AN ASSESSMENT OF THE IMPACT OF FOREIGN EXCHANGE FLUCTUATIONS ON PROJECTS PARTLY FUNDED THROUGH FOREIGN CURRENCY DENOMINATED LOANS.

BY

SAMMY KRUSCHEV SHOLLEY CHEPKAIROR

A MANAGEMENT PROJECT SUBMITTED IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE MASTER OF BUSINESS AND ADMINISTRATION (M.B.A) DEGREE, FACULTY OF COMMERCE, UNIVERSITY OF NAIROBI.

JUNE 1988

DECLARATION

This project is my original work and has not been presented for a degree in any other University.

SAMMY K. SHOLLEY CHEPKAIROR

This project has been submitted for examination with my approval as University supervisor.

J.K. NJIRAINI

ACKNOWLEDGEMENTS

Very many people, too many perhaps, contributed to the successful accomplishment of this study. To them all I am truly grateful.

Mr. J.K. Njiraini, my supervisor, deserves my most profound thanks. Without his diligent guidance and invaluable support all through, this study would not be what it is. To him I am deeply indebted and will forever be grateful. My gratitudes also go to the managment of IDB and DFCK, especially Mr. Opande (IDB) and Mr. Kanyua (DFCK) for their assistance in making sure that the data required for this study was readily availed. My brother Ben and friends John, Louisa and Morris who toiled selflessly to ensure that the mass of data was reduced to manageable proportions. To them all, I extend my sincere thanks.

To my family; parents, brothers and sisters, and friends for their moral support in the difficult task. Last but not least to Jane N. Mbugua for spending her entire weekend to ensure that my work was typed in time.

DEDICATION

To my parents Kobilo, Sokome, AK Arap Chepsiolei

and

To all those who toil with the hope of

emerging victorious

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ABSTRACT

Foreign exchange risk is a subject worrying many holders of foreign currency denominated debt, particularly in the developing countries. Foreign currency funds are usually long-term in nature and, in Kenya, are administered by development finance organizations, mainly to finance industrial ventures. The exchange risks arising are borne by the projects financed. This study is about exchange risk and how it affects recipient projects.

The four main objectives of this study were;

(a) To investigate and determine the impact of exchange risk on projects,

(b) To demonstrate the need for, and suggest appropriate method of, incorporating exchange risk in the analysis of projects;

(c) To develop a model for predicting exchange -risk impacts, and

(d) To determine minimum hurdle rate(s) for projects holding foreign denominated currency debt.

To meet the objectives of the study, a sample of 55 projects was drawn from 109 projects financed

through foreign currency denominated loans, by the Industrial Development Bank (IDB) and the Development Finance Company of Kenya (DFCK), in the period 1974 - 1984 inclusive. Data to facilitate the computation of expected and "actual" net present values (NPVS) and internal rates of return (IRRS), and to develop the predictive model was collected for each of the projects in the sample. "Actual" NPVS and IRRS were computed by adjusting the cashflows of a project to reflect exchange losses. The regression model was designed to predict the absolute impact, of exchange risk, on a project's expected NPV. The predictor variables selected were the cost of the project, the expected NPV, and the amount of the foreign currency denominated funds.

The results of the study revealed significant impacts on the net present values of projects. Exchange risk changed the expected NPVS of projects by as much as 4.56 to 2313 percent. The regression model developed has an R^2 of 59.3 percent. The hurdle rates of return were found to range from 0.5 to 7.9 percentage points above the expected IRR, with an average of 2.6 percentage points. Cashflow adjustment was established as the "best" method of incorporating exchange risk in the analysis of projects.

CHAPTER ONE

INTRODUCTION

1.1 Background.

Foreign finances form an integral part of a developing country's resources in the attempt to attain industrialization and economic development. It is thus not surprising that Kenyan economic policy makers recognize that domestic resources are inadequate for many large industrial ventures. Foreign funds are scarce and must be judiciously utilised so that stated national objectives are easily realized. It is essential therefore that before an industrial project is embarked upon, it should be properly evaluated. This is because it can be generally and reasonably assumed that the decision to approve a project is undertaken at the expense of other projects. Improper evaluation and the subsequent investment in a project is a costly affair to a nation's development programmes and is at variance with its objectives of optimally utilising scarce resources.

The Kenyan government in a bid to effectively and efficiently utilize foreign funds has set up development finance organizations to assist in the promotion and establishment of industrial projects.

These organizations finance technically feasible and economically viable projects with either local or foreign sourced funds. Three of these organizations; the Industrial Development Bank (IDB), the Development Finance Company of Kenya (DFCK) and the East African Development Bank (EADB), provide foreign currency loans to new and/or expanding medium and large scale projects. The organizations themselves receive the foreign funds from various external organizations. In order to avoid risks arising from exchange rate fluctuations and hence assure their viability, the organizations lend the funds to projects in the currencies in which they were received. This effectively transfers the risk to the recipient projects.

A project receives a foreign currency loan and converts it to local currency at the rate prevailing at the time of receipt. At the time of repayment it must convert an equivalent amount in local currency to obtain the foreign currency required. Exchange rate fluctuations may cause the amounts received and repaid to significantly differ. Developing countries have weak currencies which constantly depreciate against the hard currencies of the industrialized nations from which most foreign currency funds are received. Thus,

when a project receives loans denominated in any of the hard currencies it is automatically exposed to the risk of exchange losses. The depreciation of the local currency results in greater cash outlays in local currency than was anticipated at the receipt of the loan - presumably at the time of project appraisal. The magnitude of the increased cash outlays may cause the net present value of a project to change from positive at appraisal to negative.

Quite a number of projects financed by IDB and DFCK have been placed under receivership while many experience severe difficulties in honouring their loan obligations. Notwithstanding the possibility of other causal factors which may give rise to these situations, the management of these organizations stated that currency depreciation constitutes a major problem. When appraising, the organizations do not take into account the possible, strenuous consequences of currency depreciation on projects cashflows[1]. It is reasonable to assume that had such consideration been given, only projects that were significantly robust to ride the storm of currency fluctuations would have been financed.

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[1]Both organization make provisions, for contingency in appraising projects. These provisions are however specifically intended to cater for cost escalation during the implementation stage of the projects.

It is in the interest of project sponsors, the finance organizations and the government that a correct evaluation of projects is undertaken. For projects with foreign currency loans in their financing portfolio, this is achieved by ensuring that exchange risk is incorporated so that optimal accept or reject decisions are made. If this is done, scarce foreign currency funds are only utilized to finance strong projects which can withstand exchange rate vagaries.

1.2 The Problem and Need for the Study.

Foreign exchange risk has received substantial attention in studies done in developed countries. However, the nature of exchange risk in these countries differs significantly from the risk experienced in developing countries, where the inevitability of depreciation causes exchange losses. In the developed nations the fluctuations in exchange rates cause losses at certain times and creates gains at others. Furthermore, the nature of exchange rate systems in these countries allow firms to anticipate exchange rate movements and undertake either hedging or speculative measures to minimize exchange losses. Studies originating in these countries have thus emphasized the hedging of foreign

exchange risks to suit their circumstances. In Kenya, the monetary authorities have the exclusive mandate to manage the currency. Hedging devices such as taking forward cover, are only available in the short run. Firms which hold long-term foreign currency denominated debt somehow have to absorb most of the exchange risks arising. Where the magnitude of such risks is high, then only extremely robust firms survive.

Due to the limited understanding of the extent and impact of exchange risks on projects in Kenya, this study is timely and important to document and highlight the problem. It is hoped that the findings of this study will increase the understanding of foreign exchange risk and argue a case for its incorporation in project analysis.

1.3 Objectives of the Study.

The four major objectives of this study are:

(i) To investigate and determine the impact of foreign exchange risks on projects partly funded through foreign currency denominated loans.

(ii) To demonstrate the need to incorporate foreign exchange risk in project appraisal and to suggest an appropriate method of doing so.

(iii) To develop a model for predicting the impact of exchange risk on projects whose loan portfolio include debt denominated in foreign currency.

(iv) To determine a minimum rate of return for projects holding foreign debt.

1.4 Importance of the Study.

This study is expected to interest many people who wish to understand the various aspects of foreign exchange risk and project analysis. It is expected to specifically benefit project sponsors, analysts and other interested parties, to enable them to reach better accept or reject decisions at the appraisal stage of projects.

To project lenders, the findings of the study should aid in the determination of the hurdle rate(s) required before projects can qualify for foreign

currency funds.

To the government, the findings should be useful during the formulation of more appropriate policy guidelines in the general area of foreign finance.

Finally, the study may provide a basis for further research to academicians wishing to investigate further the effects of exchange risk on projects holding foreign currency denominated loans.

CHAPTER TWO

FOREIGN EXCHANGE RISK

2.1 Nature of Foreign Exchange Risk.

2.11 Overview.

Kenya maintains what is referred to as a managed exchange rate system. This system pegs the Kenyan shilling to the IMF's Special Drawing Rights (SDR), which is composed of a basket of sixteen currencies of the leading industrialized nations. The Kenya currency is allowed to fluctuate against the SDR. The monetary authorities support the currency if it is set to decline below some acceptable rate. The state involvement in currency management is to some extent desirable, because it brings in an element of certainty and hence confidence, in international trade.

2.12 Types of Exchange Risks.

The possible depreciation of the Kenyan currency implies the existence of foreign exchange risks for a project which has liabilities denominated in foreign currency. A foreign exchange risk is defined as "the additional variability experienced on earnings that results from currency fluctuations".[2]

[2] Jacque, L.L., The Management of Foreign Exchange Risk, Second Edition (D.C. Heath Company, Massachussetts, 1979) p.xviii.

Basically, there are three types of foreign exposures namely translation, transaction and economic exposure. These exposures give rise to translation, transaction and economic currency risk, respectively. Translation risk arise from the need to consolidate the operations of a multinational company, carried out in different currencies, in accordance with appropriate accounting rules. Translation risk is a multinational company's concern and its consideration is irrelevant to many locally incorporated companies.

Transaction risk arises out of entering dealings in foreign denominated currencies. It arises out of transaction exposure which "refers to gains or losses that arise from the settlement of transactions whose terms are stated in a foreign currency"[3]. Generally, there are three variants of transaction exposure. The first arises when a firm has trade receiveables or payable denominated in foreign currency. A currency adjustment occuring in the intervening period between the transaction and settlement date gives rise to losses or gains. The second arises when a firm has entered into contracts that require settlement in foreign currency. The third arises when a firm has borrowed or loaned funds, and the amounts involved

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[3] Eiteman, O.K. and A.I. Stonehill, Multinational Business Finance, Second Edition (Addison-Wesley Publishing Company, Los Angeles 1979) p. 76.

are denominated in foreign currency. Firms in the third world countries often acquire long-term debt, denominated in foreign currency. When their currencies depreciate against currencies in which the loans are denominated, they are exposed to the risk of losses.

Economic risk arises out of economic exposure defined by David Walker (1978) as "the possibility that the parent currency denominated net present value of cashflows will be adversely affected by exchange rate movement"[4]. Andreas Prindl (1976) views economic exposure as "the whole range of future effects of parity changes which have occurred or may possibly occur" and includes" where an actual conversion may be made or where the cashflows effect of an exchange loss is an impediment to the operations of one subsidiary", but also "the impact on future sales of company situated in a country whose currency has appreciated, or future profits where the local currency has depreciated"[5]. Another definition says that economic exposure results from the possibility that shareholders' wealth, measured as the net present value of the expected future after tax cashflows, will

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[4]Kenyon, A., Currency Risk Management (John Wiley and Sons Ltd., New York 1981) p. 7 Quoting Walker, D.P., "An Economic Analysis of Foreign Exchange Risk", Research committee occassional paper, no 14 (Institute of Chartered Accountants in England and Wales, 1978) pp. 6 and 30.

[5]Ibid

change when exchange rates change[6]. Economic currency risk has wide ranging impacts on business and its consideration is essential in assessing the long-run health of the business. It has potential effects on future revenue and costs. One of the costs affected, is that associated with holding long-term foreign currency loans. Thus, the consideration of economic currency risk is pertinent in appraising projects intended to be financed partly through foreign currency denominated debt. Economic currency risk is, however, inevitably subjective because it depends upon estimating future cashflows over "as yet unknown" time horizons[7].

2.2 Effect of a Currency Depreciation on a Project's Cashflows.

A depreciation in the national currency vis-a-vis the currency in which a firm's foreign debt portfolio is denominated, has an adverse effect on a projects cashflows. As mentioned earlier, when a project takes a foreign loan, the loan is converted to the local currency as soon as it is received. An agreement, specifying the mode of repayment for the loan is usually drawn up, between the lender and the borrower. Normally, the repayments are made in equal

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[6]Eiteman op. cit. p. 78.

[7]Ibid.

instalments over an agreed time period. At the time of payment of each instalment, the borrower has to spend home currency to buy back foreign currency. If there is depreciation, the amounts spent will exceed what was received, when the loan was initially converted to home currency.

Given below is an illustration of how a depreciation affects a project's interest and loan repayment cashflows.

Suppose a project is financed partially by a loan denominated in foreign currency. Let the loan amount be x units of foreign currency. Assume the interest rate on the Loan is r% per annum, and the terms of the loan require repayments in equal annual instalments over the term of the Loan with interest being paid annually on the outstanding balance at the beginning of the period.

Assuming that the rate of exchange is, 1 unit of foreign currency for P units of home currency, and that the home currency depreciates uniformly at the rate of q% per annum over the life of the loan, it can be shown that the annual increase in cashflows to service and to repay the loan are as follows:-

(1) Change in interest cost, $DI_t = rz((N-t+1)(1+q)^t - 1)$

where DI_t = increase in Interest Amount at time t.

r = nominal interest rate.

z = constant loan repayment amount expressed in the home currency but assuming a constant exchange rate.

N = loan period in years

q = annual rate of home currency depreciation.

(2) Change in loan repayment, $DL_t = z((1+q)^t - 1)$

where DL_t = increase in loan repayment at time t.

Other terms are defined as above.

(See Appendix 1 for derivation of formulae).

The inferences that can be drawn from the foregoing are that (i) a depreciation of the home currency causes exchange cash losses in as far as interest and principal repayments are concerned,(ii) the magnitude of the losses depends on the extent of depreciation, and (iii) gradual depreciation causes greater losses in later years than in earlier years.

The above conclusions concur with those of Townsend Walker (1981) who demonstrated that a firm holding long term foreign currency loans suffered

cash losses in interest payment and principal repayment in the event of a currency depreciation[8]. However, Walker assumed a loan with cummulative interest where the principal and the interest are payable at the end of the loan term, and also implicity implied that the major reason for seeking foreign currency loans is the relatively lower costs of such loans.

In Kenya and other developing countries, where the direction of currency is invariably a depreciation, the exchange losses experienced may more than offset the benefits of the lower interest rates mentioned above. Furthermore, the benefit of low interest rates is a minor reason for resorting to foreign funds. The principal reason for including foreign currency loans in the financing portfolio of project is the non-availability of domestic loans. Credit restrictions imposed by the Central bank have the effect of limiting availability of domestic loans. Also, as firms expand by setting up new project ventures, foreign currency debt instruments increasingly become part of their opportunity financing option.

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[8] Walker, T., A Guide for Using the Foreign Exchange Market, (John Wiley and Sons, New York, 1981) p. 205.

2.3 Effect on Net Present Value

The effect of a depreciating currency on the cashflows of a project inevitably affects the project's net present value. Currency cash losses decrease the project's net cash inflows, a phenomenon which undoubtedly reduces the project's net present value.

Let us suppose that the expected cashflows of a project are realized.

Let C_t = Expected/realized cashflow for time t

I_o = Initial investment

i = Risk-adjusted discount rate of the project. (Without the foreign exchange risk).

$$\text{The project's NPV} = \sum_{t=1}^{N} \frac{C_t}{(1+i)t} - I_o$$

This represents the ex ante and ex post NPV of the project without the foreign exchange component. If the NPV of the project was equal to zero, then the equity and debt holders receive the minimum "acceptable" rate of return from the project.

Suppose then, that the project had a foreign currency loan portfolio in its financing mix, and that the rate of exchange, changed as in appendix 1. If T is the tax rate then the NPV of the project would be given by

$$NPV = \frac{\sum_{t=1}^{N} C_t-(1-T)z((1+q)^t-1)(r(N-t+1)+1)I_o}{1(+i)^t}$$

Thus, whereas the project was accepted in the earlier case at a zero net present value, when the element of foreign exchange losses is included in the analysis, the project becomes untenable. It appears therefore that the ex ante appraisal of projects should include an element of foreign exchange risk, if optimal capital investment decisions are to be made. In such circumstances there is a strong case for the incorporation of foreign exchange risk in project appraisal.

Methods of Incorporating Exchange Risk.

There are three possible methods for incorporating foreign exchange risk in the appraisal of partly foreign funded projects. The first possible method is the adjustment of the operating cashflows. The second is the adjustment of the discount rate. The third is the adjustment of the discount rate. The third method entails the provision of a contingency amount, added to cost, at the time of appraisal to absorb exchange risk throughout the life of the foreign currency loan. Each of

these methods, the issues arising out of its use are discussed in the succeeding sections.

2.41 Adjustment of Project Cashflows.

Exchange losses are real losses representing actual or potential cash outflows to a project. Thus, adjustment of a project's cashflows to cater for these losses seems the most logical course of action. This would entail the estimation of possible exchange losses, as at each repayment date, over the life of the loan. The project's series of net cashflows are then adjusted downwards to reflect the exchange losses, and discounted to obtain a new measure of net present value.

Cashflow adjustment, however, requires an accurate and reliable prediction of the exchange rate over the term of the loan. Exchange rate prediction is one of the most difficult tasks confronting economists in the area of international finance. This phenomenon is demonstrated by the existence of at least five theories[8], attempting to explain movements

[8] These include; the Purchasing Power Parity, the Balance of payment theory, the supply and demand theory, the psychological theory and the interest parity theory. For more details see Wasserman, M.J., A.R., Prindl and C.C. Townsend Jr, International Money Management, Third Edition [American Management Association, Inc, 1972] pp. 22-24.

in exchange rates under the flexible exchange rate systems. Economists have thus far failed to agree as to which theory best explains parity equilibria. The rate of exchange between the currencies of any two countries cannot be predicted directly. Variables, which in turn are used to predict the exchange rate, must first be predicted. These include factors such as inflation, interest rates, consumer tastes and preferences, expectations, income and income growth differentials between the two countries. Forecasts of these variables, particularly in the long-run is by no means an easy task. Moreover, under managed exchange rate systems, forecasting of exchange rates is more complex. Under these systems, the monetary authorities support the currency often at artificially high levels, thus effectively rendering exchange rate forecasting impractical.

2.42 Adjusting the Discount Rate.

Under this method, the possibility of currency depreciation is accounted for by adjusting the discount rate to include a factor of foreign exchange risk. Employing the Capital Asset Pricing Model (CAPM), this would entail the further adjustment of the risk-adjusted discount rate to reflect a risk premium relating specifically to foreign

exchange fluctuations. This is done as follows.

$$R = R_N + X.$$

Where R = Risk-adjusted discount rate incorporating foreign exchange risk.

R_N = "Normal" risk-adjusted discount rate.

X = Foreign exchange risk.

The term X is expected to be a function of the currency depreciation. No attempt has been made to establish the exact form of relationship between rate of currency depreciation and foreign exchange risk in this paper.

The project's cashflows are discounted using this risk-adjusted discount rate (R) over the life of the project to give the net present value below.

$$NPV = \Sigma \frac{C_t}{(1+R)^t} - Io.$$

The main problem here is that the foreign exchange risk component is unlikely to remain constant over the life of the project. The rate of depreciation is likely to fluctuate over-time, a phenomenon which implies that foreign exchange risk should fluctuate accordingly.

The weighted average cost of captial (WACC) is the other approach to determining the appropriate

discount rate. The cost of the debt component of the cost of capital is the after tax rate of interest. The lower interest rates for foreign currency loans result in a lower after-tax cost of debt.[9] Thus, based on the traditional method of computing a project's cost of capital, foreign funded projects may have lower debt costs, and hence weighted average cost of capital, than locally funded projects. This observation may be sound in a situation of constant exchange rates. However, in view of the fact that foreign currency loans are risky, a lower cost of debt is apparently incorrect. Given the risky nature of foreign currency loans, nominal interest rates may not be appropriate for determining the project's cost of capital. A more appealing approach would be to find a rate of interest for an equivalent home currency loan which makes the investor indifferent between such a loan and the lower interest rate high risk foreign currency loan. This rate may be referred to as "the certainy equivalent interest rate"[10] (See Appendix II for the

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[9] It is assumed that local borrowing is more expensive than foreign borrowing in terms of interest rates.

[10] The home loan is said to be certain because there is no possibility of incurring a foreign exchange risk.

derivation of the certainty equivalent interest rate).

Assuming that an investor is aware that holding foreign currency denominated debt raises the possibility of a foreign exchange risk, the weighted average cost of capital, resulting from the higher "perceived" certainty equivalent interest rate may be worked out to give:

$$K^* = k + \frac{L}{S+L+B} (1-T) (R-r)$$

where K^* = WACC based on the certainty equivalent interest rate

K = WACC of the project based on the nominal interest rate r

L = Foreign debt capital

B = Local debt capital

S = Equity capital

T = Tax rate

R = Certainty equivalent interest rate

r = Nominal rate of interest on foreign debt.

The term $\frac{L}{S+L+B} (1-T)(R-r)$ represents the increased cost associated with holding foreign currency loans. (See Appendix III for derivation). The new WACC (K^*)

is then used to discount the project's cashflows and determine the net present value as follows:

$$NPV = \Sigma \frac{C_t}{(1+k^*)^t} - I_o$$

The terms are defined as before.

The problems of using risk-adjusted discount rates to reflect foreign currency risk center around the conceptual problems in the application of the risk-adjusted rate. The risk-adjusted discount rate based on CAPM assumes a world of competitive securities under an efficient capital market. In managed exchange rate systems, the market for foreign currency is far from efficient. The validity of employing the CAPM formula in relation to general risk, and specifically to foreign exchange risk, is questionable. Moreover, CAPM is basically a single-period technique, not demonstrated as functional in multi-period projects[11]. Fama (1977) showed that it is inappropriate to use the same risk adjusted discount rate for cashflows originating in different time periods, and that the risk-adjusted discount rate should be restricted to a single period[12].

[11] CELEC, S. and R.H. Pettway "Some Observations on Risk-Adjusted Discount Rate: A Comment". The Journal of Finance Vol. 34 (Sept. 1979) pp. 1331-1332.

[12] HULL, J. "A Note on the Risk Adjusted Discount Rate Method", Journal of Business Finance and Accounting (Autumn, 1986) p. 405.

Essentially the single period approach assumes that in the real-world uncertainty is resolved after the initial period. This may be so where there are efficient secondary markets for the project but is otherwise unrealistic in most real world circumstances. The CAPM offers inappropriate treatment to real life projects[13].

Hull (1986) suggested that the risk adjusted discount rate is inappropriate where cashflows of different risk and opposite signs are aggregated. The components of a project net cashflows are likely to exhibit different risk characteristics. Combining them at a single-risk-adjusted discount rate is therefore conceptually incorrect[14]. In the context of appraising a project bearing a foreign currency loan component, the risks are associated principally with the cash outflows. The cash inflows are considerably less riskier. An approach with more appeal employs two discount rates; a low one for cash inflows and

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[13] Bogue, M.C., and R.R. "Capital Budgeting of Risky Projects with "Imperfect" markets for Physical Capital". The Journal of Finance (May, 1974) p. 605.

[14] Hull op. cit. p. 449.

a high one for cash outflows. The net present value would be[15].

$$NPV = \Sigma \frac{F_t}{(1+r)^t} - \Sigma \frac{O_t}{(1+R)^t}$$

where F_t = Cash inflows at time t

r = Risk adjusted discount rate excluding the foreign exchange risk.

R = Risk adjusted discount rate including an element of foreign exchange risk.

O_t = Cash outflows at time t

where R>r.

When using the net present value to appraise a project, this approach is superior given that the project's cash outflows are likely to suffer because of a possible foreign exchange currency risk. A higher discount rate for the outflows penalizes them for uncertainty, but does not interfere with the inflows which may be unaffected by foreign currency risk.

2.43 Adjusting the Initial Cash Outlay

Adjusting the initial cash outlay is practi-

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15 This formula has been adapted from Lewellen (1977) op. cit. p. 1332.

cally the easiest method of incorporating exchange risk. Under this method, the project's initial cost is adjusted to reflect expected exchange losses during the life of the project.

Practically, a contingency amount stated as a percentage of project cost is added to the actual cash outlay. Selecting the percentage provision for exchange losses, may be based on intuition and judgement of the analyst. This manner of providing for exchange losses is highly subjective and would render the method unreliable. If the adjustment of the initial cash outlay is to be objective, then an accurate prediction of exchange rates, and subsequent determination of exchange losses, must be undertaken. The losses are then discounted at an "appropriate" discount rate to determine their present value. This is then applied as an adjustment factor to the initial outlay.

The major problem with adjustment of the initial outlay is the fact that exchange risk does not give rise to an actual cash outlay at the beginning. Exchange losses only constitute actual cash outlays during the term of the project's foreign currency loan. Thus, adjustment of initial cash outlays has little conceptual appeal.

CHAPTER THREE

RESEARCH DESIGN

This chapter deals with the research methodology used to achieve the objectives stated in chapter one.

3.1 The Population.

The population of interest in this study consists of all the 109 projects financed partially with foreign currency loans in the period 1974 - 1984 inclusive. This period was selected for two reasons. The choice of 1984 was to facilitate at least three years of actual data on loan repayment. This was necessary because in situations where projects had not completed loan repayments by 31/12/87, it was necessary to use past movements in exchange rates to predict movements in the remaining term of the loan. It was felt that three years of actual data on exchange rate movements, and hence on exchange losses, would give some basis for the determination of "actual" net present values. Also, since 1974 the exchange rate has changed considerably. The latter part of the 1970's was marked by a gradual decline in the rate of exchange. The 1980's was characterised by sharper declines in the parity

of the Kenya shilling against major world currencies[16]

Restricting the data sources to only IDB and DFCK was basically to take advantage of the cooperation accorded by these organizations by making data readily available. Moreover, there was no reason to suppose that projects financed by EADB were differently affected by exchange risk.

3.2. The Sample.

The sample for this study consisted of 55 projects selected as follows:

35 projects were selected randomly from the 71 projects comprising the population in IDB.

20 projects were selected randomly from the 38 projects comprising the population in DFCK.

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[16]The exchange rate for the Kenyan shilling against major currencies was as follows in the 1970's and the 1980's.

	Exchange rates			
Currency	Dec. 1974	Dec. 1976	Dec. 1979	Dec. 1987
1 US Dollar	7.143	8.170	7.334	16.952
1 Sterling Pound	16.612	16.080	16.458	30.842
1 Deutch Mark	2.881	3.280	4.273	10.411
1 Swiss Frac	2.884	3.390	4.639	12.878
1 French Franc	1.610	1.710	1.883	3.075
100 Japanese Yen	2.600	2.870	3.332	13.489

This information was obtained from the daily nation newspapers covering this period.

At IDB, the projects were classified by the organization into the following categories

Projects under receivership	(A)
Projects operating with major problems	(B)
Projects operating with moderate problems	(C)
Projects operating without problems	(D)
Projects with fully repaid loans	(E)

The sample selected consisted of all (6) projects from category A. A random sample was drawn from each of the other categories as follows:-

Category	Number selected
B	6
C	6
D	8
E	9

The number selected from each category was more or less in accordance with the number of projects in each category. There were more projects in category D and E than in category B and C.

The sample from DFCK was drawn randomly from a list made up for projects which had received loans denominated in foreign currency. The sample included 8 projects identified as causing concern and/or under rehabilitation, 3 which had fully repaid loans, and

the remaining 9 operating with little or no problems.

In general the sample drawn from both organizations constituted a reasonable representation of the projects financed with foreign currency loans in the period under consideration.

3.3 Data Collection.

Only secondary data was used for this study. This data was obtained from the following sources:

(i) Data on projected net cashflows were obtained from appraisal reports for each company prepared by the finance organizations. The data collected from these reports specifically consisted of;

(a) Profit after tax in each year of the project's life.

(b) Interest expense and depreciation covering the same period.

(c) Tax and interest rates.

(d) A project's financing plan specifying portion financed by equity and that by debt and showing amount

of debt denominated in foreign currency. Apart from the few incidences of machinery credit, the foreign debt was the loan provided by the finance organization. The reason for collecting all of the above data was to facilitate the computation of each project's expected and "actual" net present value[17]

(ii) Data on expected loan repayments for interest and principal was obtained from loan repayment schedules or what IDB referred to as amortization schedules.

(iii) Data on actual loan repayment for both interest and principal were obtained from billing reports of the organizations. The billings consisted of the expected amounts to be paid (Principal and interest) in foreign currency converted at rates prevailing at the

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17 The organizations do not compute NPVS but the IRRS. The IRR is then compared to the project's cost of borrowed funds to decide whether to accept or reject the project.

due date of payments[18]. Where a project has defaulted in loan repayment additional billings for arrears are made. These billings were ignored for the purpose of this study[19].

(vi) For projects which had not fully repaid their loans by 31.12.87, it was necessary to work out the expected amounts to be repaid in local currency in the remaining term of the loan. For projects which had spanned less than five years of the loan terms, a simple average rate of currency depreciation was determined using data over a period of five years upto the date of the last repayment. For projects which had done more than five years, the average rate was worked out to cover

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[18]The billings in foreign currency for both interest and principal, are made 1-2 months before due dates of payments. The bills specifying amounts payable in foreign currency also contains instructions to the projects requiring them to convert, and remit, the amounts in foreign currency as local currency at specififed dates, usually a few days before the due date. The amounts in local currency are remitted to the financiers. After the specified date the duplicate of the bill kept by the financing organization, is completed to include rates at which conversions were made, and hence the amounts received (or) receiveable in local currency.

[19]The reason for ignoring the billings resulting from default was because at the time of project appraisal, it is not realistic to anticipate such additional increases.

the period from approval to that of last repayment. The rate so determined for each project was applied to the periods in the remaining term of the loan to determine the expected amounts expected to be paid.

Appendix V shows a typical data collection sheet.

CHAPTER FOUR

DATA ANALYSIS AND FINDINGS.

The data collected for the study disclosed that the organizations [IDB and DFCK] do not compute net present values in appraising projects. The appraisal technique used is the internal rate of return. The determination of the IRR, is in most cases, based on the before tax profit adjusted for depreciation and interest. The acceptance or rejection of a project is on the basis of a comparison of the IRR with the project's marginal cost of borrowing (the nominal interest rate). Appropriate analysis of projects involves the discounting of a project's after-tax cashflows discounted at the marginal cost of capital.

4.1 Determination of Net Present Values

4.1.1 Expected Net Present Values

Using supercalc 3, a computer package, which can perform financial computation, the net present values of the 55 projects in the sample were computed. The NPVS were based on each project's cashflows - defined as the after-tax cashflows discounted at the marginal cost of foreign borrowing[20]. Appendix IV shows the expected

[20] The cost of foreign borrowing was the "best" surrogate available for the marginal cost of capital. In most cases the proportion of foreign to total loans was very high over 80%. The after-tax cashlows comprised profit after-tax adjusted upwards for depreciation and interest tax saving.

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net present values and other relevant particulars for each project.

4.12 "Actual" Net Present Values.

The classification of the projects in chapter three had revealed that twelve projects had fully repaid loans by 31.12.87. A further analysis, however, revealed that another five projects were "supposed" to have completed repayment. These projects had spanned their loan duration, had been billed for the total loan amount but since they had outstanding arrears were classified as not having fully repaid loans. Thus, in view of the fact that "actual" repayments were based on billings rather than actual payments, seventeen projects are classified as having fully repaid loans. The remaining thirty eight were in the following stages of repayment.

Number of projects	Outstanding repayment period
9	Less than one year
7	1 - 2 years
4	2 - 3 years
18	3 - 5 years

The computations of "actual" net present values for the seventeen projects were based on actual

loan repayments. Total exchange losses for both principal and interest for each project were determined by establishing actual amounts in billing reports in local currency and deducting expected amounts in local currency as determined at the time of project appraisal. The after-tax exchange losses were then established and used to adjust the project's cash-flows determined at the time of project appraisal.

The determination of "actual" NPV'S for the projects with partially repaid loans entailed the use of actual data for the period already covered and the computation of "expected payment" for the remaining term of the loan. To do this, an average rate of depreciation of the Kenyan shilling was established. This involved the use of actual data on exchange rate movement for a period of at least five years upto the date of the last repayment. The rate was then applied to future periods to determine expected exchange losses in those periods. "Actual" net present values were then computed as in the earlier case. Appendix IV shows "actual" NPVS of the projects.

4.2 Impact[21] on Net Present Value

The analysis above revealed that the NPV

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[21] The impact here is defined as;

$$\frac{(\text{Expected NPV} - \text{Actual NPV}) \cdot 100}{\text{Expected NPV}}$$

of each of the projects in the sample was reduced. The impact as defined above, ranged from 4.56 to 2313 percent. The table below shows the distribution of the impact of exchange losses.

Table 1. Distribution of Impact

Impact (%)	Number of projects	Proportion to total Projects(%)
0 - 9.9	11	20
10 - 19.9	12	22
20 - 29.9	6	11
30 - 39.9	8	14
40 - 49.9	2	4
50 - 69.9	4	7
70 - 99.9	6	11
> 100	6	11
Total	55	100

Several observations and deductions can be made from the above results. An impact on the NPV of a project which is greater than 100 percent, implies that the NPV changes sign from positive to negative. From this deduction, 11 percent of the projects in the sample had their NPVS changing from positive to negative. More than 29 percent of the projects had their NPVS changed by more than 50 percent. If 30 percent

impact is taken as "critical impact", then more than 47 percent of the projects had their net present values critically affected.

The classification of projects in accordance with their expected NPVS, the size of the loan, and the proportion of foreign loan to cost of the project, revealed interesting observations as shown in the tables below.

Table 2. Classification on the Basis of Expected Net Present Values.

Expected NPV Ksh."000"	Number of projects	Number with impact ≥40%	Proportion (%)
Upto 2000	13	10	77
2001 - 5000	17	7	41
5001 - 10000	9	1	11
10001 - 20000	9	0	0
Over 20000	6	0	0
Total	55	18	33

The observation that can be made from the results above is that projects with low NPVS are affected more by exchange risk than those with high NPVS. (An impact of 40 percent was chosen as it exhibited a clear trend between the expected NPV and the impact of exchange risk).

Table 3. Classification on the Basis of Proportion of Foreign Loan to the Total Project Cost.

Proportion of Foreign Currency Loan(%)	Number of projects	Number with impact ≥40%	Proportion(%)
0 - 39.9	19	5	26
40 - 59.9	26	9	35
60 - 79.9	8	3	38
Over 80	2	1	50
Total	55	18	33

It is apparent that projects with high proportion of foreign currency loans are affected more by exchange risk than those with low foreign loan proportions. This is evidenced by the fact that a large percentage of projects with high foreign loan proportions have impacts greater than 40 percent. A smaller number of projects with low foreign loan proportions have impacts greater than 40 percent.

A classification according to the total investment cost of the projects shown in the table below, did not give a clear indication of how the cost of the projects relates to the impact on the NPV.

Table 4. Classification on the Basis of Cost of the Project

Cost Shs "000"	Number of projects	Number with impact ≥40 (%)	Proportion (%)
0-5000	10	3	30
5001-10000	9	4	44
10001-15000	10	3	30
15001-20000	6	1	37
20001-30000	8	3	38
30001-45000	5	1	20
Over 45000	7	3	43
Total	55	18	33

4.3 Incorporating Exchange Risk in Project Analysis: Appropriate Method.

In order to suggest an appropriate method of incorporating exchange risk in project analysis, eighteen projects from the sample were used. These, composed of all projects in the sample with an investment of between ten and twenty million shillings,inclusive. The three suggested methods viz; adjustment of projects cashflow, adjustment of the discount rate and adjustment of the initial cash outlay, were examined.

First, the discount rate was adjusted upwards

by 10 percent. The expected cashflows of the projects as determined at appraisal were then discounted using this rate and a new net present value for each project established. Second, the projects' operating cashflows were reduced by 10 percent. The new cashflows were then discounted at the nominal interest rates(the surrogates used for the marginal costs of capital), to determine another set of net present values. Third, each project's initial cash outlay was increased by 10 percent. Net present values based on the expected cashflows, the "new" initial outlay, and the nominal interest - discount rate were computed[22]. For each of the three sets of NPVS, comparison was made with the projects "actual" net present value. The set closest to the "actual" net present value was rated the "best" estimator, and hence the method best incorporating risk at projects analysis. The method which achieved the best rating, the highest number of times was determined.

The table below reveals the results of the

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22 10 percent adjustment was chosen because IDB and DFCK add a mark-up of 10 percent to the cost of the project to take care of general contingency during the implementation of the project. For "some reason" 10 percents seem to have intuitive appeal to these organization. By adjusting the above parameters by 10 percent, an equivalence in the three methods of adjustments is not implied.

TABLE 5: Determination of method which "Best" incorporates Exchange Risk.

PROJECT	Actual NPV Kshs "000"	Net present values based on 10 percent adjustment and the differences arising.						
		Discount Rate (1)	Difference	Operating Cashflows (2)	Difference	Initial Outlay (3)	Difference	Method Rated "Best"
AN	3551	4149	598	3028	(523)	3463	88	3
BZ	4515	5386	871	5051	536	5576	1061	2
BX	4624	4266	(358)	3489	(1135)	3549	(1075)	1
CA	12871	12004	(867)	11741	(1130)	12934	63	3
AT	30876	30062	(814)	29339	(1537)	31751	875	1
BK	2858	2278	(580)	2442	(416)	2143	(715)	2
BH	12153	11672	(481)	11746	(407)	11633	(520)	2
AB	12720	11765	(955)	10714	(2006)	11767	(953)	3
BE	9995	9367	(628)	8355	(1640)	9340	(655)	1
AC	4947	4922	(25)	4763	(184)	4762	(185)	1
BT	3023	2796	(227)	2380	(643)	1665	(1358)	1
BY	3303	3714	411	3284	(19)	3664	361	2
AO	8306	10920	2614	8966	660	10554	2248	2
BR	(1378)	(599)	779	(744)	634	(1009)	369	3
BQ	155	732	577	437	282	29	(126)	3
BP	3639	4469	830	3968	329	4443	804	2
AI	242	2831	2589	2290	2048	2416	2174	2
BN	2626	3731	1105	2969	343	3060	434	2

above analysis.

Adjustments of the projects' cashflows scores the best rating the highest number of times (8/18). Adjustment of the discount rate and the initial outlay both achieved the second best rating of (5/18) each.

4.4 Establishing Required Hurdle Rates.

One of the objectives of this study was to determine a minimum required rate of return for a project holding foreign currency denominated loans. To do this, an analysis based on the internal rates of return was performed. The expected and "actual" internal rates of return were established in the sampled with the aid of a computer package. The differences between "actual" and expected IRRS were determined for each project. Appendix IV shows "actual" and expected IRRS of the 55 projects. The average difference was determined as 2.60 with a range of 0.50 - 7.90 percent. The table below shows the distribution of the differences in IRR for the 55 projects.

Table 6. Distribution of difference between "actual" and expected IRRS

Difference (%)	Number of projects	Proportion (%)
0.0 - 1.00	11	11
1.01 - 2.00	13	24
2.01 - 3.00	15	27
3.01 - 4.00	7	13
4.01 - 5.00	2	4
5.01 - 6.00	3	5
6.01 - 7.00	1	2
Over 7.00	3	5
Total	55	100

The implication that is deduced from this analysis is that on average foreign exchange risk decreases the IRR of a project by 2.60 percent. A project meeting the acceptance criteria has an IRR greater or equal to its cost of capital. A project barely meeting the acceptance criteria would have an IRR equivalent to the cost of capital. An IRR of 2.60 percent above the cost of capital would be reduced to the cost of capital, if the project holds foreign currency denominated loans,and exhibits the characteristics of an average project.

On the basis of the above analysis, it can generally be stated that a hurdle rate should be established between the range 0.5 and 7.90 percent above the cost of capital for a project holding foreign currency denominated loans. Preferably, the hurdle rate should be 2.60 percentage points above the project's cost of capital.

4.5 Development of Predictive Model

A multiple regression model to predict the impact[23] of exchange risk on the expected NPV of a project was developed. The impact was regressed against three selected predictor variables. These variables are;

the expected net present value denoted x_1,
the total cost of the project - x_2,
and the amount of foreign currency funds - x_3.

These variables were selected because they were considered fundamental to the problem. They are also readily available and easily determined by the project analyst at the time of appraisal.

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[23] For the purpose of this analysis Impact is taken to mean the absolute change in the expected NPV of a project i.e.

Impact = Expected NPV - Actual NPV

A multiple regression model was run using a statistical computer package - statgraphics. The model below was developed.

$$Y = -5.11087 + 0.028936x_1 + 0.043966x_2 + 0.162155x_3$$

Where Y is the Impact of exchange risk in absolute terms.

The following statistics were obtained:

(i) A coefficient of determination, R^2 of 59.3

(ii) An F ratio of 24.81

(iii) A Durbin-Watson statistic of 1.991.

Since the F ratio of 24.81 is greater than the critical of 4.18 at 99 percent degrees of confidence, the presence of regression between the variables is demonstrated. The Durbin-Watson statistic of 1.991 is greater than the critical of 1.68 at 95 percent confidence interval, and thus reveals the absence of serial correlation.

The correlation matrix here below shows the degree of intercorrelation among the predictor variables.

Table 7. Correlation Matrix

	X_1	X_2	X_3
X_1	1.00000	0.35226	0.43271
X_2	0.35226	1.00000	0.80025
X_3	0.43271	0.80025	1.00000

Though there is a high degree of inter-correlation among X_2 and X_3, their inclusion in the model is still desirable in order to develop a model with high predictive ability.

CHAPTER FIVE

CONCLUSION

5.1 Observations and Implications

This study set out to establish the impact of exchange risk on projects partly financed with foreign funds demonstrate the need for incorporation of exchange risk in project analysis, and attempt to establish a model for predicting the impact of the risk on a project's NPV.

Each of the projects in the sample had its NPV reduced by exchange losses. It was established that the impact was quite significant for a large number of projects. In view of this, it is imperative that exchange risk is included when appraising projects. Failure to do this, will result in projects bearing burdens that were not anticipated at analysis. If such burdens are very high and a project is weak, then project failure may occur. This is obviously an undesirable event which should be avoided.

Projects with low net present values are affected more by exchange risk. The impact, defined as a percentage change in the expected NPV, was found to be higher for projects with low NPVS.

Projects with low NPVS are by their very nature weak projects and any risk is likely to drastically affect their viability. Thus, in appraising projects with low NPVS, project analysts/sponsors should give greater attention to exchange risk.

Projects with high foreign loan components in their financing portfolio are affected more by exchange risk. The study established that the higher the foreign debt proportion, the greater the percentage impact on the NPV. If the two components of financing (local and foreign) are separated, the foreign portion gives rise to exchange risk while the local one acts as a shield, protecting the project from the risk. From this perspective, therefore, it can be stated that the higher the risky component of the portfolio, the higher the risk and hence, the greater its impact. It is essential, therefore, that when appraising projects with high foreign loan proportions, more consideration is given to exchange risk.

The search for an appropriate method of incorporating exchange risk revealed that adjustment of the operating cashflows is the "best" method of incorporation. This finding lends credence to

the method, which in any case seems to be more theoretically sound. Basically, exchange risk affects a projects operating cashflows in each of its operating periods. Exchange risk affects operating cashflows in the period in which exchange losses are incurred. Adjustment of operating cashflows to coincide with the time that actual cash outlays are expected to occur, is thus the most appropriate action. The adjustment of the discount rate is highly subjective and perhaps the most difficult to implement, since no relationship has been established between the rate of currency depreciation and the discount rate. Adjusting the initial outlay is the easiest to effect, though it has the least theoretical appeal.

It was determined that the average hurdle rate of return for a project holding foreign currency denominated loans is 2.6 percentage points above its cost of capital. This rate will ensure that a reasonable amount of exchange losses is absorbed. If the hurdle rate is established at 7.90 percentage points above the cost of capital, then probably all exchange losses will be absorbed, even for projects affected the most by exchange risk. If the hurdle rate is established at the cost of capital, then because of the risk the "actual" hurdle rate will be less than

the cost of capital, a situation which is unacceptable. Project sponsors should therefore reject a project whose internal rate of return is less than the "established" hurdle rate.

The model developed to predict the absolute impact on the expected NPV of a project has a reasonably high predictive ability. The R^2 of 59.3 percent is quite high given that many factors external to the project can and do affect exchange rate movements. The ability to predict the impact of exchange risk on a project's NPV, without having to predict exchange rates would be a big step forward, and is very essential in deciding whether or not to incorporate exchange risk in project analysis. If the impact is expected to be insignificant, then the incorporation of exchange risk at appraisal would be unnecessary.

5.2 Recommendations.

In view of the fact that exchange risk was found to be significant to most projects, it is essential that the projects take protective measures to minimize the effects of this risk. First, enterprenuers should resort to foreign currency funds only if they can effectively hedge, or minimize the effect and, or, if the projects are sufficiently

strong to absorb the shocks of exchange losses. A project may minimixe exchange risk by ensuring that at least part of its products are exported. The managers of such projects should negotiate with the monetary authorities so that part of the foreign exchange earned is used to settle the foreign liabilities. Projects may also borrow locally as soon as conveniently possible, to retire foreign currency loans. This has the effect of limiting exchange risk to the period of the loan already covered.

Secondly, since the government's objective is to promote industrialization and development, it should assist firms to absorb in total or in part the exchange risks they experience. The government may effect this by providing "Foreign exchange losses allowance" to cater for exchange losses. This amount should be deducted from the taxes payable by the project in each period, as determined under the normal rules of taxation.

5.3 Limitations and Suggestions for Further Research

Several limiting factors inhibited this study. First, it was not possible to obtain a measure of the projects' costs of capital. Both organizations (IDB and DFCK) use the internal rate of return to

appraise projects. The basis of accepting or rejecting a project is a comparison between the IRR obtained and the project's marginal cost of borrowing. A measure of the cost of equity, which is essential in the determination of the cost of capital, is not obtained in the process. The use of the marginal cost of capital could have yielded results different from those of this study. A possible area of research is a replication of this study using the marginal cost of capital of the projects. The results obtained should then be compared with those achieved in this study to see if there are any significant differences.

Second in the computations of "actual" net present values it was necessary in most cases (38 projects), to compute expected payments. The "actual" NPVS computed were thus not based entirely on actual data. Actual payments could have turned out to be significantly different, since past trends in exchange rates are not perfect predictors of future rates A study could be carried out say five or six years from now, using the same projects used in this study, to establish whether the results obtained using actual data, entirely, differ from those of this study.

Third, the prediction model was not tested to demonstrate its usefulness[24]. The model predictor variables did not include exchange rates which is a direct determinant of exchange losses, and hence of impact of exchange risk. The failure to validate the model implied the inability to demonstrate that a model, which excludes exchange rates in its determination, could be useful.

Fourth, the relationship between exchange risk and changes in exchange rates was not established. This shortcoming rendered discount rate adjustment unjustifiable.

Lastly, the selection of the best method of incorporating exchange risk was perhaps simplistic. The adjustment of cashflows, the discount rate, and the initial outlay by an equal percentage, implies their equivalence, a phenomenon which was not demonstrated. The use of scoring to determine the "best" method may

[24]This would have entailed collecting data, similar to that used in this study, from a different set of projects in the population (i.e. those not included in the sample) and using the prediction model to determine impacts on net present values. The impacts on NPVS would also have to be worked out by determining actual and expected NPVS. The predictive ability of the model is demonstrated by the extent to which the predicted values estimate actual values.

constitute another shortcoming.

The shortcomings pointed above could indicate areas of inquiry which may be useful to study as an improvement to this study. The following additional matters may be of interest to investigate:-

(a) Establish whether managers of projects with foreign currency loans regard exchange risk as a major problem.

(b) For projects placed under receivership or those which have closed down, establish whether or not foreign exchange risk was a major causal factor.

(c) Establish the nature of relationship between exchange risk and the rate of currency depreciation within the context of the Capital Asset Pricing Model (CAPM).

APPENDIX 1

This section is intended to derive a formula for cash losses in interest and principal repayment from holding a foreign currency loan.

Assumptions

The major assumption is that the foreign currency loan is repayable in equal annual instalments over its term, and that the interest is payable on the outstanding balance at the beginning of the period. The interest rate is expressed on the foreign currency loan.

Let x = amount of the foreign currency loan.

Let exchange rate at the date of inception of the loan be 1 unit of foreign currency = p units of local currency.

Let r = interest rate as expressed on foreign currency loan balance.

q = the annual rate of depreciation of the home currency.

N = time period of the loan in years.

From the information above the following exchange rates prevailing at the end of each year can be determined.

At the end of year 1, just before loan repayment and interest payment, the exchange rate will be given by $p + qp$ or $p(1+q)$. Thus 1 unit of foreign currency = $p(1+q)$ units of home currency. At the end of year 2, exchange rate will be given by $p(1+q)+q(p(1+q)) = p(1+q)^2$. Similarly, it can be shown that at the end of Year N, it will be equal to $p(1+q)^N$. The following table summarizes the situation as it would appear at time t:

Year	Exchange Rate
0	P
1	$p(1+q)$
2	$p(1+q)^2$
3	$p(1+q)^3$
*	*
*	*
*	*
*	*
N	$p(1+q)^N$

The general case at the end of year t is $p(1+q)^t$.

Loan Repayment (PRINCIPAL)

The constant amount in foreign currency is given by $\frac{x}{N}$. Where the exchange rate is constant the equivalent in local currency is $\frac{xp}{N}$.

When the exchange rate changes as shown, then the repayment in local currency for year t is given by $\frac{xp}{N}(1 + q)^t$. Thus the increase in loan repayment, where the home currency depreciates at q per annum, in time t is given by,

$$\frac{xp}{N}((1 + q)^t - 1).$$

Let $z = \frac{xp}{N}$ = Constant principal repayment calculated on rate prevailing at loan inception.

Thus the increase is given by

$$DL_t = z((1 + q)^t - 1)$$

where DL_t is the increase in principal repayment for time t. This represents the principal portion of the foreign exchange loss.

Interest

The interest is calculated on the outstanding balance of the foreign loan at the beginning of the period. The following is a table showing the interest repayment in foreign currency for each period over the duration of the loan in the absence of depreciation.

Year	Principal	Interest	Outstanding Balance
0	-	-	x
1	x/N	rx	x(N-1)/N
2	x/N	rx(N-1)/N	x(N-2)/N
3	x/N	rx(N-2)/N	x(N-3)/N
*			
*			
*			
N-1	x/N	2rx/N	x/N
N	x/N	rx/N	-

This data is used to analyse the interest payment, in terms of home currency, assuming both a situation of no depreciation, and of uniform depreciation of q per annum. The table below shows this:

Year	Without Depreciation Exchange Rate 1 : p	With Depreciation Exchange Rate 1 : $p(1+q)^t$	Difference
1	rxp	$rxp(1+q)$	$rxp[1+q)-1]$
2	rxp(N-1)/N	$rxp(1+q)^2(N-1)/N$	$rxp(N-1)/N[(1+q)^2-1]$
3	rxp(N-2)/N	$rxp(1+q)^3(N-2)/N$	$rxp(N-2)/N[(1+q)^3-1]$
*			
*			
*			
N-1	2rxp/N	$2rxp(1+q)^{N-1}/N$	$\frac{2rxp}{N}[(1+q)^{N-1}-1]$
N	rxp/N	$rxp(1+q)^N/N$	$\frac{rxp}{N}[(1+q)^N-1]$

Using the earlier definition where z = xp/N and then generalizing we have:

$$DI_t = rz(N-t+1)\ ((1+q)^t-1).$$

Where DI_t is the increase in interest payment in time t and represents the interest portion of the currency cash loss.

The total cash loss resulting from holding foreign currency loans in any year is the total of the loss in repayment of principal and interest. This is given by:

$$DL_t+DI_t=z((1+q)^t-1)\ [r(N-t+1)+1]$$

These additional cash outflows should be incorporated in project appraisal. The only thing that needs to be done is to estimate the expected rate of currency depreciation and to make assumptions similar to those in capital budgeting.

7.00 APPENDIX II

Determination of the Certainty Equivalent Interest Rate

This Appendix assumes the same parameters and conditions of a foreign currency loan as Appendix I. Suppose that the equivalent local currency loan (xp) has the same repayment conditions as the former, and that the investor is indifferent between a higher interest rate of R% on the "riskless" local loan and the lower nominal interest rate of r% on the risky foreign loan.

The rate (R) must equate the total interest costs of the local currency loan with the total cost (interest and exchange losses) of the foreign currency loan. Appendix I showed that the increase in interest and loan repayment in time t, as a result of currency depreciation, was $DI_t = rz((1-t+1)(1+q)^t-1)$ and $DL = z((1+q)^t-1)$ respectively. The interest payment on the foreign currency loan is shown below:

Year	Loan Repayment	Interest payment	Outstanding Amount
0	-	-	xp
1	xp/N	rxp	xp/N(N-1)
2	xp/N	rxp/N(N-1)	xp/N(N-2)
3	xp/N	rxp/N(N-2)	xp/N(N-3)
*			
*			
*			
N-1	xp/N	2rxp/N	xp/N
N	xp/N	rxp/N	-

From Appendix 1, xp/N was defined as z. The generalized amount of interest payment for period t is given by

$I_t = rz(N-t+1)$

where I_t = Interest payment in time t.

The total cost of the foreign currency loan in time t is given by

$$I_t + DI_t + DL_t = rz(N-t+1) + rz(N-t+1)((1+q)^t - 1) + z((1+q)^t - 1)$$

The total cost over the life of the loan is given by:

$$z \sum_{t=1}^{N} r(N-t+1) + r(N-t+1)((1+q)^t - 1) + ((1+q)^t - 1)$$

The total amount of interest payments on the local currency loan is determined below:

Year	Loan Repayment	Interest Payment Interest Rate=R	Outstanding Loan
0	-	-	xp
1	xp/N	Rxp	xp/N(N-1)
2	xp/N	Rxp/N(N-1)	xp/N(N-2)
3	xp/N	Rxp/N(N-2)	xp/N(N-3)
*			
*			
*			
N-1	xp/N	2Rxp/N	xp/N
N	xp/N	Rxp/N	-

On generalizing the amount of interest payment for time t is given by Rz(N-t+1).

The total cost (interest payment) of the local currency loan over the life of the loan is given by

$$Rz \sum_{t=1}^{N} N-t+1$$

The total cost on the foreign currency loan must equal the total cost on the local currency loan at the certainty equivalent interest rate (R). Thus

$$Rz \sum_{t=1}^{N} (N-t+1) = z \sum_{t=1}^{N} r(N-t+1)+r(N-t+1)((1+q)^{t}-1)$$

$$R = r+r \frac{\sum_{t=1}^{N} (N-t+1)((1+q)^{t}-1)+\sum_{t=1}^{N} ((1+q)^{t}-1)}{\sum_{t=1}^{N}(N-t+1)}$$

8.00 APPENDIX III

Determination of a Project's Cost of Capital Based on "The Certainty Equivalent Rate of Interest".

Suppose that a project has foreign debt of L-interest rate r, a home debt of B, interest rate i and equity of S with cost K_s. Assuming a tax rate of T, then the weighted average cost of capital (WACC) for the project is given by

$$K = \frac{S.}{S+L+B} Ks + \frac{B}{S+L+B}. i(1-T) + \frac{L}{S+L+B}. r(1-T) \quad *** \text{ (i)}$$

where k is the project's weighted average cost of capital. Suppose that the certainty equivalent interest rate for the foreign currency loan is R, then the perceived weighted average cost of capital for the project is given by:

$$K^* = \frac{S}{S+L+B} . K_s + \frac{B}{S+L+B} . i(I-T) + \frac{L}{S+L+B}. R(1-T) *** \text{ (ii)}$$

This is the cost of capital which should be used to discount the cashflows of the project.

Subtracting equation (i) from (ii) we have:

$$K^* - K = \frac{L}{S+L+B} (1-T)(R-r) \quad *** \text{ (iii)}$$

K*-K is the increase in the project's cost of capital and depends on the proportion of foreign debt finance,

the certainty equivalent interest rate, and the tax rate.

Rearranging equation (iii) we have:

$$K^* = K + \frac{L}{s+L+B} (1-T) (R-r).$$

N.B. It is assumed that foreign exchange losses (both on interest and principal repayment) are tax deductable.

Appendix IV

Table Showing Actual and Expected NPVS and IRR and other Characteristics of the Projects in the Sample

PROJECT	YEAR OF FINANCING	ACTUAL NPV Kshs. "000"	EXPECTED NPV Kshs"000"	DIFFERENCE	EXPECTED IRR (%)	ACTUAL IRR (%)	DIFFERENCE	COST OF PROJECT Kshs. "000"	FOREIGN CURRENCY FUNDS Kshs."000"	INTEREST RATE (%)
1	2	3	4	5= 4-3	6	7	8= 6-7	9	10	11
AA	1980	1969	3589	1620	23.64	18.79	4.85	6000	4000	12.5
AB	1984	12720	13350	697	30.21	29.51	0.70	15825	7000	13.0
AC	1978	4947	5895	948	19.83	18.61	1.22	11325	5000	11.0
AD	1975	35963	41273	5310	23.20	21.67	1.53	61533	44735	10.5
AE	1979	(10926)	(8218)	2708	-6.03	-9.39	3.36	37240	6500	12.5
AF	1975	8754	13084	4330	16.41	14.73	1.68	42964	23330	11.0
AG	1979	3124	3530	396	35.37	33.22	2.15	2107	1107	10.5
AH	1981	(24554)	(7518)	17036	9.89	6.69	3.20	68000	30000	13.0
AI	1981	242	3496	3254	20.85	13.26	7.59	10796	6000	13.0
AJ	1982	21200	27789	6789	23.08	20.42	2.66	50460	33345	13.0
AK	1979	853	1723	870	18.73	15.06	3.67	5000	2500	11.0
AL	1982	(7746)	350	8096	13.25	7.32	5.93	36000	21000	13.0
AM	1983	(215)	1926	2141	14.86	12.79	2.07	20875	9066	13.0
AN	1974	3551	5194	1643	20.28	19.76	0.52	17314	9200	9.5
AO	1980	8306	11554	3248	38.58	32.60	5.98	10000	7500	13.0
AP	1981	1518	1806	288	26.49	24.52	0.97	900	750	13.0
AQ	1981	5336	5113	777	32.48	29.44	3.04	4500	3000	13.0
AR	1975	12060	14120	2060	21.42	19.13	2.29	28960	6000	13.0
AS	1975	212	1003	791	13.08	10.86	2.12	7108	3000	10.5
AT	1980	30876	33683	2807	34.05	32.49	1.56	19320	7500	11.0
AU	1982	2589	3694	1105	27.15	23.15	4.00	4720	3500	13.0
AV	1976	1152	1263	111	18.04	17.56	0.48	4200	2200	10.5
AW	1981	931	2519	1588	26.00	18.10	7.90	4000	3500	13.0
AX	1977	3648	3990	342	25.85	24.71	1.14	5640	2400	11.0
AZ	1978	(7475)	3234	10709	13.68	9.64	4.04	63855	24000	12.5
BA	1981	10591	16410	5819	18.64	16.20	2.44	55000	23000	11.0
BB	1981	968	3217	2249	23.41	16.18	7.23	7000	5000	13.0
BC	1079	3682	4067	385	34.49	32.93	1.54	4200	1000	11.0
BD	1978	829	1609	2438	15.08	8.53	6.50	8400	6200	11.0
BE	1976	9995	10473	478	31.85	31.55	0.30	11332	6000	11.0
BF	1981	3307	3760	453	29.72	27.99	1.73	5208	1300	13.0
BG	1979	2935	6671	3736	18.58	15.12	3.46	21760	8500	12.5
BH	1978	12153	12777	624	35.94	34.47	1.47	11440	3500	11.0
BI	1980	5156	7878	2722	18.43	17.50	0.93	27320	5633	13.0
BJ	1983	43653	60024	16371	25.93	22.94	2.99	79500	31500	10.0
BK	1981	2858	3243	385	16.40	15.89	0.51	11000	5000	12.0
BL	1982	5736	7463	1727	21.26	19.91	1.35	33540	4000	15.0
BM	1983	12551	15243	2692	24.23	23.04	1.19	30000	7500	14.0
BN	1986	2626	4810	2184	18.25	15.73	2.52	17500	6000	12.0
BO	1980	1821	2569	748	22.66	20.26	2.40	4300	1450	13.0
BP	1982	3639	5443	1804	24.64	21.64	3.00	10000	5000	14.0
BQ	1978	155	1323	1168	12.97	10.81	2.16	13520	6000	10.5
BR	1984	(1378)	241	1619	14.38	11.75	2.63	12500	6000	14.0
BS	1984	525	1766	1241	22.14	16.48	5.66	4800	2800	14.0
BT	1979	3023	3655	642	15.34	14.50	0.84	20000	8200	10.5
BU	1983	6910	7893	983	33.13	31.07	2.06	5203	2202	14.0
BV	1983	212	4695	4483	12.81	12.02	0.79	126800	22748	12.0
BW	1982	47276	50752	3476	30.69	29.85	0.84	42000	700	14.0
BX	1976	4624	4986	362	21.99	21.45	0.54	15686	4000	12.0
BY	1980	3303	4944	1641	18.68	16.96	1.72	12800	6000	12.0
BZ	1982	4515	6941	2426	23.61	20.90	2.71	13800	6500	15.0
CA	1984	12871	14022	1151	29.75	28.43	1.32	10880	5500	14.0
CB	1984	17037	19839	2802	29.57	27.56	2.01	23622	5000	14.0
CC	1981	40	1902	1862	13.51	12.03	1.48	21200	6500	12.0
CD	1984	51807	58978	7171	43.47	40.39	3.08	26500	13500	14.0

APPENDIX (V)

MBA PROJECT.

DATA COLLECTION SHEET

1. Project's Name _____
2. Year of Financing _____
3. Terms of the loan.
   No. of Years. _____
   Repayment terms
   (a) No. of instalments _____
   (b) Rate of interest _____
4. Loan Amount. Units of foreign currency _____
   Kshs. _____
   Exchange rate _____
5. Loan repayment (Units of Foreign Currency)

Period	Date	Principal	Interest	Exchange rate
0				
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				
18				

6. Foreign Exchange expected to be conserved _____

_____

_____

_____

7. Financing Plan

	Local	Foreign	Total
Equity			
Loans			
A _____			
B _____			
C _____			
D _____			

8. Profitability estimates

(Kshs)

Particulars	Year 0	1	2	3	4	5	6	7	8	9	10
Profit after tax											
Interest											
Depreciation											

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