a project profile covering the duration of the project's life. While a project profile is given by cash flows in the financial appraisal, the project's profile in the economic appraisal provides flow of economic benefits generated by the investment. This chapter explains how cash flow profiles of a project are developed and constructed in a consistent fashion. It also discusses each investment project can be evaluated from different points of view.

Section 3.2 explains the reasons why a financial appraisal is necessary for public sector projects. Section 3.3 presents the process that requires an understanding of the concepts, principles and common conventions that underlie a correct financial appraisal. As projects often last for many years, Section 3.4 deals with proper forecasts of revenues and expenditures as well as their financial cash flows over the life of the project. Section 3.5 addresses the importance of analyzing the project from alternative points of view and concluding remarks are made in Section 3.6.

3.2 Why a Financial Appraisal for a Public Sector Project?

It may appear that the financial appraisal of a project is only of interest to a private investor who wishes to determine the net financial gain (or loss) resulting from the project. Likewise, a public sector project because of utilizing public funds may only concern about its impact

on the country's net wealth. From a country's prospective, a project should be undertaken if it generates net positive economic benefits. A project that yields negative economic returns should not be undertaken as it will lower the net wealth of society as a whole. Thus one may expect the appraisal of government projects to be on the economic analysis of projects only.

There are several reasons for conducting a financial appraisal of a government project. The most important one is to ensure the availability of funds to finance the project through its investment and operating phases. While positive economic returns are justified for undertaking the project, they are by no means sufficient reason for its success. A project that has high economic returns may very often fail if there are not enough funds to finance the operations of the project. Many examples of development projects with expected high economic returns have failed due to financial difficulties. Water supply projects are typical examples of projects that generate substantial economic benefits due to the large value attached to water, but receive little financial revenues because of the low water tariffs. If the project is undertaken solely on the basis of the favorable economic analysis with no consideration to the financial sustainability, the project may fail due to lack of funds to service the debt as well as maintain the system. Other examples include projects such as public transport and irrigation where services are usually provided at concessional prices.

A financial analysis enables the project analysts to establish the financial sustainability of the project by identifying financing shortfalls that are likely to occur over the life of the project, thereby being able to devise the necessary means for meeting these shortfalls. Hence one of the main objectives of a financial appraisal for a government project is to determine whether the project can continue "to pay its bills" throughout its entire life; and if not, how can the shortfalls be met.

In certain instances the government approaches a project like a private sector investor to determine its financial profitability. This is necessary if privatization of the project is being contemplated. In this case, it is important to determine the profitability of a project and to estimate the value that a private investor would be willing to pay for it. Ascertaining the financial profitability is also necessary when government policies are designed to encourage

small investors or certain groups in society to undertake projects by providing them with grants or loans. Although the government's decision to provide grants or loans is based on whether all small investors undertaking the same project yields positive economic returns or not, the government should also appraise each individual investor to determine if it is financially sustainable.

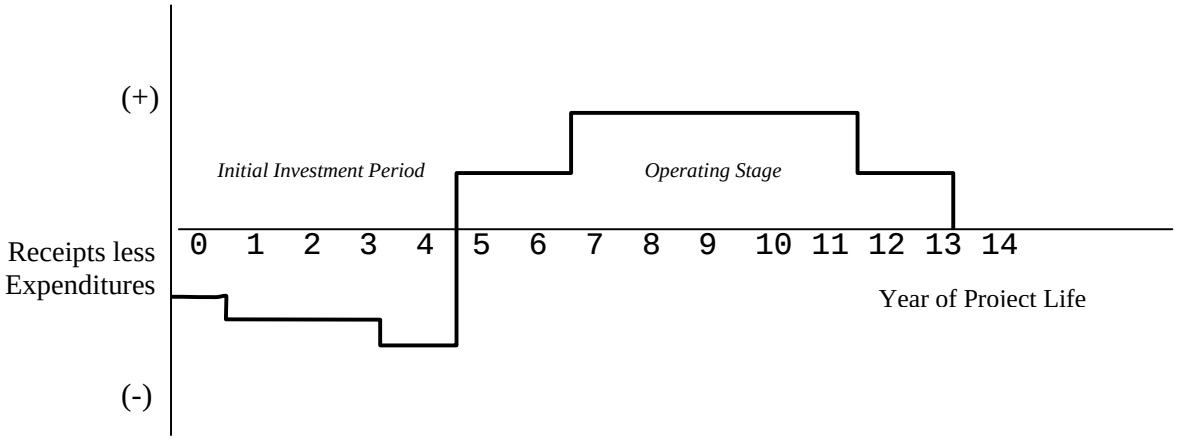
Another reason for conducting a financial appraisal of public-sector projects is directly related to understanding of the distributional impacts of the project. For example, the difference between the financial price an individual pays for a liter of water (found in the financial cash flow statement) and the gross economic benefit he derives from consuming the water (found in the economic resource flow statement) reflects a net gain to the consumer. Similarly, the difference between the financial price (inclusive of tax) that a project faces and the economic cost of an input required by the project measures the tax gain to the government. Gains and losses of this nature will be difficult to establish on the basis of economic analysis alone.

3.3 Construction of Financial Cash Flows: Concepts and Principles

The financial cash flow of an investment project is a central piece of the financial appraisal. The cash flow statement of a project is a listing of all anticipated sources of cash and uses of cash by the business over the life of the project. It can be illustrated as in Figure 3.1, where the difference between receipts and expenditures is plotted against the sequence of years which make up the project's life. The net cash flow profile (measured by the difference between receipts and expenditures) is usually negative in the beginning of a project's life when the investment is being made. In later years, when revenues from sales of output become larger than expenditures, the net cash flow becomes positive. Some projects, which require significant investments to be made at intervals throughout the life of a project such as the re-tooling of a factory, may also experience negative cash flows occasionally after the initial investment has been made. Other projects may have negative cash flows in their operating stage if they are producing a good or service which experiences wide swings in

price or demand. Some other projects will even have negative cash flows in the final years of the project's life as costs are incurred to rehabilitate the project site or to compensate workers for their displacement.

Figure 3.1: Financial Cash Flow Profile of a Project



3.3.1 The Investment Phase

The first step in the construction of a financial cash flow statement is the formulation of an investment plan for the project based on the information developed in the technical, demand, manpower, and financing modules. The investment plan consists of two sections: the first section deals with the expenditure on new acquisitions, and the opportunity cost of existing assets, and the second section deals with the financing aspects of the proposed investment. If there are different scales and/or locations under consideration, corresponding investment plans for each scale and/or location should be formulated. It is important that the investment plan conforms to what is a realistic time schedule given the demand for the project's output, manpower, financial, and supply constraints in the economy, as well as the technical attributes of the project.

The investment plan will contain a listing of all the expenditures to be undertaken up to the point where the facility is ready to begin its normal operations. Each of these expenditures should be identified according to the year in which it is expected to occur. In addition, every

expenditure should be broken down into two parts: first is being spent on goods and services traded internationally and the second part is being spent on goods and services traded domestically. These categories of expenditures are in turn divided into the payments received by the suppliers of these goods, payments to the government (such as tariffs, value added taxes, etc.), subsidies received from the government, and subsidies for the purchase of the investment items. Expenditures on labor for the construction of the project should be identified by year and by skill level for providing a clear understanding of its cost structure and determining if there is likely shortage of skilled works. These breakdowns are also necessary for estimating the respective shadow price of worker in the economic analysis of the project.

(a) Treatment of Assets

Depreciation expense or capital cost allowances are an accounting device to spread the cost of capital assets over the length of life of these investments so that net income in any given year will reflect all the costs required to produce the output. However, depreciation expense is not a cash outflow and thus should not be included in the financial cash flow profile of the project. The full capital costs of an investment are accounted for in the financial cash flow profile since the total amount of the investment expenditures are deducted in the year they occur. If any further capital charge, such as depreciation expense, were deducted from the cash flow profile, it would have resulted in a double counting of costs.

If the project under consideration is an ongoing concern or a rehabilitation project where some of the project's old assets are integrated into the proposed facilities, the opportunity cost of these assets should be included in the cash flow statement together with the expenditure on new acquisitions.

It is necessary to distinguish the "opportunity cost" of an asset from the "sunk cost" of an asset. The opportunity cost of using an asset in a specific project is the benefit foregone by not putting the asset to its best alternative use. To measure the opportunity cost of an asset, a monetary value has to be assigned to it in such way that should be equal to what has been

sacrificed by using it in the project rather than in its next best use. On the other hand, the value of an asset is treated as a sunk cost if the asset has no alternative use.[1]

The opportunity cost of the existing assets is generally included in the first year of the project's cash flow profile because the assets could be sold at that time if the project is not feasible. The financial opportunity cost of an existing asset is the highest financial price that it could be sold for. The highest financial price is typically the higher of the in-use value of the asset and its liquidation value. The in-use value of the asset is what it would sell for if it were to be used as an ongoing concern. The liquidation value is what the asset would sell for if broken into its different components and sold in parts. When considering the opportunity cost of any production plant, one should consider the in-use value of the plant if it continues to be operated as it is.

The most appropriate way to determine in-use and liquidation values is through reliable market assessors. When estimating in-use values using assessors, the assessor's and sales agency's fees should be subtracted from the quoted value to obtain the net in-use value. As well, when assessors give a liquidation value for a project's assets, the assessors' and sales agency's fees as well as the expenditures incurred in dismantling the assets should be netted from the quoted price to obtain a net liquidation value.

An approach to preparing an estimate of the in-use value of a set of assets is to consider their net replacement costs. The net replacement cost is the amount of expenditures that would have made today to build a facility that would provide the same amount of services in the future as would the assets that are now being evaluated. To estimate the net replacement value of an asset, two adjustments must be made to the historical purchase cost of assets. The first adjustment is for the change in the nominal prices of new assets or the same type of the asset can perform the same function as the asset being evaluated. This change in price is measured as the ratio of the current price or price index for this asset to the price or price

[1] Sunk cost involves neither current nor future opportunity cost and therefore should have no influence in deciding what will be the most profitable thing to do. It should, however, be noted that while the sunk cost of an asset should not be counted as a cost to a new project in examining its feasibility, any outstanding liabilities due

index of the evaluated asset in the year when purchased. This can be expressed as I_t/I_h, where I_t is the value of the relevant price index in year t and I_h is the value of the price index for the same assets in the year it was purchased.

The second parameter needed to estimate an asset's net replacement cost is its economic rate of depreciation. The economic depreciation rate for an asset reflects the loss in the market value of the asset, which is generally different from the depreciation rate used for tax purposes. A new asset net of cumulative economic depreciation over years represents the asset that can be still productive over its remaining lifetime.[2]

Suppose that the historical cost of a machine fully installed was A_0 and the machine's economic depreciation over years is d_t, the net replacement value (in-use value) of the machine in year t can be estimated as follows:

$$(\text{Net replacement value})_t = A_0 * (1 - \text{Proportion of Asset Depreciated } d_t) * (I_t / I_h)$$

(b) Treatment of Land

Land has an opportunity cost like every other asset when it is used by a project. Even if the land is donated to the project by the government, it should be included as part of the investment cost at a value that reflects the market value of land in the project area.

Land is a very special asset because it does not depreciate under most situations. However, due to improvements in infrastructure, the value of land may increase much faster than inflation during the life of the project. In such cases it is important not to include the increase in land value that is above inflation as part of the liquidation value of the project. In most cases the increase in the liquidation value of land (particularly in urban areas) has nothing to do with the project under evaluation. Real increases in land value usually come about because of investment being made in public sector infrastructure. It is important not to

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to that asset may become the liability of the new project if the ownership is the same.

[2] Economic depreciation rates for plants and equipment may be obtained from the plant manufacturer, technical journals, or insurance companies that insure a plant's assets.

attribute the increase in the real value of land to any particular project to avoid bias toward land intensive projects. The only exceptions to this rule occur when the project either improves or causes damage to the land. In such cases the amount of the land improvement or deterioration should be added to or subtracted from the real value of the land measured at the beginning of the project to determine the liquidation value of the land at the end of the project.

Alternatively, the opportunity cost of land can be reflected in the cash flow profile of the project by an annual rental charge. This rental charge can be estimated by using the rental rate per dollar value of the land times the real value of the land for each period of the project's life. If the annual rental charge approach is used, then neither the initial cost of the land nor its final market value should enter into the cash flow profile of the project.

(c) Investment Financing

An investment plan also deals with the means and schedules of financing the investment expenditures. The financing may consist of equity, grants, domestic short-term and long-term loans, foreign loans, concessional loans and other forms of foreign aid. They should be identified and the disbursement schedules should be formulated. Which of these financings will be included in the cash flow statement depends on the point of view considered. While appraising the project from the owner's point of view, for example, the loan disbursement is a cash inflow and the repayment of loan and interest payment are a cash outflow as the owner is looking to the net receipts after paying all debts and obligations. The analysis from a banker's point of view, however, is not concerned with the financing but is looking to determine the financial viability of the project to all investors irrespective of debtors or shareholders.

In the case of public sector projects, it is the financial performance of the entire invested capital and not just the equity portion that is relevant for investors. Often both debt and equity financing come from the same source and the loans have been either explicitly or implicitly guaranteed by the government. We will therefore begin our development of the financial cash flows of this project by making no distinction between the return received by

the lenders of debt and that received by the equity holders. In this case, the cash made available through borrowing is not considered as a cash inflow, nor are the interest or amortization payments on this debt considered as cash outflows.

The analysis of the financial cash flow from alternative points of view will be discussed later in more detail. Table 3.1 provides an example of an investment phase for a medium-scale mining project.

Table 3.1: Investment Phase for a Medium Scale Public Sector Mining Project (Thousands of dollars)

Item Year	0	1	2…..……..7
A. Expenditures			
(a) Site Preparation, Exploration, and Development			
Materials:			
- Traded (cif)	500.0	500.0	
Tariffs @12%	60.0	60.0	
VAT @10%	56.0	56.0	
- Non-traded	400.0	300.0	
VAT @5%	20.0	15.0	
Labor:			
- Skilled	150.0	100.0	
- Unskilled	200.0	250.0	
(b) Equipment			
Traded (cif)	600.0	2,000.0	
Tariffs @10%	60.0	200.0	
VAT @10%	66.0	220.0	
Total Expenditures	**2,112.0**	**3,701.0**	
B. Financing			
Government Equity	2,012.0	1,201.0	
Government Loan (short-term)	100.0	500.0	
Foreign Loan (guaranteed by government)	0	2,000.0	
Total Financing	**2,112.0**	**3,701.0**	

Interest during construction is an item that is often included as an accounting cost in the construction phase. This item is included as a cost to reflect the interest foregone because funds have been tied up in the construction of the project. It is not a measure of interest that

has actually been paid, but an accounting device to measure the opportunity cost of the funds employed in the project. If no interest has been paid by the project, then interest during construction is not cash expenditure and should not be included as expenditure in the cash flow statement of the project. On the other hand, if interest payments have been made during the period of construction, then it is a cash outflow when the project is being examined from the viewpoint of the owner.

3.3.2 The Operating Phase

The operating phase of the financial cash flow statement includes all cash receipts generated from the operation of the project and all operating expenditures. Expenditures and receipts should be projected by year of operation. Like investment expenditures, operating expenditures should be broken down into internationally traded and non-traded items; and each expenditure item should be broken down into its components, whenever possible. For example, maintenance expenditures should be broken down into materials and labor. Expenditures on different types of labor (skilled, unskilled, etc.) should be identified and recorded separately. Any taxes or subsidies associated with the operating expenditures should also be identified and recorded separately whenever possible. These breakdowns are necessary for conducting the economic analysis of the project and for providing a better understanding of the cost structure of the operating expenditures.

A cash flow statement can be developed from a set of income statements and balance sheets for each year over the expected life of the project.[3] It can be thought of as a rearrangement of the financial statements taking into account non-cash charges and other changes in current assets and liabilities to the net income. For example, an income statement includes sales and purchases, while a cash flow statement includes receipts and expenditures. Sales and purchases include credit as well as cash transactions, while receipts and expenditures are cash only. Although data for cash flow statements may not directly be available, a cash flow statement can be constructed from the information in income statements, balance sheets, and

[3] One of the main reasons for more readily available information for balance sheets and income statements is that these statements are often required by law for disclosure and tax purposes.

a series of adjustments as explained below.

(a) Adjustment for Sales

A project's viability is not only determined by the sales it generates but also by the timing of the cash receipts from the sales. A cash flow statement records sales transactions only when the cash from the transaction is received. Typically projects forecast their sales as a single line item which comprises both credit and cash transactions. Only cash sales are included in a cash flow statement.

A distinction must be made between sales and cash receipts. When a project makes a sale, the good or service may be delivered to the customer but no money transferred from the customer to the project. At this point the project's accountants will record that the project has an asset called accounts receivable equal to the amount of the sale and the proportion of it that is not in cash. In other words, the buyer owes the project for the goods or services that he has purchased and not yet paid for. Until the buyer has paid for what he has received, the transaction will have no impact on the cash flow statement. When the buyer pays for the items that he previously bought from the project, the project's accountants will record a decrease in accounts receivable by the amount that the buyer has paid and an increase in cash receipts. Thus, the cash receipts for any period can be calculated as follows:

Cash receipts for period (inflow)	=	*Sales for period*	+	*Accounts receivable at beginning of period*	-	*Accounts receivable at end of period*

Suppose the accounts receivable recorded on the balance sheet at the beginning of the period is equal to $2,000 and then equal to $2,600 at the end of the period. Sales for this period as recorded on the income statement are assumed to be $4,000. Total receipts or cash inflow for this period is calculated as follows:

Cash Inflow = $4,000 + $2,000 – $2,600 = $3,400

Accounts receivable are typically measured as a percentage of sales. It is important to ensure that the accounts receivable selected for the project are consistent with the current performance of industry standards. Also important is to assess the likelihood for bad debts and to make allowances for them. Bad debts occur when a project's customers default on their payments. It would lower the cash inflows to the project and need to be accounted for so that the cash flow statement is as realistic as possible.

It should be noted that the increase in cash receipts and the decrease in accounts receivable will be augmented by the VAT or other sales taxes associated with the sale of the items. These taxes are collected by the firm on behalf of governments and will be paid to the government later. This cash receipt will now be included in the cash flow statement of the seller as a cash inflow when this final payment is received, but the amount of sales tax will be subtracted from the net cash flow when it is submitted to the government.

(b) Adjustment for Purchase

Similar to the distinction between sales and receipts, a distinction is necessary between purchases and cash expenditures. The transaction will be recorded in the cash flow statement only when the cash from the transaction is paid. When the project makes a purchase, the good or service may be delivered to the project but no money transferred from the project to its vendor. At this point the project's accountants will record that the project has a liability called accounts payable equal to a portion of the amount of the purchase that is not paid in cash. Until the project has paid for what it has received, the transaction will have no impact on the cash flow statement. When the project pays the vendors for the items it has bought from them, the project's accountants will record a decrease in accounts payable by the amount that the project has paid and an increase in cash expenditures. Hence, cash expenditures can be calculated from the value of purchases found in the income statement, along with the value of accounts payable both at the beginning and ending of the period as follows:

Cash expenditures = *Purchases* + *Accounts Payable at* - *Accounts Payable*

for period (outflow) *for period* *beginning of period* *at end of period*

Assume that total accounts payable at the beginning of a period is equal to $3,500 and at the end of the period it is $2,800, with the value of purchases from the income statement being $3,800. Therefore, total expenditure or cash outflow is calculated as follows:

Cash Outflow = $3,800 +$3,500 – $2,800 = $4,500

Accounts payable are typically measured as a percentage of total purchases or that of a major input. It is important to ensure that the accounts payable on which the cash flow will be based are consistent with the industry standards.

(c) Adjustment for Changes in Cash Balance

Increases or decreases in cash balances can take place even when no changes occur in sales, purchases, accounts receivable, or accounts payable. For example, when cash is set aside for the transactions of the business, it is a use of cash which represents an outflow in the cash flow statement. Similarly, a decrease in cash held for transaction purposes is a source of cash for other uses by the project and thus is a cash inflow. Thus, if the stock of cash balances held to carry out transactions increases in a period, this increase is a cash outflow. On the other hand, if cash balances decrease, this decrease is a cash inflow. At the end of the project, any cash set aside will ultimately be released back to the project as a cash inflow. The amount of cash to be held for facilitating the transactions of the business is typically a percentage of the project's expenditures, sales, or major purchases.

(d) Adjustment for Other Working Capital

In order to carry out an economic activity, a certain amount of investment has to be made in items that facilitate the conduct of transactions. These items are working capital including cash, accounts receivable, accounts payable, prepaid expenses, and inventories. The first

three items have already been dealt with as explained above. Prepaid expenses such as insurance premiums are recorded in the cash flow statement as other expenditures are made.

Changes in inventories are not included in the cash flow statement. When a project purchases a certain amount of raw material, inventories will increase. These inventories are financed through a cash outflow and/or an increase in accounts payable. If the inventories have been paid for in cash, then a cash outlay has been recorded in the cash flow statement. If they have been acquired on credit terms, no cash outflow will occur and they will be recorded in purchase as an increase in accounts payable. The situation is similar when dealing with changes in the inventories of the final product. For example, a decrease in final good inventories implies an increase in sales. This in turn implies an increase in cash receipts or accounts receivable.

Since the components of working capital are developed independently in different plans, it is necessary to check for the overall consistency of working capital and ensure adequate working capital for facilitating business transactions of the project. This can be done by comparing the amount of working capital estimated for the project with the industry average or with similar businesses that are being successfully operated.

(e) Income tax Liability

Income taxes paid by the project should be included in the cash flow statement. The income tax liability is estimated on the basis of the project's income statement following the accounting and tax rules of the country concerned. Year by year estimates of cost of goods sold, interest expense, tax depreciation expenses, and overheads are all subtracted from the project's revenues to estimate the project's earning before taxes. While estimating the income tax liability, provisions for loss carry backward and forward if applicable should be taken into account.

3.3.3 Cessation of Project Operations

When a new project acquires an asset, the entire expenditure on the asset is accounted for in the cash flow statement at the time that the expenditure actually occurs. It is quite possible, however, that the life of the project will not coincide with the life of all its assets, or that the span of the analysis will not extend as far in the future as the project may be expected to operate (e.g., railway projects). Then the residual value of the asset should be included in the cash flow statement as an inflow in the year following the cessation of operations.

When determining the residual value of the assets at the end of the project, it is preferable to break down all the assets into different categories: land, building, equipment, vehicles, etc. The residual value is taken as the in-use value unless it is clear the facility will be shut down at the end of the project period. If it is to be shut down, then the liquidation value should be used as the residual value. The in-use value of the plant is the value of the plant under the assumption that it will continue to operate as an on-going concern. The liquidation value is the value of the assets if all components of the project are sold separately and perhaps even the plant is taken apart and sold.

While dealing with the in-use and liquidation in the future, general guidelines are to use the cumulative economic depreciation over years. The depreciation rates can be obtained from plant manufacturers, technical journals or the depreciation rates used by insurance companies.

Land is a special asset that generally does not depreciate. The residual value of land recorded in the cash flow statement should be equal to the market value of the land recorded at the beginning of the project, unless the project results in some improvement or deterioration to the land. For example, if a project involves an investment to improve the property such as drainage of a swamp, the residual value of the project should include the increase in land value resulted directly from an investment made by the project. The opposite is the case if the project damages the land and its value. The residual value of the land must be reduced by the amount of damage caused by the project. Notwithstanding, in many cases expectations

may indicate that land values are likely to rise faster than inflation but the increase is totally unrelated to the project.[4]

3.3.4 Format for the Pro-Forma Cash Flow Statement

While there is no specific format for presentation of the pro-forma cash flow statement for an investment project, it is important that the data should be set out in sufficient details so that the adjustments required by the economic and distributive appraisal can be easily applied to the financial cash flows. Entries for receipts and payments must be classified as outlined in the above discussion of investment and operating phases for the project. Receipts must be identified according to whether they arise from sales of traded or non-traded goods with all taxes. Payments should also be presented in a similar fashion with all taxes, tariffs, and subsidies itemized separately. Labor costs must be identified according to the type of labor used.

To illustrate the construction of the financial cash flow statement, we continue with the example of the mine. The investment phase of the project is outlined in Table 3.1. Now, we assume that mining project has an operating life of five years, and the machinery and equipment will be liquidated as scrap at the closure of mine. This is carried out in the year following the mine closure at which time the scrap is expected to yield $1,000,000. The land is assumed to have zero value after being mined. Table 3.2 contains the basic operating information required to develop the pro-forma cash flow statements for this project. For example, accounts receivable and accounts payable are assumed at 20 percent of annual sales and purchases inclusive of VAT, respectively. **[How about inventories and cash balances?**

[4] Expected increases in land values are generally speculative which implies that building such increases in the residual value of land may not occur. Moreover, the purpose of the analysis is to appraise the project and determine its impact on its sponsors. Large increases in land value may be sufficiently large, leading to the implementation of the project and a misallocation of resources. Thus, the residual value of land should be generally the same as its real price at the start of the project.

What would be the assumptions used to derive the figures shown in Table 3.2? These figures should be all consistent with those detailed figures shown in Table 3.3?]

Table 3-2: Operating Information for the Case of a Mining Project
(Thousands of dollars)

Item Year	0	1	2	3	4	5	6	7
Sales								
- Traded (domestic)			2,000.0	3,000.0	3,500.0	3,000.0	2,000.0	
- VAT @10%			200.0	300.0	350.0	300.0	200.0	
Purchases of Inputs								
- Traded (cif)			600.0	750.0	800.0	700.0	600.0	
Tariffs @10%			60.0	75.0	80.0	70.0	60.0	
VAT @10%			66.0	82.5	88.0	77.0	66.0	
- Non-traded			200.0	250.0	320.0	200.0	200.0	
VAT @5%			10.0	12.5	16.0	10.0	10.0	
Operating Labor								
- Skilled			100.0	150.0	200.0	150.0	125.0	
- Unskilled			50.0	70.0	90.0	80.0	60	
Other Expenses								
- Depreciation Expense			789.0	1,000.0	1,000.0	1,000.0	1,000.0	0
Working Capital								
(end of period values)								
- Account Receivables		0	440.0	660.0	770.0	660.0	440.0	0
- Account Payables		0	187.2	234.0	260.8	211.4	187.2	0
- Inventories		0	200.0	250.0	300.0	200.0	0	0
- Cash held as working capital		20.0	30.0	45.0	50.0	45.0	20.0	0

With the data presented in Tables 3.1, and 3.2, the pro-forma cash flow statement can be constructed in detail broken down by commodity and labor type as Table 3.3. This pro-forma cash flow statement provides the basis for the financial and economic analysis of the project which will follow. It is the net cash flow from this statement that gives us the project profile shown in Figure 3.1.

It should be noted that VAT on sales are collected by the business on behalf of the tax authority while VAT paid on purchases can be claimed back as input tax credits under most consumption type VAT system. Thus, a row of VAT input tax credit in Table 3.3 is created in order to derive the value of net cash flow for the project.

Table 3.3: Pro-Forma Financial Cash Flow Statement for an Investment in a Mine

(Thousands of dollars)

Item Year	0	1	2	3	4	5	6	7
A. Receipts:								
Domestic Sales (traded goods)			2,000.0	3,000.0	3,500.0	3,000.0	2,000.0	0
VAT @10%			200.0	300.0	350.0	300.0	200.0	
Change in Account Receivables			-440.0	-220.0	-110.0	+110.0	+220.0	+440.0
Liquidation Value (scrapped assets)								1,000.0
Cash Inflow			**1,760.0**	**3,080.0**	**3,740.0**	**3,410.0**	**2,420.0**	**1,440.0**
B. Expenditures:								
a) Site Preparation, Exploration and Development:								
Materials:								
- Traded Goods (cif)	500.0	500.0						
Tariffs @12%	60.0	60.0						
VAT @10%	56.0	56.0						
- Non-traded Goods	400.0	300.0						
VAT @5%	20.0	15.0						
Equipment:								
- Traded (cif)	600.0	2,000.0						
Tariffs @10%	60.0	200.0						
VAT @10%	66.0	220.0						
b) Input Purchases								
- Traded Goods (cif)			600.0	750.0	800.0	700.0	600.0	
Tariffs @10%			60.0	75.0	80.0	70.0	60.0	
VAT @10%			66.0	82.5	88.0	77.0	66.0	
Change in Accounts Payable			-145.2	-36.3	-12.1	24.2	24.2	145.2
- Non-traded Goods			200.0	250.0	320.0	200.0	200.0	
VAT @5%			10.0	12.5	16.0	10.0	10.0	
Change in Accounts Payable			-42.0	-10.5	-14.7	25.2	0	42.0
c) Construction Labor:								
- Skilled	150.0	100.0						
- Unskilled	200.0	250.0						
d) Operating Labor:								
- Skilled			100.0	150.0	200.0	150.0	125.0	
- Unskilled			50.0	70.0	90.0	80.0	60.0	
e) Change in Cash Held as Working Capital		20.0	10.0	15.0	5.0	-5.0	-25.0	-20.0
Cash Outflow	**2,112.0**	**3,721.0**	**908.8**	**1,358.2**	**1,572.2**	**1,331.4**	**1,120.2**	**167.2**
C. VAT: Input Tax Credit	**142.0**	**291.0**	**-124.0**	**-205.0**	**-246.0**	**-213.0**	**-124.0**	
D. Net Cash Flow	**-1,970.0**	**-3,430.0**	**656.0**	**1,516.8**	**1,921.8**	**1,865.6**	**1,175.8**	**1,272.8**

3.4 Use of Consistent Prices in the Cash Flow Forecast

When conducting a financial appraisal of a project, it is necessary to forecast prices of project inputs and outputs over the life of the project. These prices are influenced by movements in the real price of the good in question and the effect of inflation. The factors

affecting the real price and inflation are quite different. Real prices are determined by changes in the market demand and/or supply for the specific items while inflation is usually determined by the growth of the country's money supply relative to its production of goods and services. Forecast of inflation is generally beyond the responsibility of the project analyst. However, trends in the growth of prices and the recent history of monetary policy will often provide a substantial basis for the construction of forecasts of the general rate of inflation. In any case, it is the project analyst that must make the final judgment as to the veracity of the forecasts of these prices.

The projection of the future path of real prices is of particular importance if the price of one or more input or output is significantly above or below its normal level or trend. To understand the impact of real price changes and inflation on the financial viability of a project and how they are incorporated in the analysis, we first consider the definition or derivation of various price variables employed in the analysis.

3.4.1 Definition of Prices and Price Indices

(a) Nominal Prices

The nominal prices of goods and services are those found in the marketplace, and are often referred to as current prices. Historical data for nominal prices are relatively easy to obtain, but forecasting nominal prices in a consistent manner is a notoriously difficult task. The nominal price of an item is the outcome of two sets of economic forces: macroeconomic forces which determine the general price level or inflation, and the forces of demand and supply for the item which causes its price to move relative to other goods and services in the marketplace. In order to construct a cash flow forecasts in nominal prices, we must take into consideration the movement of both real prices and the general price level.

(b) Price Level and Index

The price level for an economy (P_L^t) is calculated as a weighted average of a selected set of nominal prices:

$$P_1^t, P_2^t, P_3^t, \ldots\ldots\ldots P_n^t$$

The price level P_L^t can be calculated for any period (t) as follows:

$$P_L^t = \sum_{i=1}^{n} P_i^t W_i \qquad (3.1)$$

where: i denotes the individual good or service included in the market basket;

P_i^t denotes the price of the good or service at a point in time;

W_i denotes the weight given to the price of a particular good or service (i); and $\sum W_i = 1$.

The weights used for calculating a price level are defined as of a certain date. This date is referred to as the base period for the calculation of the price level. The weights established at that time will rarely change because we want to compare the level of prices of a given basket of goods between various points in time. Hence, it is only the nominal prices which change through time in equation (3.1), while the weights (W_1, W_2, …,W_n) are fixed.

Instead of calculating the price level for the entire economy, a price level may be created for a certain subset of prices such as construction materials or consumer goods. It is generally useful to express the price level of a basket of goods and services at different points in time as a price index (P_I^t). The price index simply normalizes the price level so that in the base period the index is equal to one. If we wish to calculate a price index that compares the price levels in two distinct periods, we can write the equation as follows:

$$P_I^t = P_L^t / P_L^B \qquad (3.2)$$

where P_I^t denotes the price level in period (t), and P_L^B denotes the price level for the base period (B). For example, the consumer price index is a weighted average of the prices for a selected market basket of consumer goods. The investment price index is created as a weighted set of goods and services that are of an investment nature. The change in the price index for a broad set of goods and services is used to measure the rate of inflation in the economy.[5]

Suppose there are three commodities in a basket of consumer goods and their prices in Year 1 are \$30, \$100, and \$50 as shown in Example 1. The corresponding weights of these goods are 0.2, 0.5, and 0.3. The price level in Year 1 is \$71 using equation (3.1). If the prices of these three goods in Year 2 become \$40, \$110, and \$40, respectively, the weighted average of the price level will be \$75. Similarly, the price level in Year 3 as shown in the example is \$73.

Example 1: Nominal Prices and Changes in Price

Assume Year 1 is Base Year

Goods	**1**	**2**	**3**
Weights	**0.2**	**0.5**	**0.3**
Nominal Prices Year 1:	$P_1^1 = 30$	$P_2^1 = 100$	$P_3^1 = 50$
	$P_L^1 = 0.2\,(30) + 0.5\,(100) + 0.3\,(50) = 71$		
	$P_L^B = 71$		
	Price Index $P_I^1 = 1.00$		
Nominal Prices Year 2:	$P_1^2 = 40$	$P_2^2 = 110$	$P_3^2 = 40$
	$P_L^2 = 0.2\,(40) + 0.5\,(110) + 0.3\,(40) = 75$		
	Price Index $P_I^2 = 1.056$		
Nominal Prices Year 3:	$P_1^3 = 35$	$P_2^3 = 108$	$P_3^3 = 60$
	$P_L^3 = 0.2\,(35) + 0.5\,(108) + 0.3\,(60) = 79$		
	Price Index $P_I^3 = 1.113$		

- **Inflation Rate: Changes in General Price Level** (Measured in terms of a price index)

  $g P_I^2 = [(P_I^2 - P_I^1)/(P_I^1)] * 100 = [(1.056 - 1.00)/(1.00)] * 100 = 5.63\%$

  $g P_I^3 = [(P_I^3 - P_I^2)/(P_I^2)] * 100 = [(1.113 - 1.056)/(1.056)] * 100 = 5.33\%$

[5] In some countries the consumer price index is the best instrument for the measurement of inflation, for others it is the implicit GDP deflator.

Using the price level in Year 1 as the base period, we can calculate the price indices based on equation (3.2) at 1.00, 1.056, and 1.113 for Year 1, Year 2, and Year 3.

(c) Changes in General Price Level (Inflation)

Inflation is measured by the change in the price level divided by the price level at the beginning of the period. The price level at the beginning of the period becomes a reference for determining the rate of inflation throughout that particular period. Hence, inflation for any particular period can be expressed as in equation (3.3).

$$gP_I^e = [(P_I^t - P_I^{t-1}) / P_I^{t-1}] \times 100 \qquad (3.3)$$

Inflation is much more difficult to forecast than the changes in real prices, because inflation is primarily determined by the supply of money relative to the availability of goods and services in an economy to purchase. The supply of money, in turn, is often determined by the size of the public sector deficit and how it is financed. If governments finance their deficit by borrowing heavily from the Central Bank, inflation is inevitably the end result.

In the evaluation of an investment, we need not attempt to make an accurate forecast of the rate of inflation. It is essential, however, to make all the other assumptions concerning the financing and operation of the project consistent with the assumed rate of inflation. In most countries, the rate of inflation is a risk variable which we must try to accommodate through the financial design of the project. For example, even though the historical rates of inflation in the economy may be only 5 or 6%, we may want to see if the project can survive if the rate of inflation is much higher. If the analysis demonstrates that it will be severely weakened, then we may want to ask whether the project can be redesigned so as to better withstand such unanticipated rates of inflation.

(d) Real Prices

Real prices (P_{iR}^t) are an important subset of relative prices where the nominal price of an

item is divided by the index of the price level at the same point in time. They express prices of the goods and services relative to the general price level. This is shown by equation (3.4).

$$p_{iR}^{t} = p_{i}^{t} \ / \ p_{I}^{t} \qquad (3.4)$$

where P_i^t denotes the nominal price of good or service at time (t), and P_I^t denotes the price level index at time period (t).

Dividing by a price level index removes the inflationary component (change in the general price level) from the nominal price. This allows us to identify the impact of the forces of demand and supply on the price of the good relative to other goods and services in the economy.

Example 2 illustrates how real prices are calculated using equation (3.4). For instance, the real price of good 1 in Year 2 is \$37.87, which is obtained from dividing the nominal price \$40 by the price index 1.056.

Example 2: Real Prices and Changes in Real Price			
Goods	**1**	**2**	**3**
Weights	**0.2**	**0.5**	**0.3**
Nominal Prices Year 1:	$P_1^1 = 30$	$P_2^1 = 100$	$P_3^1 = 50$
	Price Index $P_I^1 = 1.00$		
Real Prices Year 1:	$P_{1R}^1 = 30/1$	$P_{2R}^1 = 100/1$	$P_{3R}^1 = 50/1$
	$= 30$	$= 100$	$= 50$
Nominal Prices Year 2:	$P_1^2 = 40$	$P_2^2 = 110$	$P_3^2 = 40$
	Price Index $P_I^2 = 1.056$		
Real Prices Year 2:	$P_{1R}^2 = 40/1.056$	$P_{2R}^2 = 110/1.056$	$P_{3R}^2 = 40/1.056$
	$= 37.87$	$= 104.16$	$= 37.87$
Nominal Prices Year 3:	$P_1^3 = 35$	$P_2^3 = 108$	$P_3^3 = 60$
	Price Index $P_I^3 = 1.113$		
Nominal Prices Year 3:	$P_{1R}^3 = 35/1.113$	$P_{2R}^3 = 108/1.113$	$P_{3R}^3 = 60/1.113$
	$= 31.45$	$= 97.04$	$= 53.91$
• **Changes in Real Prices Year 2:**			
Change in $P_{1R}^2 = [(P_{1R}^2 - P_{1R}^1)/(P_{1R}^1)] =$	$(37.87 - 30)/30$	$(104.16 - 100)/100$	$(37.87 - 50)/50$
	$= 0.2623$	**$= 0.0416$**	**$= -0.2426$**

- **Changes in Real Prices Year 3:**

  Change in P_{1R}^{3} $= [(P_{1R}^{3} - P_{1R}^{2})/(P_{1R}^{2})] =$

  $(31.45 - 37.87)/37.87$ $(97.04 - 104.16)/104.16$ $(53.91 - 37.87)/37.87$

  $= -0.1695$ **$= -0.0683$** **$= 0.4235$**

It should be noted that real prices are sometimes referred to constant prices, which, as the name implies, do not change over time. They are simply a set of nominal price observations as of a point in time that is used for each of the subsequent periods in a project appraisal. While nominal prices are affected by changes in real prices as well as changes in the price level, constant prices reflect neither of these economic forces. If constant prices are used throughout the life of the project, then we are ignoring both the changes in real prices, which may have a profound impact on the overall financial position of the project, and the impact which inflation can have on the performance of an investment. The use of constant prices simplifies the construction of a cash flow profile of a project, but it also eliminates from the analysis a large part of the financial and economic information that can affect the future performance of the project.

(e) Changes in Real Prices

The change in the real price of a good or service can be expressed as:

$$\Delta p_{iR}^{t} = \frac{p_{iR}^{t} - p_{iR}^{t-1}}{p_{iR}^{t-1}} \tag{3.5}$$

where p_{iR}^{t} denotes the real price of good (i) as of a specific period.

Using Example 2 and equation (3.5), we can compute that the change in real price of good 1 in Year 3 is -16.95%.

For each of the inputs and outputs a set of projections must be prepared in the path of its real price over the life of the project. For items where rapid technological change is taking place, such as computers, we would expect that the real price of those goods would fall. For goods

such as copper, where one of its primary uses has been dramatically reduced by the introduction of fiber optics and microwave transmission, we would expect that prices would be dampened over time.

There is one important input, however, whose relative price is almost certain to rise if there is economic development in the country. This is the real wage rate. If economic development takes place, the value of labor relative to other goods and services will have to rise. Hence, in the forecasting of real prices for a project we should consider the potential for real wages to rise and build this into the cost of inputs for a project over its life.

(f) Inflation Adjusted Values

Inflation adjusted values for prices of inputs and outputs are the result of our best forecast of how real prices for particular goods and services are going to move in the future, and this forecast is then adjusted by an assumed path of the general price level over future periods. In other words, we are producing a set of nominal prices which are built up from their basic components of a real price and a price level. These inflation adjusted values are generated in a consistent fashion. A common mistake of project evaluators is to assume that many of the prices of inputs and outputs for a project are rising relative to the rate of inflation. This is highly unlikely. The price level itself is a weighted average of individual goods and services prices. Hence, in the forecast of the real price of goods and services, we would expect that approximately as many real prices will be falling as they are rising.

To forecast the movement of the real price of a good or service, we need to consider such items as the anticipated change in the demand for the item over time, the available supplies, and the forces which are going to affect its cost of production. This analysis is very different from that which goes into the forecast of the general price level. This forecast is not so much a prediction, but a set of consistent assumptions. It is the inflation-adjusted values which we use in the estimation of the nominal cash flows of a project. They can be estimated using equation (3.6):

$$\hat{P}_i^{t+1} = P_i^t (1 + gP_{iR}^t)(1 + gP_I^e) \quad (3.6)$$

Where $\hat{P}_i^{t+1}$ denotes the estimated nominal price of good (i) in year *t+1;*

P_i^t denotes the nominal price of good (*i*) in year *t;*

gP_{iR}^t denotes the estimated growth in real price of good (*i*); and

gP_I^e denotes the assumed growth in price level index from year *t* to year *t+1*.

Two specific prices are discussed below due to the important role they play in the financial analysis of projects. These are the interest rate and the price of foreign exchange.

3.4.2 Nominal Interest rate

The most important feature for integrating expectations about the future rate of inflation (gP^e) into the project evaluation is to ensure that such expectations are consistent with the projections of the nominal rate of interest. Lenders increase the nominal interest rate on the loans they give to compensate for the anticipated loss in the real value of the loan caused by inflation. As the inflation rate increases, the nominal interest rate will be increased to ensure that the present value of the interest and principal payments will not fall below the initial value of the loan.

The nominal interest rate, as determined by the financial markets, is made up of three major components: the real interest rate (r) which reflects the real time value of money that lenders require in order to be willing to forego consumption or other investment opportunities, a risk factor (R) which measures the compensation lenders demand to cover the possibility of the borrower defaulting on the loan, and a factor $(1+r+R)gP^e$ which represents the compensation for the expected loss in purchasing power attributable to inflation. The real interest rate will be fairly constant because it is primarily determined by the productivity of investment and the desire of consumption and saving in the economy. The risk premium is typically associated with the sector and investor and is known. Inflation reduces the future value of

both the loan repayments and real interest rate payments. Combining these factors, the nominal (market) rate of interest (i) can be expressed as:

$$i = r + R + (l + r + R)\, gP^e \qquad (3.7)$$

To explain this concept more fully, let us consider the following financial scenarios. When both risk and inflation are zero, a lender would want to recover at least the real time value of money. If the real interest rate r is 5 percent, then the lender would charge at least a 5 percent nominal interest rate. If the lender anticipates that the future rate of inflation will be 10 percent, then he would want to increase the nominal interest rate charged to the borrower in order to compensate for the loss in purchasing power of the future loan and interest rate payments. Maintaining the assumption that there is no risk to this loan, we can apply the equation (3.7) to determine what nominal interest rate he would need to charge to remain as well off as when there was no inflation:

$$\begin{aligned} i &= r + R + (l + r + R)\, gP^e \\ &= (0.05) + (0) + (1+ 0.05 + 0)\cdot 0.1 \\ &= 15.5\% \end{aligned}$$

Thus, the lender will need to charge a nominal interest rate of at least 15.5 percent to achieve the same level of return as in the zero inflation scenarios.

If the rate of inflation is expected to change through time and if refinancing of the project's debt is required, then the nominal interest rate paid must be adjusted to be consistent with this new expected rate of inflation. This should have little or no direct effect on the overall economic viability of the project as measured by its NPV; however, it may impose very severe constraints on the liquidity position of the project because of its impact on interest and principal payments if not properly planned for.

3.4.3 Expected Nominal Exchange Rate

A key financial variable in any project using or producing tradable goods is the market rate of foreign exchange (E^M) between the domestic and the foreign currency. This market exchange rate is expressed as the number of units of domestic currency (#D) required to purchase one unit of foreign exchange (F). The market exchange rate refers to the current nominal price of foreign exchange. It needs to be projected over the life of the project. The market rate between the domestic and the foreign currency can be expressed at any point in time (t) as:

$$E_t^M = (\#D/F)_t \tag{3.8}$$

The real exchange rate, $E_{t_n}^R$, can be defined as follows:

$$E_{t_n}^R = \frac{\#D \,/\, I_{t_n}^D}{F \,/\, I_{t_n}^F} = \frac{\#D}{F}\frac{I_{t_n}^F}{I_{t_n}^D}$$

$$\text{or, } E_{t_n}^R = E_{t_n}^M \frac{I_{t_n}^F}{I_{t_n}^D} \tag{3.9}$$

where $E_{t_n}^M$ denotes the market rate of exchange in year t_n and $I_{t_n}^D$ and $I_{t_n}^F$ represent the price indices in year t_n for the domestic currency country and the foreign currency country, respectively.

The difference between the real and the nominal exchange rate at a given point in time, t_n, lies in the relative movement of the price index of foreign to the domestic country as measured from an arbitrary chosen point in time, t_b (base year) to the time of interest, t_n. The cumulative inflation for the domestic country over a period of time is given by the domestic price index $I_{t_n}^D$. The domestic price index at any point in time t_n can be expressed as the price

index in any initial year t_0, $I^D_{t_0}$, times the cumulative change in the price level from time t_0 to t_n. This is given as follows:

$$I^D_{t_n} = I^D_{t_0} \prod_{i=1}^{n} \left(1 + gp^{de}_{t_0+i}\right) \tag{3.10}$$

where gp^{de}_i is the rate of inflation in the domestic economy.

Similarly, the foreign price index at any point in time t_n, using the same reference year t_0 as the base year, can be expressed as the price index in any initial year t_0, $I^F_{t_0}$, times the cumulative change in the price level from time t_0 to t_n. This is given as follows:

$$I^F_{t_n} = I^F_{t_0} \prod_{i=1}^{n} \left(1 + gp^{fe}_{t_0+i}\right) \tag{3.11}$$

where gp^{fe}_i is the rate of inflation in the foreign economy.

By substituting (3.10) and (3.11) into equation (3.9), we can calculate nominal exchange rate as:

$$\mathrm{E}^{\mathrm{M}}_{\mathrm{t_n}} = \mathrm{E}^{\mathrm{R}}_{\mathrm{t_n}} \times \frac{I^D_{t_0} \prod_{i=1}^{n} \left(1 + gp^{de}_{t_0+i}\right)}{I^F_{t_0} \prod_{i=1}^{n} \left(1 + gp^{fe}_{t_0+i}\right)} \tag{3.12}$$

For convenience when conducting the financial appraisal of a project, we can select the first year of the project, t_0, as the arbitrary reference point or base year for the calculation of the relative price indices. Using t_0 as the base year, then both the values for $\mathrm{I}^{\mathrm{D}}_{\mathrm{t_0}}$ and $\mathrm{I}^{\mathrm{F}}_{\mathrm{t_0}}$ will be equal to one in that year. Hence, there will be no difference between the real and nominal exchange rates in that base period.

In the case where the initial price levels for the domestic and the foreign country are set equal to 1 in time period t_0, then the expression (3.12) for the market exchange rate can be simplified to,

$$E^{M}_{t_n} = E^{R}_{t_n} \times \frac{\prod_{i=1}^{n}\left(1+gp^{de}_{t_0+i}\right)}{\prod_{i=1}^{n}\left(1+gp^{fe}_{t_0+i}\right)} \tag{3.13}$$

The real exchange rate will move through time because of shifts in the country's demand and supply for foreign exchange. It is very difficult to predict the movement of the real exchange rate unless it is being artificially maintained at a given level through some tariffs or quantitative restrictions on either the supply or demand of foreign exchange. If the rate is not artificially maintained, the analyst usually takes the real exchange rate as constant throughout the life of the project. Consequently, the expected market exchange rate in year t_n may be estimated. The ratio of the two price indices is known as the relative price index. If through time the domestic economy faces a rate of inflation different than that of foreign trading partner, the relative price index will vary over time. If the real exchange rate is to remain constant in the presence of inflation, then the change in the relative price index must result in a corresponding change in the market exchange rate.

Since the future real exchange rate is only likely to be known with some uncertainty, and the market exchange rate might not adjust instantaneously to changes in the rate of inflation, it is more realistic to allow some flexibility in the estimation of the market exchange rate. This is carried out by assuming a range for the distribution of possible real exchange rates around an expected mean real exchange rate. To incorporate this aspect we write the above equation as follows:

$$E^{M}_{t_n} = E^{R} * (1+k)\left(\frac{\prod_{i=1}^{n}\left(1+gp^{de}_{t_0+i}\right)}{\prod_{i=1}^{n}\left(1+gp^{fe}_{t_0+i}\right)}\right) \tag{3.14}$$

where k is a random variable with a mean value of zero.

3.4.4 Incorporating Inflation in the Financial Analysis

Much of the published literature on project evaluation recommends the exclusion of inflation from the appraisal process.[6] These methods only account for projected changes in relative prices of inputs and outputs over the life of the investment.[7] However, experience with projects suffering from financial liquidity and solvency problems has demonstrated that inflation can be a critical factor in the success or failure of projects. Correctly designing a project to accommodate both changes in relative prices and changes in the rate of inflation may be crucial for its ultimate survival.

Improper accounting for the impacts of inflation when conducting the financial analysis could have detrimental effects not only on the financial sustainability of a project but also on its economic viability. Assumptions regarding inflation will have a direct impact on the financial analysis of the project and may require adjustments in the operating or investment policies. Since an inadequate treatment of inflation may adversely affect the financial sustainability of the project, ultimately the economic viability of the project may be compromised if inflation is not properly accounted for.

It is important to realize that the ultimate analysis of the financial cash flows should be carried out on a statement prepared in real domestic currency. It is not easy to analyze nominal net cash flows as one will be attempting to understand figures that reflect two changes: changes in the real price and changes in inflation. Moreover, when preparing the cash flow statement, certain variables such as tax liabilities, cash requirements, interest, and

[6] Squire, L. and van der Tak, H.G., *Economic Analysis of Projects*, Baltimore: The Johns Hopkins University Press, (1975), p. 38.

[7] All of the following authors recommend that expectations of inflation be ignored in the evaluation of projects: Little, I.M.D. and Mirrllees, J.A., *Project Appraisal and Planning for Development Countries*, London: Heineman Educational Books Ltd., (1974); Dasgupta, P., Sen, A., and Marglin, S., *Guidelines for Project Evaluation*, (Vienna: UNIDO, 1972). A more satisfactory treatment of this issue is provided by Roemer, M. and Stern, Joseph J. , *The Appraisal of Development Projects, A Practical Guide to Project Analysis with Case Studies and Solutions*, New York: Praeger Publishers, (1975), pp. 73-74.

debt repayments need to be estimated in the current prices of the years they incur. The correct treatment of inflation requires that preparatory tables be made using nominal prices, and then deflate the nominal cash flow statements to obtain the cash flow statements in real prices. By constructing the financial analysis in this manner, we ensure that, all the effects of change in real prices as well as inflation are consistently reflected in the projected variables.

Outlined below are steps required for incorporating inflation into the financial cash flow of a project in a consistent manner:

1. Estimate the future changes in the real prices for each input and output variable. This will involve the examination of the present and future demand and supply forces that are expected to prevail in the market for the item. For example, an examination of real prices of many minerals will indicate that they have been dropping a few percentage points a year over the past decade. Real wages, on the other hand, tend to increase over time as the economy grows.
2. Develop a set of assumptions concerning the expected annual changes in price level over the life of the project, and calculate expected inflation rate.
3. Determine what the nominal rate of interest will likely be over the life of the project given the expected changes in the price level estimated above.
4. Combine the expected change in real prices for each input and output with the expected change in the rate of inflation to get the expected change in the nominal price of the item.
5. Multiply the nominal prices for each item by the projections of quantities of inputs and outputs through time to express these variables in the current year's prices of the period in which they are expected to occur.
6. Begin the construction of a cash flow statement using the nominal values for the inputs and outputs.
7. Construct a profit and loss statement for each year of the project's life to determine income tax liabilities with all variables expressed in their nominal values. Depreciation expenses, cost of goods sold, and interest expenses and income tax liabilities are estimated according to taxation laws of the country in question. The

estimated income tax liabilities are included in the cash flow statement.

8. Estimate accounts receivable, accounts payable, and any changes in the stock of cash that are reflected in the cash flow statement.
9. Construct the nominal cash flow statement from the total investment point of view by assembling all projected annual cash receipts, annual cash expenditures in current prices and changes in cash balance over the life of the project.
10. Determine financing requirements along with the interest payments and principal repayments and include these items in the cash flow statement. This completes the construction of the projected variables in terms of their current values. We now have a cash flow statement in current prices from the owner's point of view.
11. Deflate all items in the owner's cash flow statement by the price index to arrive at real values for the cash flow statement. Note that loans, interest payments, and loan payments are also deflated and included in the cash flow statement in real prices.
12. Discount the net financial cash flow to the owners of the enterprise. The appropriate discount rate will be the real private opportunity cost of equity financing if the owner of the enterprise is a private owner. However, in case of public sector enterprise, the appropriate discount rate will be the target financial rate of return (net of inflation) set by government.
13. Calculate the net financial cash flow from other points of view, if necessary.

The development of pro-forma financial cash flow statements in this way ensures that the impact of inflation on the financial performance of the project is correctly accounted for. At the same time, the final financial analysis is completed with the variables expressed in terms of a constant general price level. In this way, the movement of such variables as receipts, labor costs and material costs can be compared over time without being distorted by changes in the general price level.

When the financial analysis is carried out in terms of real prices, it is essential that the private opportunity costs of capital or the target financial rates of return used as discount rates be expressed net of any compensation for the expected rate of inflation. In other words, these discount rates must be real, not nominal, variables. If a nominal private cost of capital

or target rate of return is used, the result will be a double correction for the expected changes in the general price level. Such practices will greatly distort the conclusions of the analysis concerning the financial viability of the project.

One issue is whether it is necessary to prepare a detailed financial cash flow in the case of a public sector project. The answer is clearly yes. There is hardly any difference between a public and a private project in preparing the cash flow on the cost side. On the benefit side, one has to include whatever revenues are being generated by the project along with other elements like grant/subsidy and liquidation values. In the extreme case when the services are being provided free of charge, the revenues will be zero and the financial analysis will be able to indicate the yearly requirement of funds for continuing with the project. Even if it is not possible to quantify financial benefits in monetary terms, one can apply the "cost effectiveness" criterion for public sector project selection. It is, therefore, evident that the financial analysis outlined above is both essential and feasible in the case of a public project as well.

It should be noted that the real financial prices for the input and output variables developed above are used as the base on which to estimate the economic values for the benefits and costs of the project. Once these economic costs and benefits are estimated, an economic resource flow statement can be constructed. The structure of the statement should be similar to that of the financial cash flow statement. The difference between the two statements is analyzed to determine the impacts of the project on various stakeholders.

3.5 Analyses of Investment Decisions from Alternative Viewpoints

Most investment projects can be evaluated from the prospective of different actors or institutions which are directly affected by the project. These actors or institutions in a commercial project are in fact stakeholders including the owner or equity holder, the supplier of raw materials, the workers employed in the project, the bank or financing institution, the government's budget office, or the country as a whole. In the case of projects involving some government intervention in the form of grants, subsidies, loans, or joint-venture, key stakeholders may be different from the above list depending upon the specific types of the

project. Nevertheless, it is necessary to conduct the analyses from the viewpoints of the different important stakeholders to ensure the project's sustainability and success. This is to minimize the situation in which one powerful stakeholder who is adversely affected by the project may be able to derail the entire project.

Section 3.3 has outlined the variables that are generally included in the cash flow statement while discussing how they are presented. Some variables will be relevant to the analysis from the point of view of one stakeholder but not from that of another. The most commonly-undertaken financial analyses for the commercial and government-related projects are from the viewpoints of owner, banker, government, and country. These points of view are discussed below focusing on differences in the variables included in the analyses from the different perspectives.

3.5.1 The Banker's Point of View

A banker's first and foremost interest is to determine the overall strength of the project whether potential loans the project may require are secured. A banker sees a project as an activity that generates tangible financial benefits and absorbs tangible financial resources. It disregards any distinctions in the sources of finance but asks the question whether the financial receipts generated from the operations of the project are sufficient to cover the investment and operating expenditures and to provide a sufficient return or not.

Known also as the total investment point of view, the banker takes into account all financial benefits and costs of the project so that he will be able to determine the financial feasibility of the project, the need for loans, and the likelihood of repayment on loan and interest. Included in the total investment of a project are the financial opportunity costs of any existing facilities that are integrated into the new project. The historical costs of existing assets are irrelevant to the banker. The banker typically has first claim to the project's assets

and net cash flows, so the banker's net cash flow is the project's gross receipts net of operating and investment expenditures.[8]

3.5.2 The Owner's Point of View

The owner of a project examines the incremental net income of the investment relative to what could have been earned in the absence of the project. Unlike the banker, the owner adds the loan to the net cash flows from the total investment point of view as cash receipt, and subtracts payments on interest and principal repayment as cash outlays. If the project receives any grants or subsidies from the government, these should be included as receipts in the cash flow statement. Therefore, the only difference between the analysis from the owner's point of view and that from the banker's point of view is financing.

3.5.3 The Government's Point of View

A project may require outlays from the government budget in the form of cheap credit, subsidies, grants or other transfer payments and may also generate revenues from direct or indirect taxes and fees. The analysis from the government's point of view is to ensure that the relevant government ministries have enough resources to finance its obligations to the project. If the ministry is the project owner, then the distinction between the cash flow statements from the owner's and the government point of view is the difference in their opportunity costs of funds. If, on the other hand, the government's involvement is in the form of receiving taxes and/or providing some cheap credit, subsidies, or grants, then the cash flow statement from the government's point of view will reflect these transactions.

Although the three views outlined above are the most typical points of view considered when conducting the financial analysis, it is important to analyze the impacts of the project on all

[8] In few cases a subtle difference may exist between the point of view of total invested capital and the banker's point of view. Consider, for example, a government department that is encouraging the construction of low-income housing projects by repaying the interest on the housing loan. An analysis from the total invested capital point of view will not be concerned with the loan at all whether subsidized or not. A banker, however, will be definitely more in favor of loaning to a project that receives a government loan subsidy than a similar project

involved parties. For example, if the project under consideration is likely to have a negative impact on competitors, one should anticipate their reactions and proper adjustments. It is thus necessary to estimate and signify the magnitude of the negative impacts to any affected group. These affected groups could include competitors, suppliers of inputs, downstream processors, etc. as part of the stakeholders of the project.

3.5.4 The Country's Point of View

A project can be evaluated from the country's point of view, especially when the project is undertaken by the government or involved some form of government intervention. While undertaking the evaluation from the point of view of the entire country, economic prices must be used to value inputs and outputs in order to reflect their true resource cost or economic benefit to society. The economic prices take into account taxes, subsidies and other distortions in market place. From the country's point of view, the activities that had to be foregone in undertaking the project should also be charged at real resource cost. Thus, the economic appraisal of a project adjusts the financial cash flow from the total investment viewpoint for taxes and subsidies and ignores loan and interest payments because these represent flow of funds, not real resources.

3.5.5 Relationship between Different Points of View

A project can be thought as a bundle of transactions that cause different individuals or institutions to incur different costs and receive different benefits. The evaluation of a project from several perspectives is critical because it allows the analyst to determine whether the parties involved will find it worthwhile to finance, join, or execute the project. If the outcome of a project is attractive to the owner but not to the financing institution or to the government's budget office, the project could face problems securing official approval and funding. Alternatively, if a project is profitable from the viewpoint of a banker or the budget office but unprofitable to the owner, the project could face problems during implementation.

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that does not receive the subsidy.

In short, to insure approval and successful implementation a project must be attractive to all the investors and operators associated with the project.

To illustrate the different analyses available for evaluating a project, we provide an example of a project with the following stylized facts:

1. The project will last two years, labeled years 0 and 1. The project will be built during year 0, start operating at the beginning of year 1, and terminate at the end of year 1.
2. During year 0, $1,000 is spent in the purchase of machinery.
3. To finance the project, the owner will require a loan from a private bank equivalent to 50% of the initial investment cost. The repayment on the interest and the principal of the loan is due in year 1. The loan carries a 10% interest.
4. The project generates $300 in sales in year 1 and receives a subsidy equivalent to 50% of the sales value. Operating costs are $140 in year 1. Taxes amount to $100.
5. The equipment of the project is sold at the end of year 1 for $950.
6. The project will create water pollution. The cost of cleaning the water contaminated by the project has been estimated at $50 per year of operation. The government will not require the investor to clean up after the completion of the project.
7. The land for the project, currently owned by the developer of the project, has an opportunity cost as it could have been rented to others for $30 per year.

The cash and/or resource flows of the project can be rearranged as viewed by different actors such as the owner, banker, government budget office, and the country as a whole following different accounting conventions. This is presented in Table 3.4.

Table 3.4: Net Resource Flow from Different Viewpoints (Dollars)

	Financial Analysis						Economic Analysis	
Viewpoints:	Owner		Bank		Government		Country	
Year:	0	1	0	1	0	1	0	1
Sales		300		300				300
Operation Cost		-140				-140		-

140							
Equipment	-1,000	950	-1,000	950		-1,000	950
Subsidy		150			150	-150	
Taxes		-100			-100	100	
Loan	500	-500					
Interest		-50					
Externality							-50
Opportunity Cost of Land	-30	-30	-30	-30		-30	-30
Net Resource Flow	-530	580	-1,030	1,130	-50	-1,030	1,030

The returns of this project differ from alternative viewpoints. Moreover, the analysis of the project from a financial and an economic perspective and from the viewpoints of the owner and the country can lead to four possible results, as shown in Figure 3.2.

In cell (A), the project ought to be undertaken because it generates net benefits to the owner and to the country. In cell (D), the project generates net losses to both parties and, consequently, should not be undertaken. In between, one finds ambiguous cases. In cell (B) the project is profitable to the owner, but generates loss to the society. This may occur for project such as cultivation of a crop with extensive pesticides, which may harm people living in the project area. If the government increases its taxation of this activity, owners may find it unprofitable to invest in the project. If the government imposes taxes, the activity will shift from cell (B) to cell (D). In this case, the project should not be undertaken if it is unprofitable to society.

Figure 3.2: Profitability Calculations from Owner's and Economy's View

		Economic (country)	
		+	**(-)**
Financial	**+**	**(A)**	**(B)**
(owner)	**(-)**	**(C)**	**(D)**

In cell (C), the project generates net economic benefits to society but net losses to the owners. Consequently, equity holders will not endorse or undertake the project on their own. Such an activity may include the cultivation of trees, which enhance watershed protection, bio-diversity, and erosion control. Although these services benefit society, they do not generate enough income to the private owner. If the government provides subsidizes in order to lure investors to participate in the activity, the project will shift from being a cell (C) type activity to being a cell (A) type activity. In such a situation, it is both socially profitable and the owners will have an incentive to undertake the project.

From this analysis, we can see how important it is to have projects that are attractive from both the financial as well as society's point of view. In order for socially profitable projects to be implemented, they must be designed to be financially viable. On the other hand, projects those are financially attractive but have negative economic returns will cause damage to the economy and are worse than doing nothing.

3.6 Conclusion

This chapter begins with the presentation of the main concepts, principles and conventions involved in the development of pro-forma financial statements of an investment project. As projects usually for many years, forecasts of capital investment, quantities and prices of inputs and outputs over the life of the project are uncertain but the data are necessary and required for the financial analysis of its commercial viability.

We have described the process of adjusting sales and costs of production with financial credits and also have developed ways to make projections with consistent prices over the life of the project. Included items are not only the movement of the real prices of inputs and outputs of the project but also nominal interest rates and nominal exchange rate that must be integrated with expectations about the future rate of inflation. The rationale has been made that inflation should be addressed when conducting an evaluation due to its effects on financial variables in the process. In any case, steps and general guidelines for the construction of financial cash flows are also provided.

An investment project, especially the public sector project, is often involved different stakeholders. They are most concerned what the project would have impact on them. To ensure the project's sustainability, the assessment of projects from different points of view is warranted to minimize the adverse effect by stakeholders.

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Annex 3.1

Steps in Constructing the Pro Forma Cash Flow Statements

The data requirements for conducting a project appraisal have been outlined in Chapter 3. This annex will provide a practical approach to constructing the financial cash flow statement starting from the very beginning. The construction of a cash flow statement requires that the data be organized in a number of preparatory tables in Excel that culminate in the cash flow statement.

1. All project parameters are extracted from the project documents and placed in the Table of Parameters. Table of Parameters includes all the raw data that the construction of the cash flow statements will require. This will include prices, costs, production coefficients, financing terms, inflation and exchange rates, depreciation rates, working capital and all other data that will be used in the analysis. It is imperative that all data entry in the spreadsheet be completed in the Table of parameters. The construction of all other tables should be based on formulas and equations linked to the data in the Table of Parameters. This is crucial to maintain the integrity of the spreadsheets for sensitivity and risk analyses.

2. After all required data have been input to the Table of Parameters, a Table of inflation and exchange rates is constructed. In this table, we develop domestic inflation and foreign inflation indices for the life of the project. These indices are based on the expected rates of domestic and foreign inflation. The table also contains a relative inflation index that measures the change in the general price level of the domestic currency relative to the foreign currency. It is used to determine the nominal exchange rate over the life of the project. There will be no need for including exchange rates if none of the project's inputs are imported and none of its outputs are exported. The reference year for estimating inflation is taken as the first year for convenience. As a result, the relative inflation index for the first year of the project will be equal to 1.00. Typically, the project analyst takes the real exchange rate as constant; the nominal

exchange rate is only affected by the relative change in the inflation rates of the domestic and foreign currencies.

3. The next table(s) will contain all the data on sales and purchases. It will be used to estimate the unit cost of production. On the sales side, quantities produced and quantities sold are introduced. The expected sales prices over the life of the project should be determined. Quantities sold should be multiplied by nominal prices to generate revenues. To determine the nominal price of an item, we first include changes in real prices, if any are expected, and then apply the inflation index. If the sales are for the domestic market, the prices expressed in domestic currency and the domestic inflation index should be applied. If we are dealing with exports and the prices are expressed in foreign currency, then the foreign inflation index should be applied to the real prices. Prices of all inputs are determined in exactly the same manner. This includes labor of all types, and overheads. Total costs are aggregated and divided by the total output produced to determine the unit cost of production.

4. Next is to estimate the costs of good sold, which are used in the income tax statement to determine the project's income tax liability. Based on the inventory policy followed by the project and whether FIFO or LIFO, or any other accounting method is used, physical units sold are identified in terms of when they were produced and the respective cost of production is applied to each unit. For example, if all of a year's sales were produced in the same year, then the unit cost of production of the year is the relevant one. If however, only 70% of the sales of this year were produced this year, with the balance produced the previous year, then the costs of goods sold will be determined by multiplying 70% of the sales by the unit cost of production of this year, and the remaining 30% by the unit cost of production of the previous year.

5. The working capital table typically includes two sections. The first section includes the impacts of working capital on the cash flow statements of the project. This includes the changes in accounts receivable, changes in accounts payable and changes in cash

balance. Accounts receivable, accounts payable and cash balances are typically based on the amount of sales or purchases and should be linked to nominal sales and/or purchases. In the second section, the project analyst will estimate the initial working capital requirements for the project. This will be either financed through equity or through debt.

6. The investment and depreciation schedule is prepared next. This table includes all investment data. The prices should be expressed in nominal terms. This table serves two purposes. The first is to determine the depreciation expense that will be included in the income statement to determine the income tax liability. In this case, the rate of depreciation used is specified by the tax and accounting rules. The second purpose is to develop residual values for the project's assets. These are typically based on economic rates of depreciation for the depreciable assets. The economic rate of depreciation will be applied to the value of the asset in the year it was acquired. So the residual value obtained will be in the purchasing power of the year of acquisition. Since we construct the cash flow statement in nominal prices before deflating it to real prices, the residual values expressed in the purchasing power of the year of acquisition are adjusted to reflect the increase in purchasing power.

   Land is typically an undepreciable asset. It will be adjusted for inflation only to arrive at the value of the land in nominal prices in the final year of the project.

7. The financing schedule typically includes all the loans by date of disbursement. Repayments of financing cost are estimated using nominal interest rates and broken down by interest and principal. Interest expense is used in the income statement to help determine the tax liability of the project. If the loan is denominated in foreign currency and will be paid back in foreign currency, then the entire repayment schedule should be worked out in foreign currency. The loan and repayment flows are then converted into domestic currency using the nominal exchange rates.

8. If the project is to pay taxes, then an income statement should be constructed. The income statement is constructed in nominal terms. The costs of goods sold, depreciation and amortization expenses, overheads, and interest expense that have been prepared earlier are all subtracted from nominal sales. Net income is then derived and the tax liability determined. The income tax liability is used in the cash flow statement, which is constructed in the next step.

9. All the ingredients of the cash flow statement have been prepared. The only thing left is to assemble these components to construct the cash flow statement. We start with the cash flow statement from the point of view of total invested capital.

   - Nominal cash receipts are typically made up of the following: sales and changes in accounts receivable to adjust for credit sales, and the residual values of the project's assets. All receipts inclusive of VAT and other sales taxes are added up for each year to determine annual cash inflows.
   - Nominal expenditures are broken down into investment expenditures and operating expenditures and included in the cash flow statement. If the project is using any existing assets the opportunity cost of these assets should be included with the investment expenditures. Nominal operating expenditures inclusive of VAT and other sales taxes are included in the cash flows. Changes in the cash balance and accounts payable should also be included. Finally, the income tax liability is also part of the cash outflows. All expenditures are added up for each year to determine annual cash outflows.
   - VATs on sales are collected on behalf of the tax authority and VAT on purchases can be claimed as input tax credit. Thus, the amount of VAT collected in excess of input tax credit should be netted out of the cash flows.
   - Nominal net cash flows are derived by subtracting the nominal cash outflows from the nominal cash inflows and adjusting for net VAT collected.

10. The cash flow statement in nominal prices from the owner's point of view is constructed by adding the debt as inflows and interest and principal repayment as outflows to the cash flow statement estimated from the viewpoint of total invested capital.

11. The cash flow statements in real prices from the owner's point of view are estimated by deflating each item in the nominal cash flow statement by the corresponding inflation index for the year.

Annex 3.2

Impacts of Inflation on Financial Cash Flows

The effects of inflation on a project's financial condition include: a) direct impacts from changes in investment financing, cash balances, accounts receivable, accounts payable and nominal interest rates, b) tax impacts including interest expenses, depreciation and inventories, and c) the impact on the market exchange rate. Inflation alters the amount and timing of the financial gains and losses of the various parties involved in a project including the owner, the lender and the government. Correctly accounting for those changes is necessary to determine how the overall project, and each of the interested parties, is affected by different levels of inflation.

A3.2.1 Direct Effects

(a) Investment Financing

When estimating the amount of financing an investment project requires, it is important to distinguish between two types of cost increases. First, there are cost over-runs which are caused by incorrect estimates of the quantities of materials required or changes in the real prices of those materials. Second, there is cost escalation which is attributable to general price level inflation. The "escalation" of costs that stems from pure price inflation should be recognized as normal and, if possible, should be anticipated and included in the project appraisal. If the project requires a loan or equity financing for future outlays, it should be recognized that the amount of financing needed will be affected by the amount of price inflation that takes place during the time of construction. Cost increases attributable to inflation are not overruns of real costs; therefore, additional borrowing that simply reflects the rise in the general level of prices should be planned for. If this condition is not adequately planned for at the appraisal stage, the project may experience a liquidity crisis or insolvency due to inadequate financing.

Table A3.1 demonstrates the effects of inflation on investment financing. All values are given in dollars. The project will be built during the first two periods, operate for following four, and then be liquidated in the final period. The total cost of construction will be capitalized at the end of the second period to determine the amount to be depreciated. Loans are obtained for 50% of the investment in fixed assets. Loan financing will have a nominal interest rate of 5 percent per period if there is no inflation, and interest will begin accruing during the construction period. The loan principal will be repaid at the end of the last operating year of the project, period 5. The remainder of the financing requirements is covered by the owners' equity.

In this project an investment of $5,000 is made in fixed assets in year 0, and if there is no inflation, a further $5,000 is made in year 1. If there is 25% inflation a year, the initial year's investment does not change, however, the nominal investment undertaken in year 1 increases to $6,250.

Table A3.1 Project XYZ Financing

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Price Index	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Investment Outlays	5,000	5,000	0	0	0	0	0
Inflation = 25%							
3. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
4. Investment Outlays	5,000	6,250	0	0	0	0	0
5. Impact on Financing Requirements	0	1,250	0	0	0	0	0

The presence of inflation increases the nominal amount of the investment financing required by $1,250 even when there are no increases in material needs or costs. For a 25 percent inflation rate, total nominal project costs increased from $10,000 to $11,250, or by 12.5 percent. The increased investment expense has three effects. First, it increases the interest costs to the project. Second, it increases the nominal amount of loan principal (50% of nominal investment costs) which must be repaid by the project. Finally, it results in a larger nominal depreciable expense that will be deductible from future taxes. These effects have both positive and negative cash flow impacts which are discussed below.

(b) Desired Cash Balances

Cash balances are held by a project to facilitate transactions. A commercial enterprise will need to maintain an amount of cash on hand that is related to the value of sales and purchases they carry out. If the demand for cash balances is a function only of the level of sales and sales remain constant with no inflation, then after initially setting aside the desired amount of operating cash, no further investments in the cash balances would be required. However, when there is inflation, the sales, receipts, and the cost of the goods purchased will go up even if the quantities of goods bought and sold remain the same. The resulting loss in the purchasing power of cash balances is referred to as an "inflation tax" on cash holdings.[9] Its primary effect is to transfer financial resources from the project to the banking sector. In such a situation, the project either will have to increase its cash balances in order to conduct operations or to substitute more physical resources to carry out these transactions.

The effects of an inflation tax on cash balances can be demonstrated using a simple comparison of two cases. The first case shows the cash situation for a project operating in an environment where there is no inflation. Sales will be $2,000 for each period from 2 through 5, and the desired cash balance is equal to 10 percent of the nominal value of sales. Hence, given the absence of inflation, after the initial $200 is placed in the cash account, there is no need to increase that balance. The present value of the cost of holding cash by the project is -$41 (Table A3.2, line 6).

Table A3.2 Project XYZ Cash Balance

Period	0	1	2	3	4	5	6
Inflation = 0%; Desired cash balance = 10% of sales							
1. Price Index	1.00	1.00	1.00	1.00	1.00	1.00	1.00
2. Sales	0	0	2,000	2,000	2,000	2,000	0
3. Desired Cash Balance	0	0	200	200	200	200	0
4. Change in Cash Balance	0	0	(200)	0	0	0	200
5. Real cash flow impact [4/1]	0	0	(200)	0	0	0	200
6. PV of holding cash @ 7%= (41)							

[9] Jenkins, G.P., *Inflation: Its Financial Impact on Business in Canada*, (Ottawa: Economic Council of Canada, 1975), p. 25.

However, if the inflation rate increases to 25 percent per period, the cash balances must be increased to keep abreast of the increasing nominal value of sales. We assume for the purpose of this example that the number of units sold remains the same but their nominal value increases by 25% a year due to inflation. As a result, the desired stock of cash balances will increase, requiring an additional investment of cash in the project during each period if the desired level is to be maintained (Table A3.3, row 4). After deflating these costs for inflation and discounting them, we find that the PV of the cost of the cash needed to run the business has increased substantially.

Table A3.3 Cash Balance with 25% Inflation

Period	0	1	2	3	4	5	6
Inflation = 25%; Desired cash balance = 10% of sales							
1. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
2. Sales	0	0	3,125	3,906	4,883	6,104	0
3. Desired Cash Balance	0	0	313	391	488	610	0
4. Change in Cash Balance	0	0	(313)	(78)	(98)	(122)	610
5. Real cash flow impact [4/1]	0	0	(200)	(40)	(40)	(40)	160
6. PV of holding cash @ 7% = (159)							

With zero inflation in Table A3.2, the PV of the cost of holding real cash balances was -$41. However, when the inflation rate is 25 percent, the PV of the cost of maintaining the same level of real cash balances will equal to -$159 as shown in Table A3.3, line 6. This 288 percent increase in the cost of holding cash demonstrates clearly that in an inflationary environment the need to continuously add to the stock of cash balances will add to the real costs of the project. Hence, project evaluators should incorporate a number of inflation projections in order to determine the sensitivity of total costs to the impact of inflation on the cost of holding the desired level of real cash balances.

(c) Accounts Receivable

Accounts receivable arise from making credit sales. When goods are sold and delivered but the enterprise is still awaiting payment, the value of this sale is added to accounts receivable. Such credit sales are part of the normal process of conducting business. However, in the presence of inflation, the real value of the amounts that are owed to the seller decrease the longer they are left unpaid. This creates an additional financial problem for the management of the enterprise, because they must be concerned not only with the normal risk of default

but also with the fact that the receivables are falling in real value the longer they are left unpaid.

Table A3.4 demonstrates the interaction between inflation and accounts receivable and the impact that interaction has on cash receipts. As the inflation rate rises, the value of sales increases due to the higher prices of the goods, even when the number of units sold remains unchanged. This generally leads to an increase in the amount of accounts receivable. In this case, it is assumed that receivables will be equal to 20% of sales.

Table A3.4 Accounts Receivable

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Sales	0	0	2,000	2,000	2,000	2,000	0
2. Accounts Receivable	0	0	400	400	400	400	0
3. Change in A/R	0	0	(400)	0	0	0	400
4. Real Receipts [1+3]	0	0	1600	2000	2000	2000	400
Inflation = 25%							
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Sales	0	0	3,125	3,906	4,883	6,104	0
7. Accounts Receivable	0	0	625	781	977	1,221	0
8. Change in A/R	0	0	(625)	(156)	(195)	(244)	1,221
9. Nominal Receipts [6+8]	0	0	2,500	3,750	4,688	5,859	1,221
10. Real Receipts [9/5]	0	0	1,600	1,921	1,921	1,921	321
11. Change in Real Receipts [10-4]		0	0	(79)	(79)	(79)	(79)
12. PV of the change in real receipts @ 7% = (233)							

In spite of the fact that the nominal value of sales increases each period when there is 25 percent inflation, Table A3.4 demonstrates that the PV of the real receipts for this project decreases by $233 due to the higher rate of inflation. This is because inflation causes the real value of outstanding trade credit to fall. When this situation arises, businesses selling goods or services will attempt to reduce the length of the terms they give for trade credit, while businesses purchasing the product will have an additional incentive to delay payment. If sellers are not successful at reducing the terms they give for trade credit, they will have to increase the price of the goods they sell above what would be justified by the rate of inflation. Thus, it is important to include in a project evaluation the interaction of inflation and accounts receivable to determine how the real receipts of the business are affected by inflation.

(d) Accounts Payable

Accounts payable represent the amount of money owed by a business to others for goods or services already purchased and delivered. When there is inflation, the buyer with the accounts payable benefits from having an outstanding balance because the real value of the obligation is falling during the period of time prior to the payment. This is simply the other side of the impact of inflation on accounts receivable because one enterprise's accounts receivable is another's accounts payable.

Table A3.5 shows how inflation affects a project's financial situation when accounts payable are equal to 25% of annual purchases. Once again, we see that inflation increases the nominal value of purchases which leads to greater accounts payable as well. The increased rate of inflation results in a net decrease of $155 in the PV of real expenditures. As shown in line 6, inflation increases the nominal value of purchases, and creates a corresponding increase in nominal accounts payable in line 7. When converted to real expenditures, the buyer (the project in this case) benefits from the effects of inflation on accounts payable and will have a lower overall level of expenditure, as shown in Table A3.5, row 11. This gives the buyer an incentive to extend the terms of the accounts payable to benefit from their falling real value. Hence, in the presence of inflation, the longer the outstanding accounts payable are held before being paid, the greater the benefit accruing to the buyer.

Table A3.5 Accounts Payable

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Purchases of Inputs	0	1,000	1,000	1,000	1,000	0	0
2. Accounts Payable	0	250	250	250	250	0	0
3. Change in A/P	0	(250)	0	0	0	250	0
4. Real Expenditures [1+3]	0	750	1,000	1,000	1,000	250	0
Inflation = 25%							
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Purchases	0	1,250	1,563	1,953	2,441	0	0
7. Accounts Payable	0	313	391	488	610	0	
8. Change in A/P	0	(313)	(78)	(98)	(122)	610	0
9. Nominal expenditures [6+8]	0	937	1485	1855	2319	610	0
10. Real Expenditures [9/5]	0	750	951	951	951	201	0
11. Change in real expenditures [10-4]		0	(49)	(49)	(49)	(49)	0
12. PV of the change in real expenditures @ 7%=(155)							

(e) Nominal Interest Rates

Another way inflation alters the real net financial condition of a project is through its impact on nominal interest rates. Lenders increase the nominal interest rate on the loans they give to compensate for the anticipated loss of the real value of the loan caused by inflation. As the inflation rate increases, the nominal interest rate will be increased to ensure that the PV of the interest and principal payments will not fall below the initial value of the loan. This results in increased interest payments in the short term that compensate for the decreasing value of the loan principal over the long term.

The nominal interest rate *i* as determined by the financial markets is made up of three major components: a) a factor *r* which reflects the real time value of money that lenders require in order to be willing to forego consumption or other investment opportunities, b) a risk factor *R* which measures the compensation the lenders demand to cover the possibility of the borrower defaulting on the loan, and c) a factor $(1+r+R)gP^e$ which is compensation for the expected loss in purchasing power attributable to inflation. Inflation reduces the future value of both the loan repayments and real interest rate payments. The expected rate of inflation for each period of the loan is expressed as gP^e. Combining these factors, the nominal (market) rate of interest *i* can be expressed as:

$$i = r + R + (l + r + R)\, gP^e \qquad \text{(A3.1)}$$

For example, if the real interest rate (r) is 5 percent, the risk premium and inflation are zero, then the lender would charge at least 5 percent nominal interest. If the lender anticipates that the future rate of inflation (gP^e) will be 25 percent, however, then she would want to increase the nominal interest rate charged to the borrower in order to compensate for the loss in purchasing power of the future loan and interest rate payments. Maintaining the assumption that there is no risk to this loan, the lender will need to charge a nominal interest rate of at

least 31.25% by applying equation (A3.1) to achieve the same level of return as in the zero inflation scenarios.[10]

For the project we are analyzing here, fixed assets investments are financed 50% by debt and 50% equity. All other investments such as initial supplies are financed 100% by equity. In Tables A3.6 and A3.7, the loan schedule for the debt portion of the financing is calculated under the 0% and the 25% inflation rate scenarios.

Table A3.6 Nominal Interest Rate of 5 percent

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Loan Principal	2,500	2,500	0	0	0	0	0
2. Interest	0	(125)	(250)	(250)	(250)	(250)	0
3. Loan Repayment	0	0	0	0	0	(5,000)	0
4. Real cash flow [1+2+3]	2,500	2,375	(250)	(250)	(250)	(5,250)	0
5. PV @ 5%= 0							

From the discussions above, we know that the higher rate of inflation will increase both the nominal investment required and the nominal interest rate. The higher initial capital requirement must be repaid at the higher nominal interest rate as shown in Table A3.7.

Table A3.7 Nominal Interest Rate of 31.25 percent

Period	0	1	2	3	4	5	6
Inflation = 25%							
1. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
2. Loan Principal	2,500	3,125	0	0	0	0	0
3. Interest	0	(781.3)	(1,757.8)	(1,757.8)	(1,757.8)	(1,757.8)	0
4. Loan Repayment	0	0	0	0	0	(5,625.0)	
5. Nominal cash flow [2+3+4]	2,500	2,343.7	(1,757.8)	(1,757.8)	(1,757.8)	(7,382.8)	0
6. Real cash flow [5/1]	2,500	1,875.0	(1,126.8)	(901.4)	(720.4)	(2420.6)	0
7. PV @ 5%= 0							

Comparing Tables A3.6 and A3.7, we find that the PVs of both loans are the same. This demonstrates that a loan with a 31.25% interest rate when inflation is 25 percent has the same PV as a loan with an interest rate of 5% when inflation is zero. The crucial differences are between the timing and amount of repayment. The higher nominal interest rate of 31.25%

[10] At this point the subsequent adjustment of interest rates brought about by the impact of the taxation of interest payments is ignored as is the impact of changes in net-of-tax interest rates on the demand and supply of loanable funds. For an excellent discussion of these issues see Martin Feldstein, "Inflation, Income Taxes and

and higher inflation forces the project to repay its loans faster than if the inflation rate and nominal interest rates were lower. Table A3.8 shows the difference between the project's cash flow in the two scenarios.

Table A3.8 Comparison of Real Cash Flows

Period	0	1	2	3	4	56
1. 31.25% interest with 25% inflation	2500	1875	(1126.8)	(901.4)	(720.4)	(2420.6)0
2. 5% interest with 0% inflation	2500	2375	(250.0)	(250.0)	(250.0)	(5250.0)0
3. Difference in Real cash flow [1-2]	0	(500)	(876.8)	(651.4)	(470.4)	2829.40

In real terms, the higher nominal interest rate increases the cash outflows (or reduces the net cash inflows) of the project during periods 1-4 but decreases the value of the principal that is due at the end of the project by $2,829.4. This is important to the evaluation of the sustainability of a project because the higher outflows during the early years of the repayment period could cause liquidity problems for the project if it is not generating sufficient cash inflows.

A3.2.2 Effect on Tax Related Factors

Inflation has three impacts on the tax liabilities of a project. First, the higher interest payments shown in the previous section increase the amount of tax deduction. Second, inflation reduces the value of the depreciation allowances taken for earlier investments in the project. Finally, the method used to account for inventory has an effect on the nominal earnings that are used to determine the taxable income. These three effects offset each other somewhat.

(a) Interest Deduction

Inflation can alter the financial feasibility of a project through the impact that increased nominal interest payments have on the income tax liabilities of the enterprise. In most countries, interest payments are deductible from income for the calculation of taxes, while principal repayments are not deductible. When the expected rate of inflation increases,

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the Rate of Interest: A Theoretical Analysis," *American Economic Review*, 66, No. 5 (Dec. 1976), pp. 809-820.

nominal interest rates rise in order to compensate the lender for the loss in the purchasing power of the principal outstanding and future interest payments. Table A3.9 shows how inflation, through the way it converts some of the real value of the principal repayments into interest payments, causes tax payments to fall. The higher nominal interest payments are deductible from taxable income, hence they serve to reduce the amount of taxes which the project would otherwise be required to pay.

Table A3.9 Interest Expense

Income Tax Rate = 30%

Period	0	1	2	3	4	5	6
Inflation = 0%; Nominal Interest = 5%							
1. Interest Expense	0	(125)	(250)	(250)	(250)	(250)	0
2. Real Tax Savings [row 1*.3]	0	37.5	75	75	75	75	0
Inflation = 25%; Nominal Interest = 31.25%							
3. Interest Expense	0	(781.3)	(1,758)	(1,758)	(1,758)	(1,758)	0
4. Tax Savings [row 3*0.3]	0	234	527	527	527	527	0
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Real Tax Savings [4/5]	0	187.2	337.8	270.3	215.9	172.8	0
7. Change in Tax Savings [6-2]	0	149.7	262.8	195.3	140.9	97.8	0
8. PV of increased tax savings @ 7% = 706							

(b) Depreciation Allowance

Another factor affected by inflation is the real value of the depreciation allowances for capital goods which are deductible for income tax purposes. Most countries base the deductions for depreciation expense (capital cost allowances) on the original nominal cost of the depreciable assets. If inflation increases, then the relative value of this deduction will fall causing the real amount of income tax liabilities to increase. In Table A3.10, we see that a 25 percent rate of inflation causes the tax savings from depreciation expense deductions to fall by R1,090. This is equal to approximately 10 percent of the real value of the fixed assets being depreciated.

Table A4.10 Project XYZ: Depreciation Allowance

Straight Line Depreciation over 4 periods; Income Tax Rate = 30%

Period	0	1	2	3	4	5	6
Inflation = 0%; Depreciable Investment = 10,000							
1. Depreciation	0	0	2,500	2,500	2,500	2,500	0
2. Real Tax Savings [row 1*0.3]	0	0	750	750	750	750	0
Inflation = 25%; Nominal Depreciable Investment = 11,250							
3. Depreciation	0	0	2812.5	2812.5	2812.5	2812.5	0

4. Tax Savings [row 3*0.3]	0	0	844	844	844	844	0
5. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
6. Real Tax Savings [4/5]	0	0	541	433	346	276	0
7. Change in Real Tax Savings [6-2]	0	0	(209)	(317)	(404)	(474)	0
8. PV of change in real Tax Savings @ 7% = (1090)							

(c) Inventory Accounting

(i) First-In-First-Out (FIFO)

Further tax implications of inflation are experienced by commercial enterprises which must account for inventories of inputs and outputs. In many countries to determine the amount of taxable profit companies are required to value inventories in their accounts on a first-in-first-out basis (FIFO). This means that the price of the oldest inventories (first in) is the value which is used to determine the cost of the goods sold (COGS). The difference between the COGS and the sale price is the taxable revenue from the project.

Table A3.11 Inventory and Cost of Goods Sold - FIFO

Income Tax Rate = 30%

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Sales	0	0	2,000	2,000	2,000	2,000	0
2. Purchase of Inputs	0	1,000	1,000	1,000	1,000	0	0
3. COGS	0	0	1,000	1,000	1,000	1,000	
4. Measured Profits [1 - 3]	0	0	1,000	1,000	1,000	1,000	0
5. Real Tax Liability [4*0.3]	0	0	300	300	300	300	0
Inflation = 25%							
6. Sales	0	0	3,125	3,906	4,883	6,104	0
7. Purchase of Inputs	0	1,250	1,563	1,953	2,441	0	0
8. COGS	0	0	1,250	1,563	1,953	2,441	0
9. Measured Profits [6 - 8]	0	0	1,875	2,343	2,930	3,663	0
10. Nominal Tax Liability [9*0.3]	0	0	563	703	879	1,099	0
11. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
12. Real Tax Liability [10/11]	0	0	361	361	361	361	0
13. Change in tax liability [12-5]	0	0	61	61	61	61	0
14. PV of change in tax liability @ 7% = 193							

Taxable revenue generally increases by the rate of inflation because sale prices are affected immediately by the rate of inflation, while the costs of goods sold from inventories are valued using prices of a previous period when the nominal prices were presumably lower. For example, if the project has a one year inventory of final goods at the beginning of the

year and the inflation rate for that year is 25 percent, then nominal cost prices of the goods sold will be 25 percent lower than their selling prices one year later. The result is that the measured profits are artificially inflated which increases the tax burden in both nominal and real terms.11 From Table A3.11, row 12 and row 5, we see that by increasing the rate of inflation from 0 to 25 percent, the PV of real tax payments increases by $193.

(ii) Last-In-First-Out (LIFO)

Another system for accounting for the cost of goods sold is known as last-in-first-out (LIFO). As the name implies, the most recent goods purchased (last in) are used to measure the cost of goods sold (first out), and the prices of the project inputs are generally increasing at the same rate of inflation as the outputs sold. During the production cycle of a project, this is a benefit because the profits are not increased artificially by the presence of inflation. It also means that taxes will be lower as a result. However, LIFO has a negative aspect as well because as the activity winds down, the level of inventories is reduced. The lower prices of the goods that were purchased in earlier years are now used to calculate the cost of goods sold, resulting in inflated profits and increased taxes as shown in Table A3.12, row 13. In real terms, the tax burden increased by $177 in period 5 over the no inflation scenario.

Table A3.12 Inventory and Cost of goods Sold - LIFO

Income Tax Rate = 30%

Period	0	1	2	3	4	5	6
Inflation = 0%							
1. Sales	0	0	2000	2000	2000	2000	0
2. Purchase of Inputs	0	1000	1000	1000	1000	0	0
3. COGS	0	0	1000	1000	1000	1000	
4. Measured Profits [1-3]	0	0	1000	1000	1000	1000	0
5. Real Tax Liability [4*0.3]	0	0	300	300	300	300	0
Inflation = 25%							
6. Sales	0	0	3125	3906	4883	6104	0
7. Purchase of Inputs	0	1250	1563	1953	2441	0	0
8. COGS	0	0	1563	1953	2441	1250	0
9. Measured Profits [6-8]	0	0	1562	1953	2441	4854	0
10. Nominal Tax Liability	0	0	469	586	732	1456	0
11. Price Index	1.00	1.25	1.56	1.95	2.44	3.05	3.81
12. Real Tax Liability [10/11]	0	0	300	300	300	477	0
13. Change in tax liability [12-5]	0	0	0	0	0	177	0
14. PV of change in taxes due @ 7% =126							

11 In 1974, this effect of inflation alone caused corporate taxable income in Canada to be overestimated by more than 30 percent. See Jenkins, G.P., op. cit., Chapter 2.

Comparing the effects of inflation on the tax liability in the FIFO and LIFO accounting systems, we see that in both cases, inflation increased the taxes. With FIFO and 25 percent inflation the PV of the tax liability increased by $193 (Table A3.11), and with LIFO, the PV increased by $126 (Table A3.12).

In addition to the cost difference, the timing of the tax burden is substantially different. Using FIFO, inflation increased the taxes in each period, whereas using LIFO results in no increase in taxes in the production period but in a larger tax liability in the last sales period. LIFO defers the increased tax burden attributable to inflation until a period when there is a need to lower the level of inventories. As the lower priced inventories are drawn into the cost of goods sold, the difference between inflated sales values and older prices generates larger profits and increases the tax liability. Using LIFO could increase the overall risk associated with the project in a high inflation environment if the reason for the enterprise wanting to lower the level of inventories was financial stress or business slow down. In such a situation, the increased tax liability is concentrated in a few periods when the project is already facing problems, while with FIFO the increased tax liability is spread out over each operating period. Hence, when doing the appraisal it is important to consider the type of accounting rules used for determining the cost of goods sold to assess how inflation might affect both the timing and quantity of the tax liabilities to be paid by the project.

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