ASSET AND LIABILITY MANAGEMENT OF AN INTEREST FREE ISLAMIC BANK

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DEDICATION

To my beloved **Father, Mother** and the other members of my family, I dedicate this humble work.

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First and foremost I would like to thank my Lord (*Allah*) for the bounties He bestowed upon me and may His peace and blessings be upon His Prophet Mohammed (SAW).

My deep thanks goes next to my supervisor Mr R.Sedgwick for his perceptive comments, continuous encouragement and support throughout the period of this work. My deep thanks are also extended to Mr D.Shearn who supervised the technical part and his comments and suggestions were extremely helpful for improving the final version of this aspect of the research.

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I also would like to express my gratitude to all Islamic banks which provided me with their financial reports and documents.

Finally, my most sincere thanks and tribute must go to my beloved father and mother who struggled and faced alone the difficulties of life for the sake of my well-being and good education which I am enjoying today. I ask God Almighty to make me obedient and subservient to them, always and for ever, for the whole remaining period of my life. **Ameen.**

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SUMMARY

The last two decades or so have witnessed the emergence of a new type of financial intermediaries. That is the establishment of interest free Islamic financial institutions (IFIs). As a result the literature that deals with aspects related to these institutions has grown rapidly. Three main areas have received considerable attention from economists, bankers, jurists of Islamic Jurisprudence and other academics. These are descriptive analysis of how such a system operates, theoretical framework of such a system utilizing modern tools of economic analysis and empirical studies of evaluating certain experiments. As far as the application of quantitative tools to certain problems of these intermediaries is concerned little progress has been made. This study is an addition to the work carried out in that area by discussing the Asset and Liability Management (ALM) problem of Islamic Banks (IBs) and then developing linear optimization models that help managers to decide the structure of assets, liabilities and capital accounts of their intermediaries. In addition, this study also aims to examine thoroughly the way these institutions operate so as the managerial problems of these practices are identified and taken into account in the modelling process. Similarly, the main characteristics that distinguish these intermediaries from interest based banks are identified. The application of the developed models to the data of two practising IBs reveals that the adoption of quantitative approaches to managerial problems of these firms is quite encouraging. In the sense that these techniques have captured some policies pursued by the management of the selected institutions. Moreover, these methods help managers to identify, and concentrate clearly on, the problem to be considered. However, the main requirement which deserves particular attention in the implementation process of these models is to have comprehensive, detailed and properly recorded and prepared input data.

Chapter 1

Introduction

The establishment of financial Institutions (FIs) based on the principles of Islamic Law (IL) (*Shari'ah*) is recent in its origin. The history of this establishment can be traced back to the late 1940's or the beginning of the 1950's when most of the Islamic countries (ICs) became independent states. The first Islamic financial institution (IFI) in modern time was established in the late 1950's in a rural area in Pakistan. Landowners were the main backers of the institution. They were prepared to deposit funds without interest earnings, and the credit too was made without charging interest to the poor peasants for the improvements of agriculture sector of the economy. But this experiment came to an end in the early 1960's because of the inability of the intermediary to meet the requirements of depositors and the salaries of the recruited staff. Wilson (1983) reported that this difficulty was the result of the limited resources available to the institution, because of its reliance on a small administrative fixed fee at the time when the loan was made available as the sole source of income to cover operating and other expenses. As this experiment of Pakistan came to an end another private initiative took place in the early 1960's, in the rural area of Mit-Ghamr in Egypt under the name of savings bank. This trial was launched by Ahmed EL-

Naggar, who later became the general secretary of the International Association of Islamic Banks (IAIB). Low-income peasants and labourers were the main backers of the institution. Within three years, the number of depositors reached 60 thousands as compared to a thousand founding depositors. The partial success of this experiment has been the result of careful selection of the staff of the bank. Accordingly, they had gained the confidence of the people in the local community, because of their adherence to Islamic teachings in their daily practices. Despite its success the experiment was short-lived because of the lack of government support and the fact that the bank did not share in the outcome of the results generated by the borrowers. Because, the bank , as in the experiment in Pakistan, charged a small administrative fixed fee at the time the loan is made and did not share in the profit or loss on the funds loaned for investment purposes which is an essential requirement for the operation of a bank conducting its affairs according to Islamic principles, as we will see in later stages of the research. After these private initiatives no further attempt was made until the 1970's, when Egypt and Pakistan proposed the establishment of Islamic Banking during the meeting of the foreign ministers of the Organization of Islamic Conference (OIC). As a result the Islamic Development Bank(IDB), a Jeddah-based international institution, was established. The main purpose of this institution was to foster economic development among the members of the OIC countries. After that the idea of establishing banks and other financial institutions (FIs) on the bases of IL has flourished. On the domestic level it was the establishment of Dubai Islamic Bank (DIB), of the United Arab Emirates, the first commercial bank to start providing financial services on the basis of Islamic teachings. From that time the process of establishing Islamic financial institutions (IFIs) has grown rapidly, especially in the second half of the 1970's and early 1980's. Now there are more than 100 IFIs working

in Muslim as well as other communities. This new phenomenon has attracted the interest of economists (Muslim and non-Muslim), bankers and the jurists of Islamic jurisprudence. As a result several studies have been conducted in examining different issues concerning the work of this new type of financial institutions (FIs) and the implications of their establishment. The scope of these studies can be grouped into three main categories, Ahmed(1989). The first is descriptive, consisting mainly of historical discussions of the nature of the banking system based on the principles of Islam. The second examines rigorously the theoretical framework of such a system, using modern tools of economic analysis. The third, which is still in its infancy, focuses on evaluating the experiences of the practices of some working institutions. As far as the application of the concepts of the theory of finance and quantitative tools to IBs are concerned, no significant progress has been made apart from the work of Bashir (1982,1983). In that occasion Bashir discussed the portfolio management of IBs then he developed a mathematical model to help managers decide: 1)- the optimal investment proportions, and 2)- the optimal profit and loss sharing (PLS) ratios. It is clear that Bashir's study lies in the area of asset management (i.e. resource allocation). In this study , however, the author shares the view of other academics e.g.Kusy and Ziemba (1986) that both sides of the balance sheet should be considered in discussing the asset and liability management (ALM) problem of banks. Two things justify this simultaneous considerations: 1)- basic accounting principles need to be satisfied; and 2)- the liquidity of assets and liabilities can be matched. Therefore the purpose of this study is to discuss the ALM problem of IBs and then develop a mathematical model that will help managers in deciding the "optimal" combinations of assets and liabilities that optimize (i.e. maximize or minimize) the targeted objective(s) over the span of a planning horizon.

Hence this current study aims to achieve the following objectives:

1. Examine thoroughly the way Islamic Banks (IBs) conduct their business operations in providing financial services to their customers. From this discussion the special features that distinguish these institutions from conventional interest-based banks are identified.

2. Discuss the asset and liability management (ALM) problem, and other managerial problems, facing the management of these intermediaries (i.e. IBs).

3. Develop an optimization model that can capture the constraints that limit the freedom of action of the management in pursuing the targeted objectives. The main purpose of this exercise is to see what optimization techniques can offer in the planning and management of the activities of IBs.

In the light of the forementioned objectives the hypotheses of the study, therefore, can be stated as follows:

Are "Islamic Banks" banks? If the answer is yes in what sense do they differ from the existing interest based commercial banks?

What are the likely implications, on the managerial level, of these banks being "Islamic"? In other words, are there any problems that might arise for the management of these institutions in a world where the whole environment through which these intermediaries operate is not "Islamic"?

How well does the management of these banks cope with the encountered difficulties?, and finally

What are the likely benefits and costs of adopting the proposed optimization techniques to counter some of these problems?

The author has taken the above approach in treating the ALM problem of these banks on the belief that if the founders or the management of these intermediaries want to gain a sustainable ground in the markets they serve they should devote a great deal of considerations to the following factors:

- Firstly, to adhere fully to the principles of Islamic Law (IL) whatsoever the difficulties faced. So that customers will have confidence that owners/managers of these institutions are genuine in their efforts and claims.

- Secondly, they should be innovative and competent in the managerial aspects as well as the "production" of financial services. That is they should be able to build up good skills, experiences, benefiting from modern technology and managerial techniques which have been developed in the advanced world. Because as Qureshi(1983) pointed out " a poor management may turn out to be fatal to the new system. Under this system, the savers will put a great deal of trust in financial intermediaries by giving their savings without getting a guarantee for its return". However, this last option should not be adopted blindly regardless the availability of resources for carrying out such a process and the special characteristics of the Muslim communities.

The methodology pursued in achieving the aims of this study is summarized in the following steps:

1. The first step is descriptive covering two main areas:

   - The working of Islamic Banks (IBs) is examined rigorously as expressed in the literature of Islamic Banking and as it appears in practice. More emphasis in this study, however, is given to the contractual arrangements that link these banks with surplus and deficit economic units. Undertaking

this approach allows us to determine the special features that distinguish these newly established intermediaries from interest based banks as well as this approach allows us to identify the managerial problems attached to such arrangements. On the practical level two operating institutions have been chosen. These are Kuwait Finance House (KFH) and Jordan Islamic Bank (JIB). These two institutions have been selected for two basic reasons. The first is their cooperation and willingness at the early stages of the research to supply me with information. The second is the fact that this particular selection enables me to study the arrangements adopted by Islamic Banks in different localities of the Muslim world, because the economic conditions in each locality are different. Hence on the one hand it can be derived how flexible Islamic Law (*Shari'ah*) is in serving the needs of each community and on the other hand to observe the impact of the environment on the operations adopted by each institution, especially the impact of the regulations of the monetary authorities.

- Discussing in particular the Asset and Liability Management (ALM) problem of these institutions and accordingly determine what is so special about the ALM problem of these intermediaries.

2. The second step is empirical where a questionnaire was designed and forwarded to the management of some of these institutions. The main aim of this exercise was to identify the objectives targeted by the management of these banks and the constraints that limit the decision making process of the management.

3. The third and last step was to build optimization models of the ALM problem of these banks. Single and multi-objective linear versions have been considered on

the basis of certainty for a planning period of one year. Having developed these two models, the results generated by them are compared with those actually achieved and some managerial implications of this exercise are drawn.

The course of the above methodology is covered in the chapters that this study contains. In addition to this introductory chapter the study consists of nine other chapters. A summary of their contents is given below:

Chapter Two. explains the general framework of how financial intermediaries conduct their business of the provision of financial services. This theoretical discussion serves as a background that helps us in understanding the way the newly established banks operate and how they differ from other FIs especially non-Islamic banks.

Chapter Three. In this chapter the work of Islamic Banking is examined as expressed in the literature and applied in practice. On the theoretical level the principles provided by IL in the finance field are discussed first. This discussion is then followed by a rigorous examination of the instruments used by these intermediaries to pool and transmit funds. On the practical level Kuwait Finance House (KFH) and Jordan Islamic Bank (JIB) are studied to see how IBs conduct their affairs in the real world.

Chapter Four. In order to have more insight into the working of IBs, how they determine their position in the intermediation sector and recognize that they differ from existing non-Islamic banks, the maturity transformation role of banking is examined. This step has been taken because one of the criterion used to distinguish banks from other FIs (i.e. Non-bank financial intermediaries (NBFIs)) is the fact that banks tend to create liquidity rather than transmit it, whereas other financial institutions tend to distribute rather than add to the existing liquidity created elsewhere.

Chapter Five. Having examined the nature and the working of IBs in the previous chapters, this chapter focuses on the ALM problem of these institutions. Therefore,

the main task to be accomplished in this chapter is to study the special features of the ALM problem that arise from the fact that these banks are identified as "Islamic". Features like the limitations imposed on these intermediaries from the environment within which they operate, the competition from conventional interest based institutions and so forth.

Chapter Six. The ALM problem is an area of vital importance to the management of commercial banks in general. It is, therefore, not surprising that a great deal of effort has been spent in analysing and proposing solutions of how this problem can be tackled. In the recent past many academics have constructed quantitative approaches, taking the form of mathematical models, as one way of dealing with this problem and suggesting how it can be solved. Since the author is going to follow this approach, a review of the previous work is the main concern of this chapter.

Chapter Seven. This chapter covers the second step of the research methodology. That is the questionnaire designed and sent to the management of some of Islamic Banks is analysed. The questionnaire contains 18 questions (see Appendix 7.3). Seventeen of which have been included in five parts of this questionnaire with each part serving a particular purpose. The eighteenth question is a general one that has been included to give the management of these intermediaries the opportunity to suggest, comment or add any thing which they think is of great assistance to the fulfilment of the aims of this study. In most cases percentages have been used in analysing the obtained responses, while in others (i.e. in cases where ranking have been asked of the management or some relationships between some variables were sought) the Kendall coefficient of concordance (W) has been used. This approach has been followed because of the small size of the sample.

Chapter Eight. This chapter covers the first part of the third step of the research.

That is the construction of a Linear Programming (LP) model for the ALM problem of an IB. The results of the developed model are then compared against the actual results achieved by the management of two practicing institutions (i.e. KFH and JIB). Some managerial implications of applying such a technique (i.e. LP) has been dealt with as a second phase of assessing the use of the model. This second phase has been conducted under the subject of post-optimal analysis of the results obtained by the LP program. The reason for doing this exercise is to introduce this mathematical method as a decision making tool for the decision maker, rather than as a mechanical approach of obtaining the optimal solution of the program.

Chapter Nine. Covers the second part of the last step of the research. That is the building up of a multiobjective optimization model (MOOM) for the ALM problem of an IB. Thus the main step taken in this phase of the research is to relax the assumption of a single objective discussed in the previous chapter. The results generated by this model are then compared with those actually achieved on the one hand and with those of the single objective on the other. This simple exercise allows us to assess the results obtained by this model and thereafter identifying some of the managerial implications of applying such a model.

Chapter Ten. This last chapter in this study contains the general concluding remarks drawn from undertaking this research and their implications for the management of IBs. In addition some suggestions for further research in the the ALM area of IBs in particular and the area of Islamic Banking in general are included.

Chapter 2

What Is a Financial Intermediary?

2.1 Introduction

The main purpose of this chapter is to explain the general framework of how financial intermediaries (FIs) operate, their links with borrowers and lenders, how they are classified, and the special role played by them in the economy. In doing so, the operations of the newly established banks (i.e. Islamic Banks (IBs)) can be understood more easily.

2.2 General Framework of how funds can be channelled.

Funds between surplus economic units (ultimate lenders) and deficit economic units (ultimate borrowers) can be channelled through three main ways:

2.2.1 Direct Financing - Barter Exchange.

In this case borrowers and lenders trade funds between themselves without the involvement of any intermediaries or markets. In a modern economy it is argued that this is an inefficient way, because of the problems associated with its practice. Broadly speaking, problems associated with this way of finance are similar to those associated with barter exchange. Among others, one can mention the following:

- High transaction costs in terms of time, search and the like.
- Difficulties of matching the needs of the two parties (ultimate borrowers and lenders).
- Lack of diversification.
- High risks: liquidity, default and the variations in rates of return.

Although this direct way of financing is inefficient in many aspects, it does take place in the present time, especially in the communities where financial practices are not widespread, because of the underdevelopment of the financial system or the resentment of the people to participate in it.

2.2.2 Direct Financing - Market place case.

In this way of financing, financial markets are being established, so that the two parties can meet their requirements as sellers of funds (holders of securities = security buyers) in the case of ultimate lenders or as buyers of funds (security issuers = security sellers) in the case of ultimate borrowers. Brokerage firms will play an important role in providing information about trading opportunities against fixed fees or commissions. The function of these firms is to play the 'middleman' role, that is

transmitting funds and securities between the parties without any transformation to the basic characteristics of the securities involved. Some of the gains that this way of finance can provide are listed below:

- Easing trade between lenders and borrowers, because there is a particular place where both parties can meet.
- Reducing transaction costs in terms of time and search.
- Providing more liquidity, because of the ability of encashing securities, before their maturity date, more easier than the barter exchange case.
- Narrowing the gap in mismatch requirements of the two parties (ultimate borrowers and lenders), because more information is available about trading opportunities.

Even though this way of transmitting funds has overcome some of the difficulties countered in the barter exchange case, there is still a third way through which these problems can be reduced further. This way is the establishment of firms that specialize in funds trading. These firms are called financial intermediaries (FIs) and their functioning is treated in the next section.

2.2.3 Indirect Financing - Financial Intermediaries case.

Here we come to a situation where the channelling of funds is conducted through firms performing the "production" of financial services function as other firms, in the economy, that specialize in the production of goods and other services. These firms are literally known as financial intermediaries or institutions (FIs). Therefore, FIs can be defined as those institutions that stand in between surplus economic units

(ultimate lenders) and deficit economic units (ultimate borrowers). That is they stand between those economic units whose earnings exceed their expenditure at any moment in time and those units whose needs of financial resources exceed their own resources. In this case securities, in most cases, are no longer passed on without being transformed. That is why the contractual arrangements are broken down into two separate phases:

1. Arrangements between intermediaries and their borrowers, on one hand and,

2. The intermediaries and their lenders on the other.

Thus FIs are combining brokerage (distribution) and transformation functions. That is why they are called firms, because they mix up certain 'factors of production' as inputs to produce the final 'output' in the form of financial services. Although what it is that these firms produce is a controversial point, but these intermediaries seem to satisfy the following basic needs of other firms and households, Lewis and Davis(1987):

1. Payment services, which provide means of paying for and acquiring goods and services.

2. Consumption transformation, which enables the purchase of goods to be rearranged over time. For example households can defer spending to later periods, firms can undertake investment now.

3. Financial security, which ensures the consonance of consumption and investment expenditure in the face of changed economic circumstances, as may arise from ill health, accidents to life or property, unemployment, exchange rate variations, etc.

The above discussion of the ways of channeling funds can be summarized in Figure 2.1. It is clear from this Figure that in direct financing case (whether it is a barter exchange or market place) funds are being exchanged with primary securities i.e. securities issued by deficit economic units no alteration has been made to the basic characteristics of these securities. However, in the indirect way of financing the operation is broken down into two separate cases:

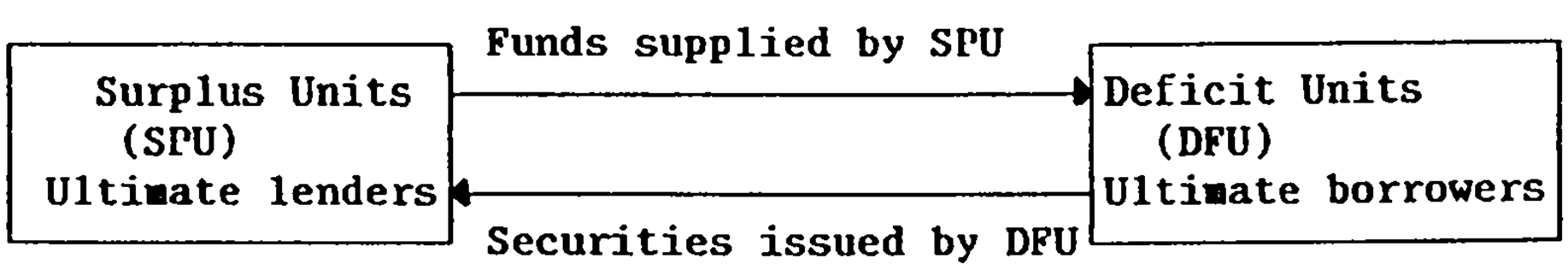
- Intermediaries are pooling funds from surplus units by issuing secondary securities (with characteristics different from primary ones) against themselves.

- Intermediaries are transmitting funds to deficit units by holding primary securities issued by these economic units. The lower section of Figure 2.1 provides the following facts about FIs:

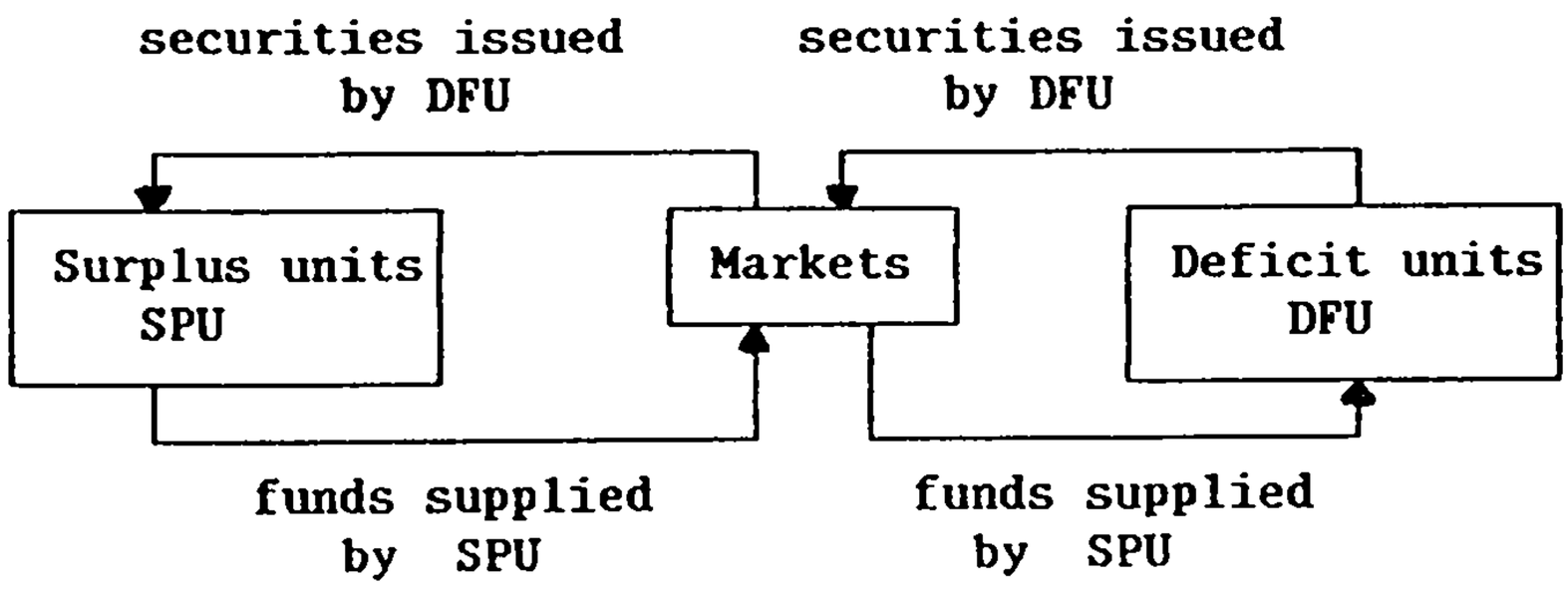
  1. In channeling funds through FIs, three players are involved:
     - Surplus economic units (ultimate lenders), - FIs, and - Deficit economic units (ultimate borrowers). This fact also is present in the middle section of the Figure, where FIs are replaced by markets.
  2. FIs obtain funds from surplus economic units by issuing securities which represent the claims of lenders on FIs. These securities are known as "secondary securities". Thus secondary securities are those financial instruments issued and sold by FIs in exchange of funds from surplus economic units. Secondary securities, therefore, are assets for lenders and liabilities against FIs.
  3. Deficit economic units (ultimate borrowers) acquire funds from FIs by issuing securities which represent FIs claims. These securities are termed "primary securities". Therefore, primary securities can be defined as financial

Figure 2.1 Stages of Intermediation.

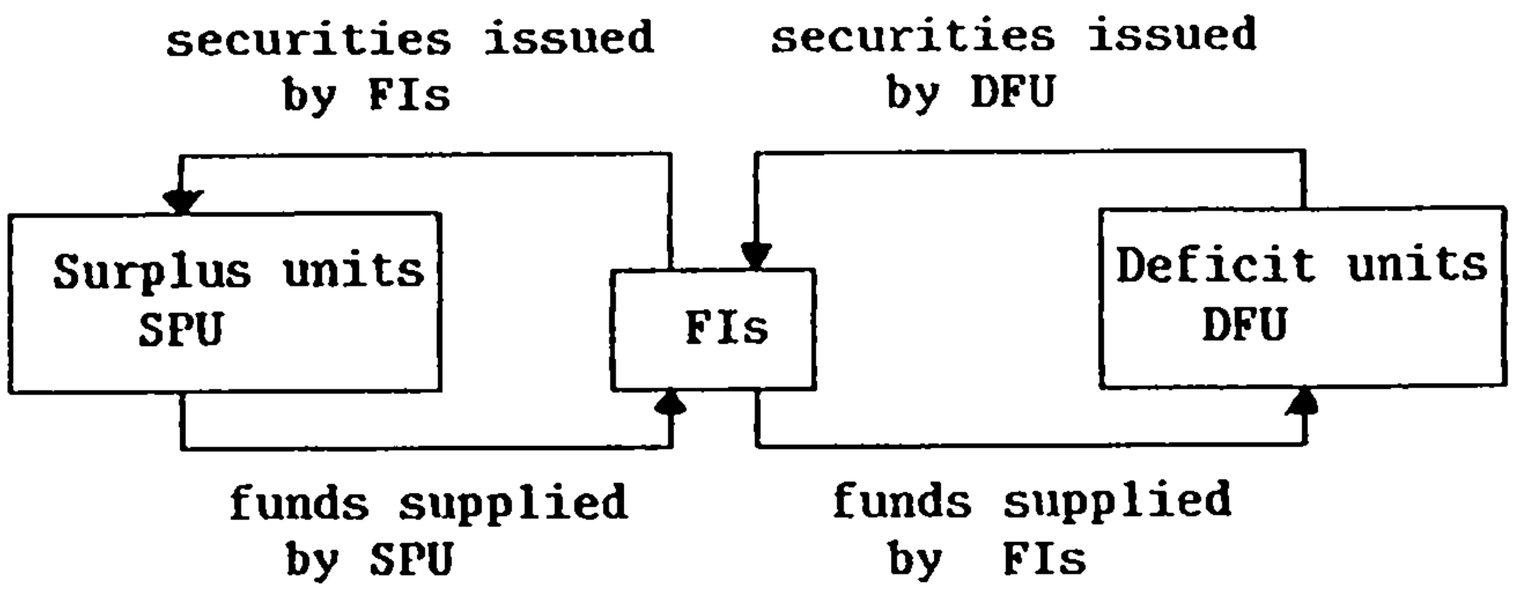
The first phase: Barter case.



The second phase : Establishment of markets.



The third phase: Establishment of FIs.



claims, debt or equity instruments, against business concern, individuals and governments. Hence primary securities are assets of FIs and liabilities against ultimate borrowers.

4. The securities issued by FIs differ, in many aspects such as size, safety, liquidity, maturity, markatability, etc, from primary securities. The most important of which are market value and liquidity. Liquidity is defined, in this case, as the investors' ability to convert assets such as checking accounts into cash at short notice with little or no loss in current value, Gup (1984). Thus financial intermediaries are assets transformers in the sense that changing risky primary securities (their assets (e.g. loans)) with unstable market value into less risky securities (their liabilities (e.g. chequing deposits)) with stable market value. In short, the securities are no longer passed on, in most cases, without any transformation to the basic characteristics of primary securities.

5. Since FIs are defined as firms that belong to the service sector of the economy like any other firms, the management of these institutions, therefore, is responsible for earning income for those who have initiated their establishment. As Crosse and Hempel (1980) pointed out that "... FIs management should use the same basic framework for decision making as any other private business corporation ... the task of competent management of FIs is to perform the economic functions inherent in the intermediation business in such away as to maximize the return on the owners' investment over time without taking excessive risks".

It appears from the above list that it is the function of asset transformation which gives FIs the distinctive feature in the structure of the financial system.

Therefore, it seems that a fundamental question arises; that is why are these firms able to perform this function? In other words, why are FIs able to operate in the way described above? The main reason advocated by academics in their analysis is the fact that these firms are able to exploit and benefit from the phenomenon of the Law of Large numbers. It is widely argued that this law helps FIs to achieve the following aims:

Firstly, **FIs are able to reduce risk.** There are various types of risks (e.g. default risk, variations of rate of return risk, exchange rate risk,etc) that are borne from dealings in financial transactions. Two basic types of risk are examined here to illustrate how FIs can benefit from the law of large numbers in order to reduce the size of the risk involved. Default risk refers to the inability of the borrower to repay his obligations (i.e. the principal plus the amount of interest or profit, if any, realized) back when they come due. It is obvious in the case of direct financing that the single ultimate lender bears all the default risk borne from such engagement in the direct financial transactions. However, if that single investor places his funds with an intermediary which in turn on-lends this amount and other funds of other depositors to a large number of borrowers, the size of risk incurred by the single lender will be reduced in this case. To illustrate how this can be done let us consider the following example: suppose that an individual lender wants to invest 100 pounds directly, let say, to a businessman in his local community. Assume further that there is a probability of 5 percent that the businessman will default completely i.e. when the time of the repayment comes due the lender receives the whole of his money back or nothing at all. Now let us suppose that instead of direct lending to the

ultimate borrower the lender deposited his 100 pounds with an FI, which is also faced with a 5 per cent that the borrower will be unable to repay the money back, and the FI has received other deposits so that its total deposits are 1000 pounds. The FI has used these deposits to finance the projects of 10 entrepreneurs, 100 pounds each. Since there is a probability of 5 per cent that the money lent will be considered as bad debts, the FI can expect a loss totaling 50 pounds on these funds. This loss in turn will be divided between, let say the 10 depositors, each one of them incurring the sum of 5 pounds. We can see from this simple example how our lender has exchanged a 5 per cent chance that he will lose *all* his money if he lends directly to a single borrower, for a near certainty that he will lose 5 per cent of his investment only as a result of the spreading of the loss of 50 pounds over all depositors of the FI. We can conclude that FIs are able to reduce the size of the default risk for a single lender by this pooling of risk mechanism. Now consider the other type of risk, i.e. the variations of the rate of return. The key element of reducing the size of this risk is through diversification. This process refers to the spreading of funds over a range of projects rather than putting the whole money in a single project or with a single borrower. Thus an individual lender is faced with greater risk (i.e. putting all his eggs in one basket) if he places his funds in a single project. Since intermediaries are dealing with a large number of borrowers it is expected that their portfolios are well diversified or at least these portfolios are more diversified than in the case of direct financing to the extent that the size of the variations of rates of return is reduced.

Secondly, **FIs are able to provide liquidity.** This aim is achieved by FIs through the maturity transformation of primary securities they hold as their assets. In other words at least some FIs, such as banks, are able to transform their illiquid risky assets (primary securities) into safe liquid liabilities (secondary securities). FIs are able to perform this function because of the of the large number of customers they deal with. It is expected that under normal conditions not everybody wants his money at the same time or at least that there is a large number of depositors who can make almost a perfect offsetting between deposited funds and those withdrawn. Therefore, FIs but especially banks are in a position that allows them to practise the maturity transformation function. It should be noted that the Law of Large numbers is only one factor that explains why FIs are able to produce another class of securities which differ, in many aspects, with the securities issued by ultimate borrowers, there are other factors which should not be ignored (e.g. good and sustainable shares in the markets of both depositors and borrowers, especially that of depositors, good assessments of the credit-worthiness of borrowers, the participation in well developed financial markets, etc). Moreover, in the case of retail banks [1] there is another factor that should be taken into account. That is the money transmission function that these intermediaries provide. This element has given an edge to banks over other FIs in providing liquidity to individuals and institutions. As early as the day of their establishment banks have accepted deposits from surplus economic units and issued certificates for these customers specifying the conditions and rights of withdrawing the

[1] Rtail banks, commercial banks, interest-based banks, non-Islamic Banks or simply banks are used in this research interchangably to mean the same thing.

deposited funds. In modern time, however, this function has developed and expended tremendously. Banks provide an array of deposit facilities ranging from demand to time deposits. In any case the accountholder of these deposits, particularly demand type, is supplied with cheque books and cards which are used for discharging debts and spending expenses (whether to pay for services or goods and commodities). In addition, with the help of developments in information technology banks have introduced other means through which the function of the money transmission services can be carried out. These means include, among others, Visa, Access and other credit cards, automated teller machines,etc.

Thirdly, **FIs are able to reduce the monitoring costs of borrowers' projects.** In recent years much emphasis has been placed on the delegated monitoring function carried out by FIs. Many models have been developed which illustrate the fact that FIs are delegated the task of monitoring the costly loans or projects of borrowers or entrepreneurs. FIs can play this role because they have a net cost advantage over the direct case of lending and borrowing. This is so because the environment through which financial transactions take place is characterized by the presence of information asymmetry phenomenon. That is, investors or entrepreneurs know more about the businesses they are undertaking than the ultimate lenders do. If lenders are inclined to monitor the investors's project they should be prepared to incur a monitoring cost. Therefore, they are faced with the following dilemma: either not to bother about the performance of the projects financed by their funds or to incur the cost of monitoring. However, there is a third way that this dilemma can be overcome. That

is to delegate this task to some of them or to an outsider who can reduce the monitoring cost quite considerably through the specialization of information processing and collection about the businesses of the borrowers. In this last case FIs clearly fit the bill of performing such a task. As Diamond (1984) demonstrated "... the cots of monitoring may be very high [in the case of direct lending-borrowing process] if there are many lenders. If there are m outside security holders in a firm and it costs $K > 0$ to monitor, the total cost of direct monitoring is m*K. This will imply either a very large expenditure on monitoring, or a free rider problem where no securityholder monitors because his share of the benefits is small. The obvious thing to do is for some securityholders to monitor on behalf of others, and we are then faced with analysing the provision of the incentives for delegated monitoring [carried out by FIs]." It was, in fact that work of Diamond (1984) which initiated the large block of literature developed in this area. Diamond (1984) argued that diversification within the intermediary is the key element of achieving such net cost advantage over direct lendi ng-borrowing of the cost of monitoring the information of the projects of borrowers.

From the foregoing discussion we can summarize the following characteristics that FIs have, Boyd and Prescott (1986):

1. Financial intermediaries borrow from one subset of agents in the economy and lend to another.

2. Both subsets-borrowers and lenders- are typically large. Thus, to the extent that numbers represent diversification, FIs are generally well diversi-

fied in both sides of their balance sheet.

3. Financial intermediaries deal with borrowers whose information set may be different from theirs. In practical terms, this means that would-be borrowers often have better information concerning their own credit risk than do the intermediaries.

4. FIs produce costly information on the attributes of would-be borrowers. This information is used to allocate loans and set terms.

5. FIs issue claims that have state contingent payoffs different from claims issued by ultimate borrowers.

2.3 Classification of FIs.

In the previous section we have discussed generally how intermediaries operate and why they are able to perform such a distinctive role in the economy. Attention in this section is given to the task of classifying FIs. There are many FIs operating nowadays: what differentiates one group of FIs from the other (or an FI from the other)? One can argue that this is a simple task, because if we have many business companies practicing in the same sector (let us say the automobile sector) and yet we can distinguish one factory from the other, therefore the same principle holds true for FIs. However, while this argument can be applied to other sectors, because of the high degree of specialization, it cannot be applied easily to the 'finance industry', because of imperfect specialization. Carter and Partington (1981) state " The 'finance industry' consists of many different types of firms providing a wide range of services, and this presents difficulties in deciding how to classify them. This difficulty is partly

the result of imperfect specialization by financial firms, i.e. many firms perform different kind of functions for their costumers and the distinguishing features may not be very clear from mere examination of their balance sheets...". In this study, however, we can argue that all FIs are similar in purpose, i.e. the provision of financial services to their costumers. One way of classifying FIs is to examine thoroughly the primary and secondary securities in which FIs deal. As Gup (1984) states " the principal difference among various types of FIs concerns the types of primary securities they hold as assets and the types of secondary securities they sell as liabilities", Table 2.1 is presented below to illustrate this point.

Table 2.1 Examples of Securities at Selected Financial Intermediaries.

Financial Intermediary	Primary Security	Secondary security
Savings and loan associations	Mortgages	Saving shares
Mutual funds	Stocks and Bonds	Mutual fund shares
Life insurance companies	Stocks, Bonds and Mortgages	Life insurance policies or certificates
Credit unions	Consumer loans	credit union shares
Commercial banks	Commercial and industrial loans, consumer loans and Mortgages	Demand deposits savings accounts Certificates of deposits
Pension funds	Stocks and Bonds	Pension funds policies
Money market funds	short-term securities	shares

Note : This Table has been reproduced from Gup(1984).

It is clear from the above Table that FIs do have some overlapping of services, especially in the case of primary securities, in providing financial services to their customers, but they do have contrasts which distinguish one FI from the other. For example, take the case of Mutual and Pension funds, both intermediaries hold stocks and bonds as their primary securities. However, the secondary

securities that are issued by each one are not the same. Mutual funds are issuing mutual fund shares, on the other hand Pension funds issue pension funds policies. It is, therefore, obvious that one way of dealing with the classification problem of FIs is to examine thoroughly the primary and secondary securities each FI holds.

Another approach of classifying FIs is to consider in a broad sense the way they undertake their business. Carter and Partington (1981) point out that "... thus it may be necessary to consider ... the way in which they [FIs] operate their business ...".

A good starting point for examining the classification of FIs is the traditional classification of FIs; that is FIs generally can be divided into two main groups: Bank Financial Intermediaries (BFIs) and Non-Bank Financial Intermediaries (NBFIs). This classification of FIs is based upon two broad approaches as discussed by academics (e.g Carter and Partington (1981), Bain (1981), Goacher (1986), and Lewis and Davis (1987)). These two approaches are:

- Examining the liabilities of FIs and determining the precise nature and use of these liabilities. In the previous section we concluded our discussion about FIs by summing up five important facts about the operations of FIs. It is the last fact which is our main concern here, that is the class of securities created by FIs against themselves (these securities are assets for lenders and liabilities against FIs). It is argued by some academics that the liabilities of BFIs are unique in the sense that they serve the function of means of exchange and payment. Thus, these liabilities of BFIs are used as money for settling debts and payments, whereas the liabilities of NBFIs cannot be used in this way. In other words, the liabilities of BFIs consti-

tute a major part of the money supply, whereas the liabilities of NBFIs do not. Clearly, this distinction depends upon the definition of money, a narrow definition (M_o) means all FIs are classified as NBFIs, broad definitions mean FIs are divided into BFIs and NBFIs. Nonetheless, even if we take the latter criterion (broad definition of money) much controversy remains, as Goacher (1986) points out " there are many ambiguities, such as what proportion of these liabilities should be included in the chosen money supply measure, surrounding this particular basis of classification". Since this criterion of classification does not tell us a lot about the contribution of an individual bank to the liquidity available for the rest of the economy (banks and non bank agents). It is, therefore, not of much importance in our analysis. In Niehans and Hewson's (1976) work this criterion of classification is termed as gross liquidity, and it can be measured in terms of suitably defined monetary aggregate like M_1, M_2, etc.

- The other approach is based on the criterion of whether the intermediary can create credit (liquidity creation), or passes on credit (liquidity distribution). If the intermediary creates liquidity (adds liquidity to the rest of the economy) is said to be considered as an BFI, if this is not the case the intermediary is classified as an NBFI. More investigations of these points will be carried out when the maturity transformation of IBs is examined.

2.4 The role played by the FIs in the economy.

To begin our discussion, we can state that the basic role played by FIs centres around narrowing the gap between the mismatch needs of ultimate lenders

(savers) and ultimate borrowers (investors), as stated by Hempel and Yawitz (1977) " FIs operate in order to fill the diverse needs of both ultimate lenders and ultimate borrowers in the economy". Clearly, this is not the only role played by FIs. Imagine that we are in an economy where neither money nor any other financial asset exists, in this case, all economic units would be required to have balanced budgets at all times and capital formation, therefore, would be very low. It depends upon the distribution of current income, more consumption now means small amounts will be assigned for savings in the future and vice versa. In this economy, it is argued that external financing would be very limited. Hence, this economy would tend to be relatively inefficient in allocating resources and would tend to have a low rate of economic growth. Now consider the other side of the coin, that is the case of an economy where a complete financial system (i.e. where a range of financial instruments, institutions and markets exist) is established. In this economy there exist money as well as variety of financial assets and the trade in funds is internalized, (as we saw in the second section). In this economy the specialized institutions (FIs) can perform the function of channeling funds either as agents (brokers) i.e. the transmitting of funds and assets without any modifications, or as asset transformers. It is this latter case which is thought to give FIs certain advantages in performing the intermediation role, this is not to say that brokerage function is not an important function, but just to emphasize the "production" function performed by FIs. This asset transformation function assists economic growth in so many aspects, Hempel and Yawitz (1977), Yeager and Seitz (1989) and Henning, Pigott and Scott (1988). First, it bridges the gap of mismatching needs of ultimate borrowers and ultimate lenders by creating two markets, one for borrowers and

the other for lenders (see the second section). Second, it separates saving from investment decisions, so as the budget constraints of economic agents are extended. Third, it encourages saving and investment processes by providing a menu of financial assets (e.g. current accounts, units of unit trust,etc) and a variety of arrangements (e.g. loans, drafts,etc) for transmitting the available funds respectively. Therefore, saving and investment processes became more attractive, so that the growth of capital and income is increased. Fourth, it (transformation) reduces risk and costs involved in the direct way of channeling funds, and it increases liquidity and marketability of liabilities. Fifth, possessing and providing information about investment opportunities, so as the selection of assets for portfolios is delegated and monitored by FIs. Sixth, productivity increases, because of specialization of activities.

Having said that, however, it is important to note that maturity transformation or transmutation as some called it, i.e. liquidity creation, as one aspect of asset transformation is not a desired function that should be carried out all times by FIs as some economists have argued. Niehans (1978) pointed out "there is no logical or economic reason why financial intermediaries should always increase the money supply. Nonbank intermediaries, for example, while perhaps increasing the liquidity of the rest of the economy, typically reduce its money supply. This is because they hold some monetary assets as reserves, while even their most liquid liabilities (like savings deposits) are not monetary. There is also no logical or economic reason why FIs should always increase the liquidity of the rest of the economy. One could imagine banks that find it profitable to maintain balance sheets implying a reduction in the nonbank liquidity by borrowing (in the aggregate) long to lend (in the aggregate) short ... by and large, however,

asset transformation by banks is usually of a sort to add both to the liquidity and to the money supply of the rest of the economy...". Some academics, on the other hand, have gone further than this by describing asset transformation function as a *mis*-function of FIs and the process that leads to the presence of this phenomenon as *mis*-intermediation. This type of analysis is well explained in the work of McCulloch (1981). After developing his analysis McCulloch (1981) ended his discussion by the following statements "we have shown that *mis*-intermediation, the traditional mismatching of asset and liability maturities by financial intermediaries, is a potential source of macroeconomic disequilibrium. Rather than protecting economic participants from interest rate uncertainty, it actually subjects the economy to additional, unnecessary interest rate uncertainty, and to inefficiency in the intertemporal production process. Far from being an essential function of financial intermediaries, maturity transformation is actually a *mis*-function".

2.5 Concluding Remarks.

From the above discussion the following remarks can be drawn:

FIs are firms whose main function is trading in funds. They internalize the operations of the provision of financial services, because of the considerable advantages that they can gain from; specialization, economies of scale and scope, the exploitation of the law of large numbers,etc.

In performing their function FIs create another class of financial instruments termed secondary securities. That is why the saving and investment operations are being separated by creating two markets; one for ultimate

borrowers and the other for the ultimate lenders. Secondary securities have many different features that distinguish them from primary ones. The most important of which are: market value, risk, safety and liquidity. It is well explained in the literature of FIs and the examination of the operations of FIs that: secondary securities are having a stable market value, more safer, less risky and more liquid than primary securities. Of course, many factors have attributed to the presence of these distinguishing elements. Among others, one can mention: the well developed money and capital markets, the well established inter-FIs link and the exploitation of the law of large numbers. This latter factor helps FIs in building well diversified portfolios on both sides of the balance sheet and constructing good models that assist in making nearly accurate expectations of some events (e.g. the number of people that are going to withdraw or deposit their funds in certain periods).

FIs are similar in purpose; that is the provision of financial services to their customers. However, different FIs are working under different names. One of the distinguishing factor that helps us in classifying FIs is the financial assets in which they deal. In other words, the examination of assets that an FI holds (i.e. primary securities) and the assets issued by that FI (i.e. secondary securities) allows us to classify them accordingly.

FIs play a very important role in the modern economy. They provide information about investment opportunities, and a menu of assets for savers as well as a variety of different arrangements for investors.

Chapter 3

How Do Islamic Banks Operate?

3.1 Introduction

The main concern of this chapter is to study the arrangements provided by Islamic Banks (IBs) in conducting their business operations of the provision of financial services. These new institutions claim that they can provide contractual arrangements for their customers on the basis of profit and loss sharing (PLS) principle. That is, these new institutions, in contrast to conventional banks, do not go to raise or invest funds through the use of the debt mode of finance. By examining the way these institutions operate, several interesting questions can be answered. Among others, one can mention the following: are they (IBs) really playing a special role in the communities within which they operate, so their existence is justified, or are they playing the same role as the conventional institutions? That is, is the reality just a change in name? Instead of saying just the word bank, should it be preceded by the adjective "Islamic" to signify a fundamental difference? The examination of how IBs operate, goes as follows: principles governing their operations are stated first. Contractual arrangements available to them (IBs) are discussed next. Thirdly, the functioning of

two operating institutions are examined; namely the Jordan Islamic Bank (JIB) and Kuwait Finance House (KFH).

3.2 Principles Governing the Operations of Islamic Banking.

Islam is a religion that provides general guide-lines which cover all aspects of human life, it is, therefore, not a religion in the limited sense of the word. It seeks to develop a new moral responsibility in man, and integrated social existence and a new socio-economic and political order. It has its own approach to economics, concepts, objectives, methods, laws and instruments, (Presley (1988)). Therefore, Islam provides a framework within which banking operations can be conducted. This framework is guided by the following principles,(Khan (1983), El-Naggar (1983) and Al-Abadi (1981)).

3.2.1 The Prohibition of "*Riba*" in all Transaction Forms.

It has been stated clearly and explicitly in the *Qur'an* (Muslims Holy Book) and the *Sunnah* [1], the two main sources of Islamic Law *Shari'ah* that *Allah* (i.e. God) prohibited usury and permitted trade. But, what is meant by this word? and what kind of banking operations are considered as *Riba* [2] transactions? Literally, the word *Riba* (usury) means increase, excess, growth, rise and the like. However, with respect

[1] *Sunnah* is the second source of Islamic Law (*Shari'ah*), and it refers essentially to the Prophet Mohammed's (PBUH) example as indicated by his practice of the *Deen* (i.e. religion of Islam). The only way to know the *Sunnah* is through the collection of *Ahadith* (plural of *Hadith*). This latter refers to a report on the saying, deed or tacit approval of the Prophet (PBUH), Chapra(1985) with minor modifications.

[2] The word *Riba* and usury are used in this study interchangeably to mean the same thing.

to the provision of financial services the word *Riba* is referred to in a specific context. In the pre-Islamic period the word usury was used conventionally to identify a class of business transactions. The general feature of these traditions was that a fixed amount was required over the principal. One form of dealings was that a person sold a product to some one on the agreement that a specified price was payable at future date. If at the end of the stipulated time the price was not paid by the buyer, then the seller would increase the amount due and extend the payment period, Khan (1985). Another form was that Arabs used to lend money to each other on the agreement that after a specified period of time the borrower would repay an excess amount over the principal sum due, Khan (1985). A third form was that an Arab would make a loan to someone on the basis of a monthly fixed return over the principal sum and if at the end of the loan period the borrower was unable to repay they would increase the monthly fixed return, Khan (1985). Clearly, these practices demonstrate two ways of practicing usury. The first is that maturity of the loan or an unpaid due amount is being extended on the basis that the lender is getting paid for this extension. The second is providing or lending money on the basis of guarantied fixed rate of return at specific times (monthly, quarterly, yearly or any other interval the borrower an lender agree upon). Therefore, in financial transactions the word "*Riba*" is referred to as the 'premium' that must be paid by the borrower to the lender with the principal amount as a condition for the loan or for an extension in its maturity, Chapra (1985). It is, therefore, very clear that all interest based dealings which dominate the financial practices nowadays fall within the range of this explicit definition. In Islamic jurisprudence, this kind of "*Riba*" is known as *Riba-Al-Duyun.* [3] In fact there is another type of usury known as *Riba-Al-Buyu* [4] which is an extension

[3]According to Ibn Rushd classification as reported by AL-Ameen (1983).
[4]This type in turn covers two types of *Riba.* These are *Riba-Al-Nassi'ah* and *Riba-Al-Fadl.*

of usury to barter trade of some identical commodities. These commodities have been named by the *Sunnah* of Prophet Mohammed (PBUH). Since this kind of usury is not our main concern here we are not going to discuss its nature. The reader can consult, Chapra (1985), Al-Ameen (1983) and AL-Shabbani (1987) and others. We can conclude from the foregoing discussion that providing financial services according to the teachings of Islam cannot be conducted on the basis of receiving and paying interest.

Before we end this discussion it is important to state some reasons about why Islamic Law (*Shari'ah*) is so restricted on the ban of *Riba* (usury) from the economy in general and the financial system in particular. The most advocated reason presented by Muslim economists is that lending on the basis of usury is regarded as an unjust way of making profit, "But if you return back you shall have your capital sums, deal not unjustly and you shall not be dealt with unjustly", (*Al-Qur'an, Surrah* (Chapter) 2, Verse 279). It is clear from this quotation that Islam considers *Riba* dealings as an unjust way of earning income. This is so, because undertaking any investment project has no certainty that the project will yield a positive rate of return. The project financier, therefore, has no reason in claiming a positive rate of return (i.e. pre-determined rate of interest), while his money cannot yield money without the collaboration of labour. The parties involved in any kind of business should, therefore, share the outcome of the business whether it is negative or positive. The other factor to be mentioned in this case is why the fortune of the lender is limited to this fraction of the results achieved by the entrepreneur? In highlighting this fact Muslim economist argue that " when a person lends money, the funds are either used to create a debt or an asset (i.e. through investment). In the first case, Islam considers that there is no justifiable reason why the lender should receive a return

simply through the act of lending per se. Nor is there justification, either from the point of view of the smooth functioning of the economy or any tenable scheme of social justice, for the state to attempt to enforce an unconditional promise of interest payment regardless of the use made of the borrowed money. If, on the other hand, the money is used to create additional capital wealth, the question is raised as to why the lender should be entitled only to small fraction (represented by interest rate) of the exchange value of the utility created from the use made of the funds; the lender should be remunerated to the extent of the involvement of his financial capital in creating the incremental wealth", (Iqbal and Mirakhor (1987)). The other reason presented is the fact that the proclaimed "pure rate of interest" is just a theoretical matter that exists in the classrooms and academic literature. As Iqbal and Mirakhor reported the Muslim economists argument "... when forced into the position of identifying the pure rate of interest, the theorists always refer to the rates of return on "riskless assets" such as those paid on high quality government securities or the rate of return on debentures of highly successful corporations. But this is a rate of interest on debt, not the rate of return on capital assets. In the case of most successful companies' debentures, the rates of interest are determined on the basis of the long-term success of these businesses, and if these corporations face difficulties and their profits decline, the "pure rate" ceases to prevail because their debentures are no longer considered "riskless". Hence the pure rate of interest is only a theoretical construct that does not correspond to the actual return on capital assets...". These two reasons are few examples only. The list, therefore, is not an exhaustive one, the interested reader can refer to Chapra(1985), Iqbal and Mirakhor (1987), Siddiqi (1983) and Presley (1988). Having listed these objections, however, we should acknowledge the reasons why debt or interest based mode of finance dominates the world of financial affairs

nowadays? I believe two main reasons can be listed. The first is the presence of the information asymmetries phenomena, because of the '*Moral Hazard*' [5] problem. That is the borrower or entrepreneur can monitor the outcome of his business costlessly or at least with a cost less than that of the lender if the latter carries out such a task (i.e. monitoring the outcome of the project undertaken by the borrower). In case the lender (capital provider) decides to monitor the performance of the project, financed through his money, he has to incur a cost of carrying out such a task. Therefore, if there is a cost associated with such monitoring debt contract is argued to minimize this cost. This point is well illustrated and emphasized in the recent literature of the theory of financial intermedaitiom, examples of these, Diamond (1984), Williamson (1986,1987), Boyd and Prescott (1986) and Lacker (1989,1991). Khan (1985) [6] stated that his work offered an explanation to the dominant role of debt mode of finance in the world of financial affairs "a new explanation is given for firms using debt to finance their capital structure. The theory based on the idea that if there are monitoring costs associated with financial contracts then debt minimizes these costs". Williamson (1986) arrived to the same conclusion by stating that "debt [contracts] can be derived as optimal arrangements between borrowers and lenders such contracts serve to economize on the monitoring cost". Second, is the fact that existing laws and regulations, in most if not all countries, beside the academic literature tend to privilege holders of debt instruments. This is very clear in the case of insurance deposit

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[5] In explaining this phenomenon Williamson (1987) states "if entrepreneurs in this environment [the environment within which his analysis is conducted] were *pathogically honest* (they never lie, even if it were in their interest to do so), then there would be no need for monitoring investment outcomes, and the problem would be uninteresting. However, agents are assumed to be rational (attentive to their own interests). Thus, without monitoring, an entrepreneur whose project was funded at time t and was successful would adopt the following utility maximizing strategy: report at t+1 that the project was unsuccessful and then consume the entire return".

[6] This work originally completed in 1983 as a Ph.D dissertation at Boston University and published as a book in 1985.

schemes, collaterals and other regulations. Pres ley(1988) pointed out "there is a fundamental difference between an ordinary shareholder who is one of the proprietors of the enterprise, liable for its debts to the extent of his investment, and a creditor who, as a debenture holder, lends without the risk of owning and operating capital goods and who claims interest irrespective of the profit or loss position of the enterprise. He runs a risk, but this risk is not of the enterprise but of the solvency of the borrower". Qureshi (1983) pointed out that interest based banks are working smoothly because of "... a combination of the Law of Large numbers and the government intervention ... ". Therefore, it is in this 'proto-type' environment where it has been derived that debt contracts are optimal as Lacker (1991) did when he concluded his work stating that only collateralized debt contracts are optimal.

3.2.2 No Gain without the Risk of Loss.

Since Islam prohibits interest as the basis on which funds are traded, it should therefore provide alternative financial instruments for the provision of financial services. These contractual arrangements which Islam offers are based on the profit and loss sharing (PLS) principle. Lenders (being depositors or any economic agent with excess money assigned for lending purposes) under this arrangement are not entitled to receive a pre-determined positive rate of return (i.e. interest rates) at specified intervals regardless the outcome of the undertaken business. Instead, if those surplus economic units (i.e. lenders) want to have a return on their funds they have to share in the profit/loss. Thus, the Islamic financial institutions (IFIs) working according to this principle are expected to provide risk-capital based on the equity-mode of finance. However, we should note that there are other permissible instruments which are not based on this principle but their use involve the presence of financial risk of

different nature (see next section).

3.2.3 Financing lawful (*Halal*) Businesses.

There are certain aspects of business trade and investment projects that are prohibited in Islam, e.g. trading in alcohol, pork meat, gambling industry etc. Therefore, these new institutions must not engage in financing these kind of operations or industries.

3.3 Contractual arrangements Provided by Islamic Law (*Shari'ah*) for conducting financial intermediation.

Since IBs only came into existence recently, those who discussed the possibility and problems of establishing such institutions had no examples in modern time on which to focus their discussion. Attention, therefore, has been oriented to examining the operations of conventional banks (interest-based banks (IBBs)). As a result of this examination, two kind of operations have been distinguished: First, permissible operations (i.e. banking services). This category includes all operations that do not involve any interest transactions. Services are being offered by institutions against a commission, fee or fixed charge. Examples of these are; opening current and saving accounts, safekeeping operations and offering advice and consultancy. Second, non-permissible operations (i.e. usurious transactions). All operations conducted on the basis of guarantied pre-determined rate of interest are included in this category. Examples of these are, accepting deposits on the basis of pre-determined interest rate and offering loans for borrowers on the same basis. The spread between the interest

received and the interest paid represents an important, if not the main, source of revenue for IBBs. Those who initiated the idea of establishing Islamic Banking have examined the sources of Islamic law (i.e. *Qur'an*, the *Sunnah* of Prophet Mohammed (PBUH) and the Islamic jurisprudence (*Fiqh*)) to derive alternative arrangements. These alternatives are grouped into two classes, Hamdi (1989).

1. Instruments based on the Profit and Loss Sharing Principle(PLS). Examples of these are *Musharakah* (participation finance) and *Mudarabah*(capital trust).

2. Instruments based on Sales and Rental Principle. Examples of these are *Murabahah* (mark-up on sale) and *Ijara* (leasing).

3.3.1 Instruments based on the Profit and Loss Sharing Principle(PLS).

In this case the IB (or any other FI that choses to offer financial services on the bases of Islamic Law) passes on the pooled funds (i.e. the funds acquired through the available deposit schemes to be discussed later) to entrepreneurs on the basis that no positive pre-determined rate of return is guarantied. The profits achieved in this intermediation process depends entirely on the outcome of the financed projects.

3.3.1.1 *Musharakah* (participation finance or mutual finance).

This contract can be defined as a joint venture between two or more parties to carry out a certain business with defined amounts of capital provided by each party. Profits or losses are to be shared between them. However, profits are allocated according to an agreed proportion in advance, whereas losses are borne by the partners in proportion to their contribution to capital, Presley (1988). In the Islamic banking context

this contract is being used to finance industry, trade, real estate, contracting and almost all legal enterprises through equity or direct participation. Through equity the capital needed for carrying out the businesses is divided into small amounts each of which represents partner's share in the required funds. Each equityholder is entitled to share in the realized profits (actually achieved) after deducing operating costs. However, the proportion assigned to each holder can be mutually agreed upon in advance, or it can be assigned according to the capital proportion provided by each partner. If losses are to be the case, the situation is clear as stated previously, these are borne by partners in proportion to their contribution to the capital. The other way of channeling funds to entrepreneurs is through direct participation. In this case the bank participates with other party(ies) in capital assets, technical and managerial expertise, working capital and the like, in varying degrees and agree (partners) to divide the profits in proportions agreed upon in advance, Hamdi (1989). The way this contract is being implemented by IBs can be described as follows: The bank, first, gathers funds assigned for that type of investment (the percentage of these funds to the total investment funds of the bank is left to the management to decide its value). Having gathered funds, the bank then transmits them to the entrepreneur(s), who will utilize them alongside with his (their) own funds. Here different cases can be distinguished. That is the bank can transmit depositors funds alone, mixing both sources (i.e. its own and those of depositors) or the bank could use its funds alone. If the bank uses the depositors funds alone, then the realized profits, if any, will be divided among capital suppliers after deducing operating costs (from which the bank is being paid). In case of losses, these will be divided between capital suppliers and those responsible for running the business will not incur any unless losses occur because of dishonesty, breach of the contact of the deed or negligence of taking all

necessary measures to make the business successful. In similar ways the other cases can be treated, that is when the bank mixes depositors funds with shareholders or shareholders funds alone. *Musharakah* mode of finance is well suited for financing private or public companies and particularly financing for, short, medium and long-term periods depending on the nature of the project financed (commercial or productive). However, we should note that in the latter two cases, i.e. medium and long-term operations, *Musharakah* has a unique feature. That is *Musharakah* instrument in this case could be permanent (i.e. on equity basis), or fixed number of years after which it should be repaid at one go or on decreasing basis, (Mudawi(1986)). In all cases projects are evaluated; if they are economically feasible and expected to be profitable, and if the would be partner has adequate experience, the extent of the bank's participation is then negotiated, Presley (1988). In the Islamic banking literature as well as in practice there are two types of *Musharakah* agreement with respect to the maturity of the contract: 1) *Musharakah* agreed upon for certain projects but terminates with the project's completion. In this case the two parties agreed that this contract is initiated to complete a specific project within a specific period of time, and 2) redeemable *Musharakah*. This latter type of deal is similar to redeemable participation in conventional banking system. In the practices of Islamic banking another form of participation is being used. This form is known as "decreasing participation", which is a "self-liquidating" form of partnership used for medium and long-term operations. In this type of partnership the ownership of the whole project of operation would be transferred to the partner (customer) after an agreed period during which the bank would have retrieved its principal and would have shared in the profits and losses realized during that period, Hamdi (1989). In summing up, *Musharakah* contract is characterized by the following features, Presley (1988).

1. The IB is not guarantied a fixed return on its participation.

2. If *Musharakah* financing is offered for a project that has been initially financed by fixed interest borrowing. IBs are prepared to inject fresh money to buy out other banks or creditors from the projects, and by so doing clear the balance sheet of any interest-bearing debts.

3. Whether a bank steps in to finance fixed assets, working capital or both, the bank's benefits lies in the profit-sharing scheme between the bank and the venture.

4. Profits are shared *pro rata* with equity (total shares' rights) and are calculated for this purpose, after allowing for management fees and before depreciation and provisions, as non-cash items.

5. The IB may extend free interest participation to alleviate liquidity shortages on a short-term basis. The percentage of *Musharakah* financing does not constitute a major element of the total financing of IBs. Presley (1988), for example, reported that this percentage ranges from 7 to 10 per cent of the total financing package of IBs.

3.3.1.2 *Mudarabah* (capital trust or agency participation).

This contract can be defined as an agreement between two parties in which one provides capital (financier or *Rab-al-Mal* (capital owner)) and the other provides work (*Mudareb* or *Rab-Al-Amal*(work provider)) for undertaking certain business activity. In the Islamic banking context *Mudarabah* is a contract between the IB regarded as an investor or financier (*Rab-Al-Mal*) who provides a second party, the entrepreneur (*Mudareb*) with financial resources to finance a particular project, Presley (1988).

Profits, if any, are shared between the two parties in a mutually agreed proportion in advance. In case no profit realized or a loss occurs (from normal business causes or natural disasters), the bank (capital supplier) bears all the losses and the *Mudareb* (entrepreneur) receives no reward for his efforts, as far as he is not negligent or he has breached the deed of the contract. This arrangement illustrates how Islamic economics value human resource endeavour. The *Mudarabah* contract is well adopted for project and trade financing. However, the application of *Mudarabah* can be extended to cover all activities such as industry, agriculture,etc, Al-Ameen (1983). IBs also use it to finance contracting business and trade. In order to implement this contract the IB can use its own funds, depositors' funds or both mixed together. So, it is important to look at the contractual relationships that exist between the bank and depositors on the one hand and between bank and entrepreneurs on the other. These relationships can be classified as follows, Presley (1988):

1. If the bank uses its own funds, it is said to be (the bank) an investor (*Rab-Al-Mal*) and the entrepreneur is regarded as *Mudareb* (*Rab-Al-Amal*). Profits or losses will be distributed between them as discussed previously.

2. If the bank employs the depositors' funds without using any of its own, the bank would be acting as an agent for the depositors from the time deposits are accepted to the time when money is invested in a *Mudarabah* contract. At this stage the bank becomes a *Mudareb* (first *Mudareb*). Losses, if any, are the liability of capital supplier(s). However, if profits are realized a portion of which will be assigned directly to depositors (capital suppliers), the other portion will be shared between the bank and the entrepreneur (second *Mudareb*) as they specified in the deed of the contract.

3. If the bank utilizes a mixture of both (its own and depositors' funds). The bank would be acting as an agent for depositors, whereas between the bank and the entrepreneur the former acts in its own capacity as an investor (*Rab-Al-Mal*). However, it is possible to consider the bank as the capital supplier in both cases (i.e. in case of his funds as well as those of depositors). In this case the rules explained in the previous point are applicable, (Al-Sawy (1990)).

In order to apply *Mudarabah* contract the two parties should take into consideration the following conditions, Khan (1985):

1. Sharing of profit/loss: The entire loss has to be borne by the principal while the profit has to be shared between them in some pre-specified proportions. This is so because in the case of loss the agent has suffered a loss of his effort and labour so he cannot be asked to share any loss of capital.

2. Agent's responsibilities: Unless specifically restricted from engaging in certain activities, the agent is generally free to act 'as he sees fit' for the pursuit of profit.

3. Duration of the business: There may or may not be a specified contractual period for the business, depending on the agreement between the principal and the agent.

4. The *Mudarabah* account, in case of opening accounts on the basis of this contract in an Islamic financial institution (IFI), must be recorded properly and audited independently, Presley (1988).

Before ending this part of the profit and loss sharing (PLS) mode of finance, it is important to make a few remarks. First, under the PLS system all capital is expected

to be risk-capital, because funds are channeled on the PLS basis. Second, from theoretical point of view the new PLS system is intended to have some advantages which support its existence. However, new problems arise as well. The advantages can be listed as follows, Qureshi (1983):

- The PLS system ensures large supply of risk-capital.

- It provides a higher rate of return to the society since the more risky is a project, the higher is its expected rate of return. As the assumption of linearity between risk and return in the theory of finance states "the higher the risk, the higher the return is expected to be". In the case of IBs, this might be very clear in the case of depositors where they are entitled to share in the entire realized profits rather than taking a fraction of this profits in the case of interest based banks.

- It leads to efficient allocation of risk in the society, since the losses will be shared across a broad base of ownership.

- It promotes participation of financial institutions in the overall economic activity which may improve the performance of the enterprise.

Having listed some of the advantages, we turn now to account some of the problems that arise in adopting the PLS system, Qureshi (1983):

- The PLS principle requires a lot more work than it is required under an interest-based banking system. The bank should know a great deal more about the investor (not only professionally, but also as a person as well). The presence of informational asymmetries in the intermediation process will cause great difficulty in the implementation of the PLS system. That is why the level of monitoring the activity of the entrepreneur will have to be very large and fairly

thorough. Monitoring will have to be very high order and sufficiently efficient for the successful implementation of the new system. In fact, the system will entail substantial monitoring costs, definitely much higher than under the interest based debt system. These costs are primarily in the nature of fixed costs and as such there will be some economies of scale if these are spread over a large operations. Khan (1985) pointed out that "the critical requirement for the working of the PLS system is the ability of the financier to monitor the real performance of the project".

- Projects have to be carefully evaluated in order to assess the actual risk involved. This is extremely important for the proper pricing of risk. Given the existing methods of project evaluation, it will be necessary to introduce substantial changes in the methodology to achieve this end. This will obviously require a large expenditure.

- The problem of efficient portfolio selection is worth mentioning, because investment banking can be successful if the management of the bank can achieve a well diversified portfolio. For then the small savers can be protected from unnecessary exposure to risk. Therefore, the problem of portfolio selection is more critical for an investment bank than for a typical one. However, achieving a well diversified portfolio requires high quality management as it is the case in unit trusts (in the U.K. and Mutual funds in the U.S.A) where skilful managers are responsible for fulfilling this task.

3.3.2 Instruments Based on Sales and Rental Principles.

The IB in this case would act as an intermediary by acquiring the commodities on behalf of the would be partner(s). These acquired items, in turn, will be rented or re-sold to the customers on a higher margin, Hamdi (1989). The most important instruments used by IBs are discussed below.

3.3.2.1 *Murabahah* (Mark-up on sale).

This contract can be defined as the supply of goods by the seller to the buyer at a specified profit margin mutually agreed between them, Chapra (85). In the Islamic banking context, the IB would act as the seller and the customer is regarded as the buyer. This latter would approach the IB requesting that certain item(s) (be it a commodity, machinery or raw materials) be bought and acquired for him for a specific price, (Hamdi (1989)). The customer provides the bank with the specifications and quotations of the goods to be purchased, (Presley (1988)). When the bank and its customer have agreed on the terms of the deal, the former purchases the goods or commodities and passes the title to the customer at later date. The profit accruing to the bank is mutually agreed in advance as mark-up on the cost of purchase, (Presley (1988)) or as a fixed amount added to the purchase cost [but agreed upon in advance by the two parties], (collection of Booklets (KFH) (1977)). In order to implement *Murabahah* contract in accordance with Islamic law, the following conditions must be met, Presley (1988):

1. The purchase price should be declared to the client, especially where the bank succeeds in obtaining a discount or rebate. Since the mark-up is calculated on the net purchase price, any discount or rebate obtained has to be acknowledged and accounted for to the benefit of the client.

2. The goods themselves must be classified and clearly identified according to international or commonly accepted standards or classifications, otherwise *Murabahah* is void.

3. The profit element is pre-determined, and therefore it should be known when the contract is being signed, (Hamdi (1989)).

4. The last condition relates to whether the original agreement between the IB and the customer is binding or not.

As far as this last condition is concerned, the two methods are applied by IBs. For example, *Dar-Al-Mal AL-Islami* (Islamic finance house) (a Geneva based institution) considers the agreement as a binding one. While KFH gives the customer a non-binding promise to buy commodities that were purchased by KFH on his behalf, (Presley (1988)). The repayment of the due sum by the customer is very simple. Once the purchase price plus the bank's margin have been agreed upon, repayment can be stretched over a period of 6 to 24 months and sometimes 36 months. In any case, repayment may be discharged by instalment or on lump sum basis, (Presley (1988)). However, if the customer uses his own funds to finance the *Murabahah* operation, the bank, in this case, would act as a broker charging a service fee, but no commission is charged for the extension of the letter of credit, Presley (1988). One can notice that *Murabahah* contract is being used as a replacement of the letter of credit facility provided by the Interest-based banks. Therefore, this contract is mainly used to finance trade operations domestically and internationally. Finally, the *Murabahah* contract is being used widely by IBs. The operations of some banks are dominated by *Murabahah* operations as noted by Ahmad (1987) "... the available evidence suggest that *Murabahah* is the most popular and dominant technique of

financing amongst the IBs studied". This is because of the low level of risk involved in *Murabahah* operations.

3.3.2.2 *Ijara* (Lease Financing).

Ijara (leasing) is being implemented by IBs in the same way as it is applied by conventional banks. Under this agreement, the lessee(being an individual or a businessman) approaches the bank requesting the purchase of a machinery or an equipment that can be rented to him (i.e the client). The bank, in turn, will study the position of the lessee and the expected cash-flow from the operation. If the bank sees that the operation is feasible and it can generate sufficient income it will enter into an agreement. The conditions of the agreement will be set afterwards. Within this global context of leasing, two forms are distinguished in Islamic finance. First, direct Leasing whereby the IB allows the customer to use capital assets owned by the bank for a limited period of time ranging from a few days to a few months or years depending on the type of the asset in question. In return the lessee pays a monthly or annual rental fee, (Presley(1988)). Second, lease and purchase (Hire-purchase (HP)) finance (*Ijara* wa Iktina), whereby the IB rents the assets to the customer who promises to purchase the asset after a specified period. The payments to the bank, in this case, are equal to the bank's share in the net profit attributable to the asset plus a part of the principal charges. Accordingly, when these accumulated parts equal the cost of the asset, the ownership of the asset will be transferred to the client. The payment of rental allowances can be paid in different manners. One form is that the lessee will open a saving(or an investment) account with the bank, therefore, payments will be credited to this account, (Presley(1988) and *Dar-AL-Mal-Al-Islami* (1990)). The accumulated sum of funds would be invested by the bank and credited to this account. When the

accumulated amounts in the account equal the purchase price of the asset, the title of the asset will be passed to the lessee on exchange of the payment of the price. *Dar-Al-Maal-Al-Islami* (Geneva based institution) reported the use of this method in its operation, (*Dar-Al-Maal-Islami* (1981)).

Before we end this section it is important to discuss the ways through which funds are being raised. The methods are listed below:

1. **Current Accounts (also known as trust deposits).** Holders of this type of accounts are treated in the same manner as in the case of conventional banks. Account-holders are not subjected to any losses as well as they are not entitled to share in any profits. The amounts held in these accounts are payable on request. Clients also are being supplied with cheques and cheque card facilities.

2. **Saving Accounts.** Customers are being offered this kind of accounts free of charge. The bank guarantees the return of the funds on demand. Therefore, accountholders are not entitled to share any profit or loss. Customers are encouraged to hold saving accounts by providing them some services, such as interest-free loans, financing of small projects and sale of consumer durable or productive goods by instalments (deferred payments). These services are oriented to those who have regular savings with the bank.

3. **Investment Accounts.** Holders of this type of accounts are encouraged to deposit their funds in these accounts on the basis of predetermined profit and loss sharing (PLS) ratio. That is, in contrast to the conventional banks, the holder of an investment account is subject to loss and is entitled to profit if any. Therefore, the rate of return is related to the performance of the bank, which, in turn, is a function of the results of the projects financed by the bank.

Thus, selecting profitable investments and spreading the available recourses on a large number of projects are important tasks involving considerable effort spent by the management of IBs. Investment account facilities are being offered to customers under two forms: First, joint investment accounts whereby the depositors give the bank the absolute right to invest the funds on their behalf in any projects selected by the bank. Second, specified investment accounts whereby the accountholder specifies the projects or the area of the business activity within which his funds can be invested. In this case, the bank would act as an agent transmitting money to a third party. This operation is being carried out by the bank against fees charged to the holders of this type of accounts.

3.4 Islamic Banks in Practice.

In this section the operations of two working institutions are examined. These are the Jordan Islamic Bank (JIB) and Kuwait Finance House (KFH). Before we examine the operations of these two institutions, it is important to give a general overview for each one of them.

3.4.1 General Background.

The KFH and the JIB were established in 1977 and 1978, respectively. A year after their establishment the two banks started operating (i.e. KFH started its operations in August 1978 and JIB started its operations in September 1979). KFH operates in one of the richest Gulf states, while JIB operates in one of the middle-income Middle eastern countries (according to the International Monetary Fund(IMF) classification).

According to the Banker magazine's classification of the top 15 Arab Islamic Financial Institutions (AIFIs) in November 1989 [7] KFH has been classified the second after the Geneva based *Dar-Al-Maal-Al-Islami* (the Islamic House of Finance) with respect to total capital which amounted to 166 million dollars and first with respect to total assets which accounted for 4147 million dollars. The JIB came in the 9th rank after Faisal Islamic Bank of Sudan (FIBS) with respect to total capital factor which stood at the level of 21 million dollars and the bank classified fifth with respect to total assets which accounted for 468 million dollars. The KFH is therefore much bigger (about eight times) than the JIB with respect to the capital factor.

3.4.2 How does KFH operate ?

In the "Collection of Booklets" published by KFH in 1981 it has been stated clearly that the House has been established to fulfil the following: First, conducting all banking operations and services for its own, or for the account of third parties, without practising usury, whether in the form of interest or any other form. Second, carrying out direct investments, or purchase or finance projects or activities owned by others, on a non-usurious basis. In order to explain how these objectives are being achieved by KFH the balance sheet of the House as it appeared at 31st December 1988 is presented below :

[7] We did not use the classification of the years that followed (i.e. 1990, 1991 and 1992), because of the major disturbance (i.e. the Gulf crisis) which took place in the Gulf region in August 1990.

Table 3.1 KFH balance sheet at 31st December 1988 (items are expressed in percentages)

Assets	per cent	Liabilities	per cent
CBB	3.00	CA	12.00
DFI	21.00	INISA	43.00
MAR	25.00	IDLP	0.05
INV	0.04	IDUP	23.00
MTMAR	11.00	DFFI	14.00
TIP	33.00	APA	2.00
IAC	2.00	OL	2.00
OI	0.06	PUC	2.00
FA	2.00	SR	1.00
CWP	2.00	GR	0.05
Total Assets	100.00	Total liabilities	100.00

Definition of the symbols used in the Table above:

Assets side :

CBB = cash and balance with banks.

DFI = deposits with financial institutions.

MAR = *Murabahah* and other accounts receivable.

INV = inventories.

MTMAR = Medium term *Murabahah* and other accounts receivable.

TIP = trade in property.

IAC = investment in *AL-Muthana* complex.

OI = other investment.

FA = fixed assets.

CWP = construction work in progress.

Liabilities side :

CA = current accounts.

INISA = investment and non-investment saving accounts.

IDLP = investment deposits for limited period.

IDUP = investment deposits for unlimited period.

DFFI = deposits from other financial institutions.

APA = accounts payable and accruals.

OL = other liabilities.

PUC = paid-up-capital.

SR = statutory reserve.

GR = general reserve.

Source : Annual Report of KFH 1988.

The above Table shows that on the assets side four operations dominate the utilization of funds. These are : Trading investment in property (TIP), *Murabahah* and other accounts receivable (MAR), deposits with other financial institutions (DFI), and Medium term *Murabahah* and other accounts receivable (MTMAR). They accounted for 90 per cent of total assets at the end of 1988. The same fact can be noticed for the liability side, whereby four items dominate the sources of funds. These are: investment and non-investment saving accounts (INSA), investment deposits for unlimited period (IDUP), deposits from financial institutions (DFFI), and current accounts (CA). These items alone accounted for over 80 per cent of total liabilities.

3.4.2.1 How does KFH acquire funds (sources of funds)?

As we noticed earlier that the major source of funds are deposits. The saving accounts item being the chief source of these deposits. The Table below shows this has also been a feature of the banks operations in previous years.

Table 3.2 The percentage share of total deposits to total liabilities over the years 1979 - 1988 of KFH.

year	TD/TL(%)	SD/TD(%)
1979	88	32
1980	88	37
1981	84	40
1982	83	39
1983	87	48
1984	87	54
1985	91	56
1986	92	54
1987	93	50
1988	92	46

Source : Annual reports of KFH 1979 - 1988.

TD = Total deposits.

TL = Total liabilities.

SD = Saving deposits.

It is clear from the above Table that the level of deposits with respect to total liabilities did not go below the 80 per cent level. Its lowest share being 83 per cent of the year 1982. The same fact can be noticed for savings deposits with regard to total deposits. In addition to saving accounts KFH provides other types of deposits. A brief explanation of which is given below:

1. **Current accounts.** Deposits held in these accounts are payable on demand. The customers are not entitled to any profits and they do not bear any losses. The House guarantees to pay the balance on request. From the Islamic viewpoint, these deposits are regarded as interest-free loans (*Qurud - Hassana*) from the depositors to the KFH, (KFH annual report (1988)).

2. **Saving accounts not committed for investment purposes.** This category of deposits is also not entitled to share in any profits and it does not bear any

losses. Funds deposited in this category can be withdrawn in whole or in portion at any moment, Memorandum of Agreement and Articles of Association KFH (1977).

3. **Investment deposits.** Included in this category are those funds deposited by customers for investment purposes. These funds are used by the House to finance its own projects or financing projects of third parties. Investment deposits can take two forms; limited or unlimited. The limited ones are those deposits accepted for a period of one year, on the other hand unlimited deposits are those obtained on the same duration but they are renewable at the end of each year. Both types of deposits are accepted on the profit and loss sharing (PLS) basis. Table 3.3 is given below to demonstrate the distribution of funds among different deposits over the years 1979 through 1988.

Table 3.3 distribution of funds among different deposits of KFH over the years 1979 to 1988.

year	CA/TD%	INISA/TD%	IDLP/TD%	IDUP/TD%	DFFI/TD%
1979	24	32	5	39	-
1980	19	37	5	39	-
1981	19	40	3	38	-
1982	15	39	2	44	-
1983	12	48	.06	40	-
1984	9	54	.006	35	2
1985	17	56	.001	26	1
1986	17	54	.01	25	4
1987	11	50	-	25	14
1988	13	46	.06	25	15

Source : annual reports 1979 - 1988.

CA = current accounts

INISA = investment and non-investment saving accounts

IDLP = investment deposits for limited period

IDUP = investment deposits for unlimited period

DFFI = deposits from financial institutions

Table 3.3 above shows that the main items through which funds are being pooled are : investment and non-investment saving accounts (INISA), investment deposits for unlimited period (IDUP) and current accounts (CA). Their level over the years under investigation did not go below 80 per cent of total deposits. However, the evolution of deposits to each type of accounts is not the same. It is clear from the Table that INISA item is attracting more funds than the other two, especially in the IDUP item whose level has declined over the last five years. This change of pattern may due to the fact that KFH had channelled most of its funds into the Kuwaiti real estate and construction sectors and these two sectors were badly hit by the collapse of the market of the two sectors in

1984. Neither depositors nor shareholders received any return on their funds in 1984. The depositors might, therefore, have switched to the INISA item. The other item which is growing steadily is DFFI, in spite of its late introduction in 1984 it showed quite a remarkable growth in the last two years. The main purpose of holding this type of accounts is to avoid the practice of usury from the dealings with other banks. As it has been pointed out in the annual report of the House for the year 1989 "... deposits with financial institutions [are] an arrangement that enables KFH to lend on Kuwaiti dinars and borrows in foreign currencies without the involvement of interest transactions". The other ways through which KFH raises funds are listed below:

(a) **Accounts payable and accruals.** This item accounted for 2 per cent only of total liabilities at the end of 1988. Included in this category are the amounts paid in advance by customers in return of future services offered to them (e.g. buying goods or commodities).

(b) **Other liabilities.** Included in this category are : profit attributable to share capital and net profit attributable to reserve accounts.

(c) **Shareholders' equity.** This item consists of paid-up-capital, statutory and general reserves.

3.4.2.2 How does KFH utilize funds(uses of funds)?

At the end of the year 1988 we have noticed that the left hand-side of the balance sheet is being dominated by four kinds of operations. These are : trading investment in property (TIP), with 33 per cent of total assets (TA), *Murabahah* and other accounts receivable (MAR) with 25 per cent of TA, deposits with

financial institutions (DFI) with 21 per cent of TA, and Medium term *Murabahah* and other accounts receivable (MTMAR) with 11 percent of TA. Table 3.4 is presented below to examine the pattern of the most widely used operations for transmitting funds.

Table 3.4 The percentage sharing of KFH main operations over the years 1979 -1988.

year	CBB/TA	DFI/TA	MAR/TA	MTMAR/TA	TIP/TA	IAC/TA
1979	17	-	33	5	43	-
1980	19	3	34	10	33	-
1981	16	3	40	7	65	-
1982	21	.04	30	6	40	1
1983	15	.06	20	9	52	1
1984	10	3	23	5	53	3
1985	8	2	22	9	46	4
1986	5	5	26	9	46	3
1987	4	15	26	11	35	3
1988	3	21	25	11	33	2

Source : annual reports 1979 - 1988.
Note: all values are expressed in percentages.

CBB = cash and balance with banks.

DFI = deposits with financial institutions.

MAR = *Murabahah* funds and receivable accounts.

MTMAR = Medium term *Murabahah* and other accounts receivable.

TIP = Trading investments in property.

IAC = Investments in *AL-Muthana* complex.

TA = Total assets.

It is clear from the Table above that the majority of the House's funds has been invested in trade and property sectors. This can be noticed from the sharing percentages of the MAR, MTMAR and TIP items. The lowest share of these items accounted for 69 per cent for the year 1988. However, it appears that TIP

is being the dominant factor through which funds are being channelled. But, after the year 1984 the share of this item has declined. This may due to the fact that market prices for properties collapsed in 1984. Therefore, the KFH was badly hit by this incident. The other factor that can be observed is the fact that current account share had declined over the last five years, especially the last three. This may due to the growing share of deposits with other intermediaries and the fact that the House is renting properties whose contribution to total profits stood at 17 per cent in 1988.

3.4.3 How does the Jordan Islamic Bank(JIB) operate?

From the "Articles governing the operations of the Bank", and "Directory of Islamic Financial institutions" edited by John Presley (1988), the following points are stated below : The JIB was established in Amman in 1978 to conduct a full range of banking services within the limits permitted by Islamic Law "*Shari'ah*". The bank was particularly concerned with providing such financial intermediation to all citizens of Jordan and adopted a policy of opening as many regional branches as possible. The main activity of the bank is to provide traditional banking services to citizens of Jordan. In addition to these banking operations, the bank is offering financial, investment, and collective social activities operations on non-usurious basis. The way these operations are carried out by the bank is explored below :

3.4.3.1 How does the bank acquire funds?

The balance sheet, as it appeared at the end of 1988, can be used as a starting point to explain the techniques used to acquire funds.

Table 3.5 JIB's Balance Sheet at 31st December 1988 in percentage.

Assets	per cent	Liabilities	per cent
CHB	33.6	TD	16.00
SOC	0.1	JIA	64.00
IFL	0.2	DOB	1.00
IFI	55.8	SIA	8.00
FSP	7.1	OL	6.00
FA	2.2	PIC	3.00
OA	1.00	SR	1.00
		GR	1.00
TA	100	TL	100

Source : Annual Report 1988

Assets side:

CHB = cash in hand and balances with other banks.

SOC = shares of other companies.

IFL = interest-free loans.

IFI = investment financing (i.e. *Mudarabah*, *Musharakah*, *Murabahah* and others)

FSP = financing specific projects

FA = fixed assets

OA = other assets

TA = total assets

Liabilities side:

TD = trust accounts (i.e. current and demand deposits)

JIA = joint investment accounts (i.e. saving, on notice and time deposits)

DOB = deposits of other banks

SIA = specified investment accounts

OL = other liabilities

PIC = paid-in-capital

SR = statutory reserve

GR = general reserve

TL = total liabilities

It is obvious from the Table above that the major source of funds are deposits. These items accounted for 80 per cent of total liabilities at the end of 1988. This fact is also observed during the previous years of operation, the following Table confirms that :

Table 3.6 Percentage of total deposits to total liabilities over the years 1979 through 1988 of JIB.

TD/TL(%)	54	75	80	79	82	81	81	79	80	80
Year	1979	'80	'81	'82	'83	'84	'85	'86	'87	'88

Source : Annual reports of 1979 - 1988.

TD = total deposits = trust deposits + joint investment deposits.

TA = total liabilities .

In order to attract funds, the bank offers the following types of deposits:

(a) **Trust deposits (TD).** These kind of accounts are similar to those provided by interst-based banks (i.e. current and demand deposits). The bank is authorized to use these deposits at its own risk if they are invested in risky operations. These deposits can be withdrawn on demand and their holders are supplied with cheque books and cards.

(b) **Joint investment accounts (JIA).** Such accounts receive certain percentage of the realized annual net profits and incur certain proportion of losses. In other words, these accounts are accepted on the basis of profit-and-loss-sharing (PLS) principle. Table 3.5 indicates that this type of deposit is very important and accounted for 64 per cent at the end of 1988.

(c) **Specified investment accounts (SIA).** The bank in this case is acting as an agent transmitting funds of depositors to specific projects recommended by the depositors themselves. Therefore, the bank receives a commission fee for offering this service.

In addition to these external sources the bank utilizes its own capital to finance its operations or those of third parties. But the contribution of this factor is insignificant, it accounted for 3 per cent only at the end of 1988. It can be noticed from the above discussion that the major funds of the bank are being channelled through deposits, attention, therefore, is given to the pattern of how these different deposits have grown over time.

Table 3.7 Distribution of different types of deposits over the years from 1979 to 1988 of JIB.

Year	D/TL(%)	TD/D(%)	JIA/D(%)	SIA/D(%)
1979	68	51	29	20
1980	81	39	54	7
1981	83	47	50	3
1982	81	45	53	2
1983	86	34	62	4
1984	88	25	68	7
1985	90	21	70	9
1986	88	20	69	11
1987	88	18	73	9
1988	88	19	73	8

Deposits(D) = trust deposits + joint investment accounts + specified investment account.

TL = total liabilities.

From Table 3.7 the following observations can be made:

- Deposits constitute a major part of the bank liabilities. It started at the level of 68 per cent of total liabilities in 1979, reached its highest level of 90 per cent in 1985, and stood at 88 per cent in 1988.

- Joint investment accounts become an important way of obtaining funds. In 1979 they stood at 29 per cent of total deposits and reached the highest level, 73 per cent, in 1987 and 1988. While the share of these accounts is increasing the share of trust deposits is decreasing. This share of trust deposits stood at 51 per cent in 1979 but only accounted for 19 per cent in 1988. This is a natural process as the business of the bank grew up and customers become familiar with investment deposit scheme.

3.4.3.2 How does the JIB employ funds?

It is clear from Table 3.5 that the main part of the bank's funds are being utilized for investment operations. The share of these operations with respect to the total use of funds stood at 55.8 per cent in 1988. The second important factor is cash in hand and with other banks which stood at 33.6 per cent at the end of 1988. Thus both items constitute more than 80 per cent of total assets. Table 3.8 is presented below to trace the pattern of these two, as well as other items, on the left hand side of the balance sheet(i.e. assets side).

Table 3.8 JIB percentage share of assets items to total assets over the period 1979 - 1988.

Year	CHB/TA	MMMF/TA	SIP/TA	IS/TA	IFL/TA
1979	79	10	-	-	.05
1980	43	44	5	-	.03
1981	43	45	3	.03	.02
1982	28	59	3	.03	.03
1983	36	54	4	.04	.05
1984	27	62	6	.03	.02
1985	31	56	8	.02	.02
1986	28	59	8	.02	.02
1987	33	55	8	.02	.02
1988	33.6	55.8	7	.01	.02

Source : Annual reports of JIB 1979 - 1988.

CHB = cash in hand and balances with other banks.

TA = total assets.

MMMF = *Murabahah*, *Mudarabah* and *Musharakah* funds.

SIP = specified investment projects.

IS = investments in shares.

IFL = interest-free loans.

As it has been noticed earlier CHB and MMMF are the two dominant ways through which funds are being utilized. In 1979 their level stood at 89 per cent of total assets and in 1988 were maintained at the slightly higher level of 90 per cent. However, the pattern of both is not the same. While the share of MMMF to total assets has increased over time, the share of CHB on the other hand has declined. The former item started with the share of 10 per cent to reach its highest of 62 per cent in 1984 and it ended up in 1988 with a share of 55.8 per cent. The latter item started with its highest share of 79 per cent to reach its lowest level of 27 per cent in 1984, and it stood at 33.6

per cent in 1988. This difference of pattern of growth may due to the fact that customers became more confident and familiar with the operations carried out by the bank as the management of the bank gained expertise and familiarity with these new methods of investment operations, therefore the customers have switched from CHB to MMMF. The other important element is the specified investment operations (SIP), where the bank is acting as an agent that transmits funds to those projects specified by creditors. However, the other items (i.e. IS and IFL) have an insignificant share in the portfolio operations of the bank.

3.5 Concluding Remarks.

From the above discussion, it is clear that these newly established IB institutions have major contrasts with interest based banks in the provision of financial services. Foremost, among many is the replacement of the interest mechanism by the profit and loss sharing mechanism. That is funds are no longer accepted and transmitted on the basis of a pre-determined positive rate of interest or certainty of returns. Thus neither the bank nor depositors can guarantee the nominal value of their principals, it is the outcome of the financed projects which will determine profits or loss. In addition to this general remark, the following remarks should be noted:

Deposits constitute the major part on the liabilities side through which funds are being generated.

Both institutions combine payments and intermediation services. These arrangements take the forms of demand, investment, and specified deposits.

The assets of these newly established intermediaries, unlike conventional banks, are not merely financial ones. In their balance sheets appear such items as inventory. Moreover, these institutions also involve themselves in direct investments by setting up businesses on their own. Thus some of the assets held by them are less liquid than those held by their counterparts interest-based banks. This can explain, to a certain degree, why these intermediaries also hold substantial amounts of cash to meet liquidity requirements. As a result of these practices transformation of illiquid assets into liquid liabilities is partially fulfilled.

Since the PLS system ensures large supply of risk-capital, the monitoring cost of projects will be much more higher than under the present interest-based system. It, therefore, requires from the management to know a great deal about the entrepreneur, not only as professionals but on a personal basis too. The presence of information asymmetry in the intermediation sector obliges the management to give considerable attention to the monitoring and evaluation of projects functions.

The selection of efficient portfolios will be of great importance, because the success of the bank depends upon achieving a reasonable rate of return to depositors. The failure of achieving so may affect the future of the bank. Thus holding a well diversified portfolio is one of the prime concerns of the management of these banks.

Given the present practices of IBs, maintaining a strong and continuous relationship with depositors is of vital importance to their survival. Therefore, studying and analysing the factors that affect this relationship provides the management with very valuable information about the requirements

of their customers.

Finally, the above points imply that the implementation of PLS mechanism requires a high quality management in the field of management as well as Islamic Law (*Shari'ah*). Under PLS system depositors have to place great trust in FIs, and they need to know a lot more about the management and operations of these intermediaries than under the present interest-based system.

Chapter 4

Islamic Banks and the Maturity Transformation Function

4.1 Introduction

The basic function of financial intermediaries (FIs) is to transfer financial resources between surplus and deficit economic units. This function is carried out by FIs through the use of financial instruments. Therefore, as we described in chapter two, FIs transform one type of securities called "primary securities" into another type of assets known as " secondary securities" in a manner that appeals to both surplus and deficit economic units. In this chapter, however, we are going to examine one aspect of this transformation that is maturity transformation (transmutation). In doing so more insight into the position of these newly established Islamic institutions in the sector of financial intermediation can be gained.

4.2 Theoretical Framework

It has been stated in chapter two that two broad approaches, using the traditional way of classifying FIs, have been suggested by academics in examining the classification of FIs. These are:

- **Examining the liabilities of FIs and classifying them accordingly.** By using this criterion of classification two groups are distinguished by academics; namely Bank financial intermediaries (BFIs) and Non-Bank financial intermediaries (NBFIs). The first group (i.e. BFIs) consists of those institutions part of whose liabilities serve the function of means of exchange and payments. The second group includes those FIs whose liabilities do not perform these functions or at least the liabilities of this group of institutions have inferior qualities in performing this function. However, this method of classification does not help a great deal in achieving our aim i.e. examining the maturity transformation of IBs. This is so because this approach does not give us a precise quantifiable measure about the contribution of a single institution to liquidity creation. Therefore, attention is turned to the other approach.

- **The second approach is based on the criterion of whether the intermediary can create credit (liquidity creation) or passes on credit (liquidity distribution).** If the intermediary creates liquidity (adds liquidity to the rest of the economy) is said to be considered as an BFI; if the reverse is true the intermediary is classified as an NBFI. It is in the work of Niehans(1978), Hewson (1975) and Niehans and Hewson (1976) where this point has been most thoroughly investigated. From this work the following criteria are derived to examine the maturity transformation of Islamic banks.

1. The notion Provided by Niehans (1978)

Niehans(1978) states that "a bank supplies the rest of the economy (including other banks) with money if its monetary liabilities (e.g. checking deposits) exceed its monetary assets (e.g. currency reserves and demand deposits with other banks). In the reverse case, the bank reduces the money supply in the rest of the economy".

2. The net liquidity criterion

This criterion was elaborated by Niehans and Hewson (1976) in examining the maturity transformation of *Euro*-banks. This notion can be explained as follows: A bank accepts deposits of various maturities D_0, $D_1 ... D_n$, subscripts indicate the maturity, with D_0 signifying checking deposits. The bank uses these deposits to make loans L_0, $L_1 ... L_n$ (L_0 includes central bank reserves), subscripts refer to the same maturity classes as for deposits.

Net liquidity (i.e. contribution of a single bank to the liquidity available in the economy) (liquidity creation or maturity transformation) is given by the following formula:

NL = the contribution to Net liquidity of a single bank.

$$NL = \sum_{i=0}^{n} \lambda_i D_i - \sum_{i=0}^{n} \lambda_i L_i = \sum_{i=0}^{n} \lambda_i (D_i - L_i)$$

Where, $\sum(D_i - L_i) = 0$, λ_i = liquidity coefficients ($\lambda_0 = 1$ the case of chequing deposits)

Liquidity creation requires "mismatched assets and liabilities". In the sense that the bank "borrows short to "lend long"; that is ($D_i \neq L_i$ for some i_s). Under this definition three distinct cases exist:

Positive maturity transformation, the bank in aggregate borrows short and lends long. In this case the bank is adding to the liquidity of nonbanks (i.e. money supply is increased).

Negative maturity transformation, the bank in aggregate borrows long and lends short. In this case the liquidity of nonbanks is reduced (i.e. money supply is reduced).

Zero maturity transformation, assets are matched with liabilities (i.e they have the same "moneyness").

3. The Lorenz Curve

This curve has been initially elaborated by Lorenz (1905) to deal with the distribution of wealth (i.e. income and assets distribution), but it has been later recognized that this tool is very useful for economic analysis, (Hainsworth(1964)). This curve allows a visual comparison to be made between two distributions with respect to the overall arithmetic mean. In this study the curve [1] is used to compare bank inequality distribution (maturity transformation) between assets and liabilities of a bank. In order to construct this curve one should: "express the percentages of assets and liabilities in each maturity class as a percentage of aggregate assets (liabilities), cumulating these percentages for both assets and liabilities and then plotting these cumulated percentages, (say assets on the vertical axis and liabilities on the horizontal axis), allows comparison of the

[1] We should note, however, that there is a basic difference between the conventional Lorenz curve and the one that we are going to construct which we may call "mismatch curve". This basic difference refers to the fact that in the Lorenz curve analysis, the distributions are ranked by size -for example, in the analysis of income distributions, income is ranked from the lowest to the highest class- whereas with the mismatch curve no ranking is undertaken. As a result, the conventional Lorenz curve is either concave upwards or downwards to the line of equality (depending on the labeling of the axes), and it can never cross the line of equality. The mismatch curve may in principle cross the line of equality, although empirically it may not, because of the preponderance of a particular form of maturity transformation, (Hewson(1975)).

resulting curve, which may be called the "mismatch curve", with the diagonal-which is the arithmetic mean relationship (perfect equality)[i.e. each asset and liability class has the same degree of maturity]. The larger the area between the mismatch curve and the diagonal, the more unequal is the distribution of claims (assets) relative to the distribution of liabilities",(Hewson (1975)).Within this context one can end up with one of the following three cases:

Positive maturity transformation; that is the bank on the aggregate, is borrowing short to lend long. This is to be the case where the mismatch curve is concave upwards to the line of equality.

Negative maturity transformation; that is the bank on the aggregate is borrowing long to lend short. This is to be the case where the mismatch curve is concave downwards to the line of equality.

The curve can be a combination of the other two cases. This could arise where (say) there is an excess of assets (liabilities) over liabilities (assets) at both short and long term maturities, in which case the mismatch curve would cross the equality line, (Hewson(1975)).

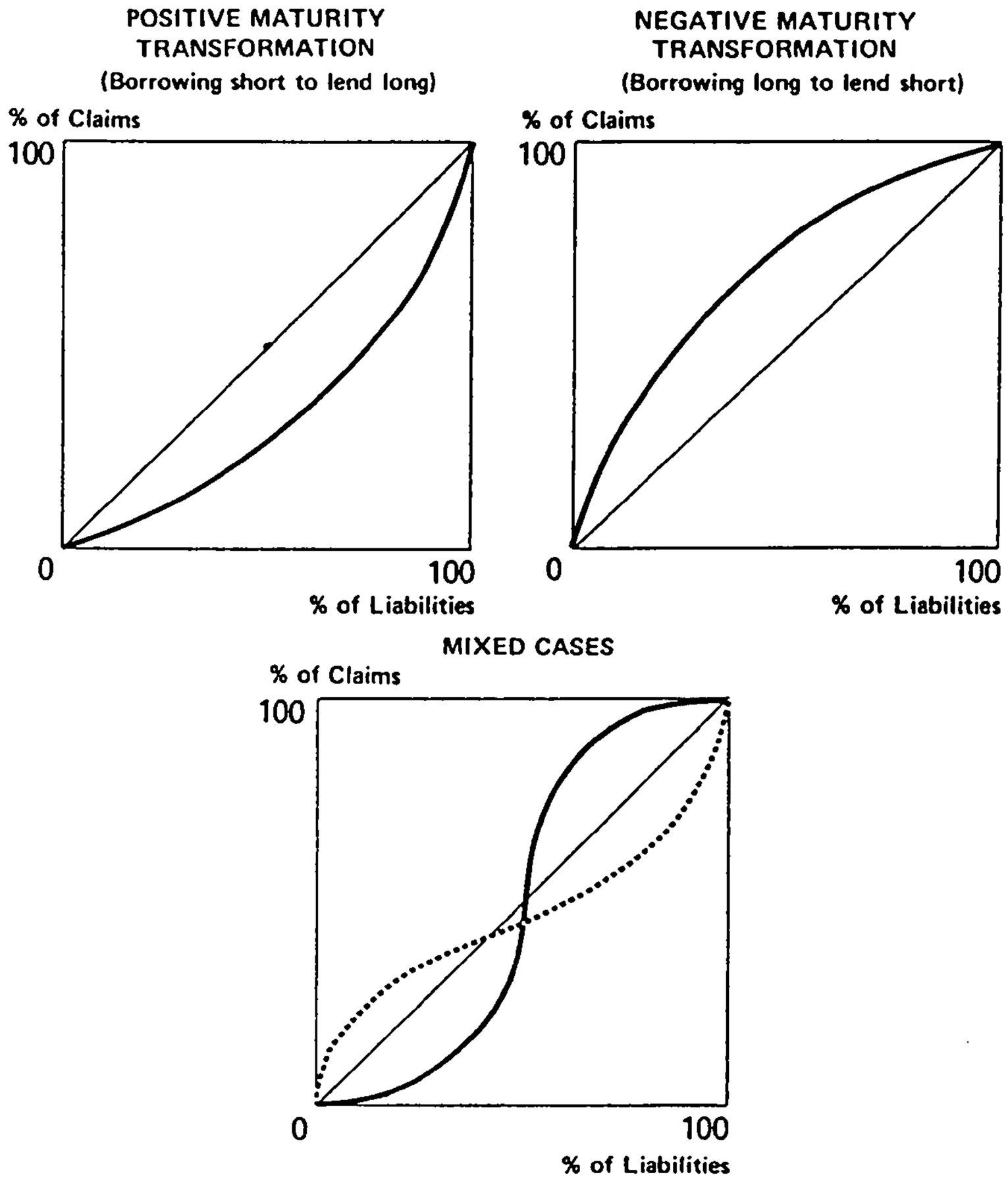
These three possible cases of maturity transformation are presented diagrammatically in Figure 4.1.

4.3 Examining the Maturity Transformation of JIB and KFH

In this section the maturity transformation of two practicing interest free IBs is examined using the techniques explained in the previous section. The banks are JIB

and KFH.

Figure 4.1 Mismatch Curves for Different Types of Maturity Transformation



4.3.1 The application of Niehans notion

Tables 4.1 and 4.2 are introduced to examine the liquidity distribution of monetary assets and liabilities for both institutions.

Table 4.1 Liquidity Distribution of the most Highly Liquid Assets and Liabilities of JIB over the Period of 1979 to 1988

Year	Current and Call Accounts (CCA)	Cash and Reserve with other Banks (CROB)	CCA - CROB
1979	2.525.371	5.748.075	-3.222.704
1980	4.847.694	6.746.021	-1.898.327
1981	12.213.100	13.471.671	-1.258.571
1982	16.381.841	12.800.393	3.581.448
1983	19.678.838	25.437.099	-5.758.261
1984	21.245.370	27.555.017	-6.306.647
1985	23.522.935	27.855.419	-15.332.484
1986	26.418.915	45.766.084	-19.332.484
1987	30.895.166	65.956.075	-35.060.909
1988	35.507.682	74.764.664	-39.256.982

Source: Annual Reports 1979 - 1988

Note: CCA and CROB are dominated in Jordanian Dinar (JD)

Table 4.2 Liquidity Distribution of the most Highly Liquid Assets and Liabilities of KFH over the Period of 1979 to 1988

Year	Current Accounts (CA)	Cash and Balances with Banks (CBB)	CA - CBB
1979	16.138.618	12.681.411	3.457.207
1980	29.212.498	31.241.601	-2.029.103
1981	55.180.706	55.316.027	-135.321
1982	70.050.502	117.353.956	-47.303.454
1983	79.648.586	120.881.102	-41.232.516
1984	69.130.953	74.078.540	-4.947.587
1985	123.379.064	67.792.726	55.586.338
1986	133.440.627	44.071.246	89.369.381
1987	107.792.290	39.393.665	68.398.625
1988	143.330.899	37.016.135	106.314.764

Source: Annual Reports 1979-1988

Note: CA and CBB are denominated in Kuwaiti Dinar (KD)

In the above Tables, it is clear that both institutions in the first six years tended to reduce rather than add liquidity to the rest of the economy. This can be noticed by the minus (-) sign which precedes the difference between monetary liabilities and assets, see the last column of each of the above Tables. This, in fact, is an expected behaviour, because these institutions preclude debt instruments (e.g. treasury bills) from their portfolio holdings. These instruments, especially government short term securities, are considered to be among the most important source of liquidity for interest based banks. This is so because of their marketability and the other characteristics that they acquire (e.g. very low default risk). In addition, the nature of the business carried out by IBs, that is their engagement in real investment projects, means that their assets holding are not merely financial ones as is the case of conventional banks. However, in the last four years covered by the Tables the situation of the two institutions is not the same. While the JIB followed the same pattern, i.e. the reduction of money supply of the rest of the economy by holding monetary assets greater than monetary liabilities, the KFH followed the other side of the coin. That is, it started adding liquidity (i.e. adding to the aggregate money supply) to the rest of the economy by holding liabilities greater than monetary claims. This may due to several factors. One of the possible explanation is the fact that KFH has concentrated most of its investments in construction sector in early years, so it may now be renting out a considerable amount of property that can help in generating a permanent income. This in fact is true as it has been reported in the annual report of the House for the year 1983 "in order to secure continuous stable and reasonable flow of income KFH leases 120 buildings at reasonable rents. Rental income from these buildings rose by 33% during 1983...", look, for instance at Table 4.2 the last column for the years 1982 and 1983 respectively. The other factor is that KFH started holding a

considerable amounts with other banks in the last four years (see the last column of Table 3.3). On the other hand, JIB is still a small size bank so that its operations are not that extensive even domestically. However, the bank has opened several branches nationwide, around 11 branches in 1986. These branches may depend heavily in meeting their liquidity requirements from the central branch of the bank. The above Tables 4.1 and 4.2 show that the general contribution of the KFH is liquidity addition (i.e. adding monetary assets that can be used as money of other economic agents), whereas the general contribution of JIB is liquidity deduction, in the form of reducing the amount of notes and coins in circulation in the rest of the economy. However, we should be very cautious in deriving such conclusions, because this notion deals only with one type of assets and liabilities; that is monetary ones.

4.3.2 The application of the net liquidity definition

In order to apply this criterion, assets and liabilities are classified as follows:

1. Short-Term (ST) assets: included in this category are assets (liabilities) that have maturities less than one year (< 1year maturity).

2. Medium-Term (MT) securities: this category consists of assets (liabilities) with maturities ranging from one year, but less than two years (1 year - < 2 years of maturity).

3. Long-Term (LT) assets: those assets (liabilities) with 2 years maturity and over (2 year-maturity- and over >).

Table 4.3 Maturity Structure of Assets and Liabilities of JIB at the 31st December 1988

Items	Assets (A)		Liabilities (L)		L - A	L - A Percent	A / L
	Amount	Percent	Amount	Percent			
S.T	75.219.307	34	40.742.211	19	-34.477.096	-15	1.79
M.T	140.043.818	63	151.318.281	71	11.274.463	8	0.89
L.T	7.321.216	3	21.392.288	10	14.071.072	7	0.30

Source: Annual Report 1988

Total Assets = JD222.584.341

Total Liabilities = JD213.452.780

Note: Imbalances between total assets and total liabilities due to the exclusion of funds denominated in foreign currencies.

Table 4.4 Maturity Structure of Assets and Liabilities of KFH at the 31st December 1988

Items	Assets (A)		Liabilities (L)		L - A	L - A Percent	A / L
	Amount	Percent	Amount	Percent			
S.T	572.823.860	49	306.990.923	27	-265.832.937	-22	1.81
M.T	518.981.947	44	793.652.087	69	274.670.140	25	0.63
L.T	81.029.873	7	47.128.801	4	-33.901.072	-3	1.75

Source: Annual Report 1988

Total Assets = KD1.172.835.650

Total Liabilities = KD1.147.771.811

Note: Imbalances between total assets and total liabilities due to the exclusion of the proposed net profits to be distributed to depositors and proposed dividend of shareholders.

To apply the net liquidity definition, after establishing the maturity class of assets and liabilities, one needs to know the liquidity coefficients related to each maturity

class of assets and liabilities. Tables 4.3 and 4.4 indicate that the operations of both institutions are dominated by short and medium term operations. As an illustrative example of the net liquidity notion, the following liquidity coefficients are assigned arbitrary for each maturity class of assets (liabilities).

Table 4.5 Arbitrary values of liquidity coefficients used to calculate net liquidity for KFH and JIB.

Maturity class	Liquidity coefficients
S.T. < 1 year	.60
M.T. 1 year -< 2 years	.40
L.T. 2 years and over	.20

Applying the above coefficients to the last columns of Tables 4.3 and 4.4 (the L-A percent column) produces the follyowing results:

N.L (JIB) = - 15 x 0.6 + 8 x 0.4 + 7 x 0.2 = -5.2 percent

N.L (KFH) = - 22 x 0.6 + 25 x 0.4 - 3 x 0.2 = -3.8 percent

The above results indicate that both institutions are performing the function of liquidity destruction (i.e. they reducing the volume of money supply in circulation) rather than liquidity creation. This situation is observed by the minus (-) sign which precedes the values of N.L for each institution. The meaning of these results is that, for every Jordanian Dinar (JD) (in the case of JIB) of total deposits, liquidity destruction amounts to 5.2 pence (JD1 = 100 pence)(i.e. the money supply in circulation is reduced by 5.2 pence). In the case of KFH, for every Kuwaiti Dinar (KD) of total deposits, liquidity destruction accounts for 3.8 *Fils* (KD1 = 100 *Fils*)(i.e. the money supply in circulation is reduced by 3.8 *Fils*). However, in the above example we assigned liquidity coefficients to different maturities arbitrary, it is, therefore, important to test other assumptions to see how sensitive the result is to this arbitrary assignment. In fact using other assumptions would produce the same result i.e. the performance of both institutions (i.e. KFH and JIB) tend to produce a reduction in

the volume of the liquidity available in the economy. Table 4.6 illustrate this fact.

Table 4.6 Values of Net Liquidity (NL) for both KFH and JIB using other assumptions for the values of liquidity coefficients (λ_i's)

Liquidity coefficients	NL(KFH)	NL(JIB)
.80, .40, .20	- 8.2	- 7.4
.90, .50, .30	- 8.2	- 7.4
.80, .70, .50	- 1.6	- 2.9
.90, .60, .10	- 5.1	- 8
.40, .30, .20	- 1.9	- 2.2
.30, .20, .10	- 1.9	-2.2

Note: The values on the first column are applied to maturity classes as follows: short, medium and long respectively.

The above results for net liquidity may be interpreted as that both institutions are borrowing on the aggregate medium to lend on the aggregate short and medium. This can be seen by referring to Tables 4.3 and 4.4 which show that 71 percent of liabilities are of medium term nature of JIB and 69 percent of total liabilities are of medium term nature in the case of KFH.

4.3.3 The utilization of Lorenz "Mismatch" curve concept

To construct the mismatch curve the cumulated percentage ratios of assets and liabilities for each maturity are plotted on the vertical and horizontal axes respectively. The percentage ratios are taken from Tables 4.3 and 4.4 columns 2 and 3 respectively. The mismatch curves for both institutions are plotted in Figures 4.2 and 4.3. The general impression that can be gained from Figures 4.2 and 4.3 is that the maturity transformation of both institutions falls in the range of the second category (i.e. negative maturity transformation). Thus, the operations of the KFH and the JIB on the liability side are of the medium term maturity. On the other hand, the operations of the assets side are of short and medium term nature. This result supports the

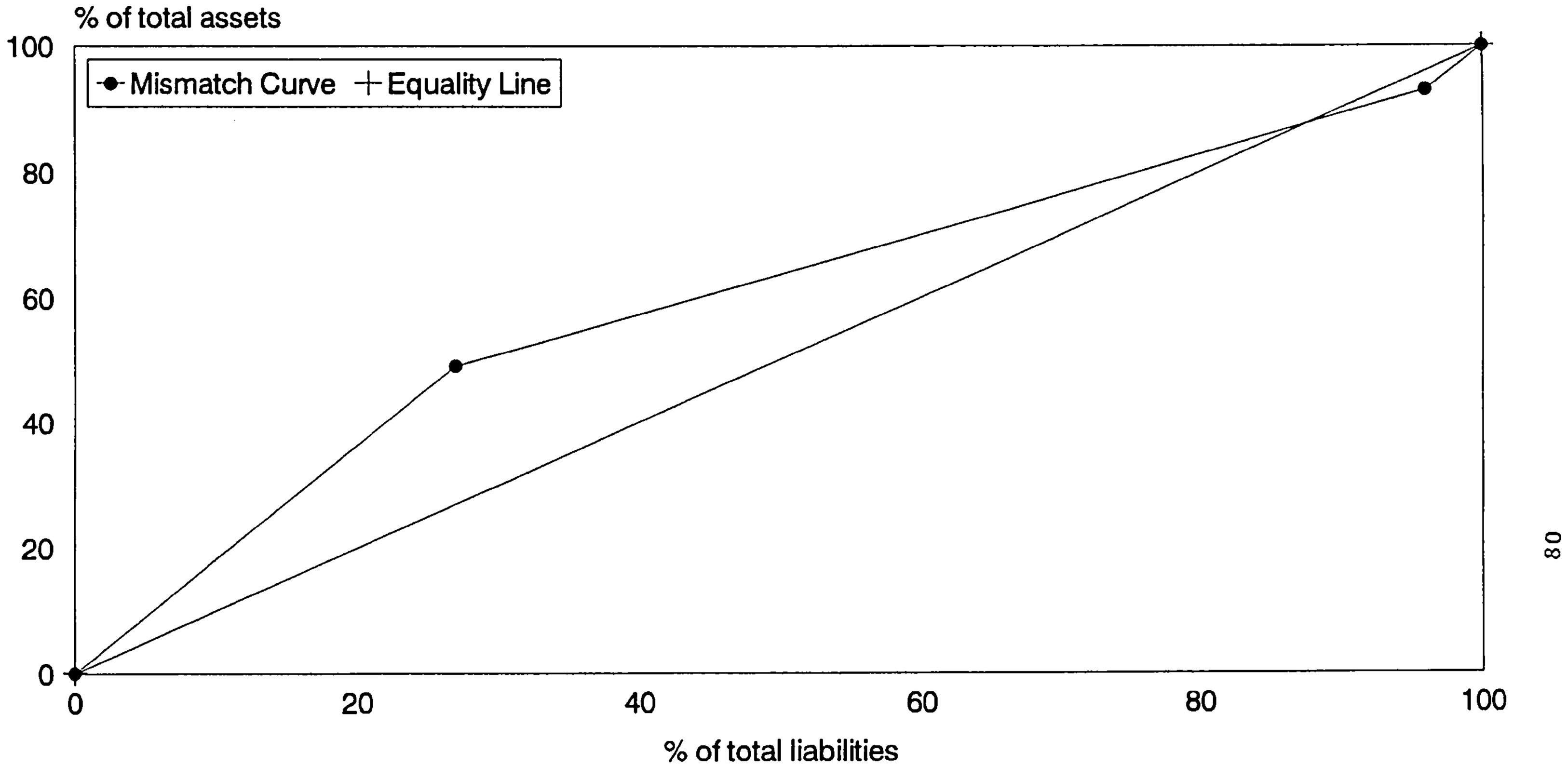


Figure 4.2 Mismatch of Kuwait Finance House (KFH).

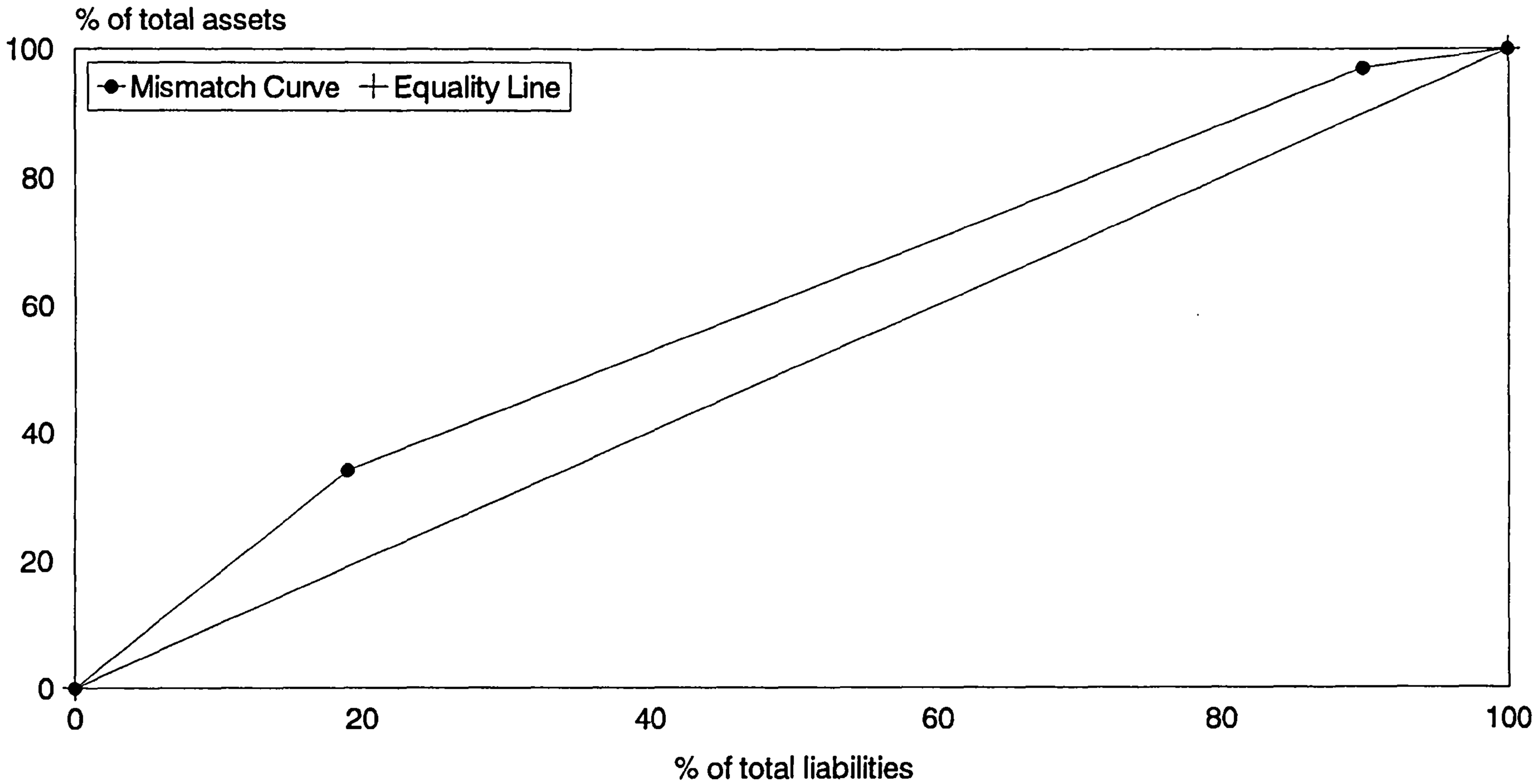


Figure 4.3 Mismatch of Jordan Islamic Bank (JIB).

findings of the previous section, where it was found that the overall contribution of both institutions is liquidity destruction rather than creation. Hence, we can conclude that these two institutions are playing the role of distributing liquidity which has been created elsewhere rather than creating it.

In order to make the above results much more clearer, a simple exercise has been carried out to examine the maturity transformation of some interest based institutions. The ones that have been selected are the Bank of Jordan (BJ), National Westminster Bank and the consolidated balance sheet of American commercial banks. The selection has been made randomly no criteria have been used other than availability of information. Moreover, in this simple exercise we have used the last two criteria only (i.e. net liquidity and the Lorenz "Mismatch" curve), because these two tools examine the maturity transformation for the overall operations of assets and liabilities rather than dealing with one class of assets (liabilities). The results obtained from this exercise are presented in Appendix 4.1. It is clear from these results that these interest based banks tend to create liquidity (add to the aggregate money supply). Although the bank of Jordan (BJ) did not match the performance of the National Westminster Bank and American banks, it is obvious that it is playing the opposite role to that of the JIB and KFH (i.e. these latter two are on the aggregate reducing the amount of notes and coins in circulation). This difference in the quantity of liquidity added by the Bank of Jordan and that added by the British Bank (i.e. NatWest), and American banks may due to the well developed and organized money markets in Britain and the United States. The general impression that can be gained from this simple exercise is that it allows us to compare visually the behaviour of interest based with interest free banks with respect to maturity transformation. Hence these preliminary results open the door for a more thorough theoretical and empirical investigations

into the role played by these newly established banks.

4.4 Concluding Remarks

From the above discussion of the examination of the asset maturity transformation aspect of two practicing IBs (KFH and JIB), the following observations can be made:

The transformation function is only partially performed by IBs. The transformation of less liquid primary securities with unstable market value into liquid secondary securities with stable market value, as is the case with conventional banks, is performed less by IBs. The inability of IBs to perform this function may due to several factors. Some of which are the nature of the undertaken business (equity or rental and sales contracts), the underdevelopment of financial instruments and the lack of well organized financial assets markets. The engagement of these newly established banks in the real investment opportunities may affect the transformation function in the illiquidity aspect of real assets. The instruments utilized by IBs are still underdeveloped in the sense that they are not fully financial ones so that they can be traded in secondary markets. Nienhaus (1988) states "the financial instrument for the liquidity management of Islamic Banks are still underdeveloped; as a consequence, the macroeconomic transformation function is only partially fulfilled by Islamic Banks".

The spread between the interest paid and interest received is a major factor from which conventional retail banks generate their income. This factor, however, is replaced by the profit-and-loss-sharing (PLS) principle for IBs. Thus, neither the bank nor the depositors (i.e. holders of investment accounts) are guaranteed to receive such a pre-determined positive rate of interest. This, in turn, means

that PLS yield is regarded as a factor depending on the outcome of the projects financed by the bank. Holders of investment accounts are exposed to the risk of nominal losses.

The unbalanced portfolios structure, e.g. the KFH before and up to 1984 when it concentrated its investments in the construction sector, may affect the efficiency of the maturity transformation function in IBs, because diversification of the operations of the intermediary is very important factor for maturity transformation.

Both institutions have an item termed demand deposits on the liability side of their balance sheet. So one can conclude that both intermediaries are combining payment services (i.e. chequing system) with intermediation services. But, in contrast to conventional banks, these intermediaries are conducting the intermediation function on the PLS basis. Therefore, IBs are providing variety of assets for both lenders and borrowers as is the case in conventional banks. However, there is a major difference between the two systems is the fact that interest mechanism in conventional banks is replaced by PLS mechanism in the newly established banks. Presley (1988) pointed out "just as in the traditional system, the Islamic depository financial intermediaries transform the liabilities of business into a variety of obligations to suit the tastes and circumstances of the surplus units. One major difference between the two systems is that, owing to the prohibition against interest and the fact that the banks will have to rely primarily on profit sharing, Islamic Banks will offer their asset portfolios of primary securities in the form of risky, open-ended "mutual funds" type package for sale to investors/depositors".

IBs, as judged by their practice to date, act more as a liquidity distribution system rather than as a system which adds liquidity to the rest of the economy.

These interest free institutions are of special nature. Therefore, the needs arise to accommodate this special nature within the management of these institutions and the regulatory agencies which supervise the activities of these intermediaries.

Appendix 4.1 Examining the Maturity Transformation of Some Interest Based Banks.

In this Appendix the data and the results obtained for some interest based banks from the application of net liquidity and the Lorenz "mismatch" curve criteria are presented. These have been organized in such a way that these two criteria can applied easily. The values for net liquidity are presented first and then followed by those of the Mismatch curve.

1. **The case of the Bank of Jordan (BJ)**

Table 4.7 The balance sheet of the BJ at the 31st December 1986.

item	% of total assets (A)	% of total liabilities (L)	L - A (%)
S.T	28.4	23.4	- 5
M.T	17.7	53	35.3
L.T	53.9	23.6	- 30.3

Source: Bank of Jordan Annual Report,1986.

Note: values are expressed as a percentage of total assets (liabilities) and S.T, M.T and L.T refer the same classification as defined in section 4 of this chapter.

From the above Table the NL for BJ is given below:

$$NL(BJ) = .60 \times (-5) + .40 \times 35.3 + .20 \times (-30.3) = 5.16$$

2. **The case of National Westminster Bank (NWB).**

Table 4.8 The balance sheet of the NWB at 31 December, 1988.

item	% of total assets(A)	% of total liabilities (L)	L - A (%)
S.T	10	20	10
M.T	2	62	60
L.T	88	18	-70

Source: National Westminster Bank, Report and Accounts 31 December 1988.

Note: Values are expressed in percentages and the same classification of assets (liabilities) is applied as explained in Table 4.7.

The net liquidity (NL) for National Westminster Bank (NWB) is given below:

$$NL(NWB) = 10 \times .60 + 60 \times .40 + (-70) \times .20 = 16$$

3. **The case of American Banks.**

Table 4.9 Balance sheet of all American commercial banks (ACB) at December 31, 1985.

item	% of total assets (A)	% of total liabilities (L)	L - A (%)
S.T	9	40	31
M.T	17	32	15
L.T	74	28	-46

Source: Financial Markets and the Economy, Henning, Pigott and Scott, 1988, P-50.

Note: Values are expressed in percentages and the same classification of assets (liabilities) is applied as explained in Table 4.7. Also in all three Tables 4.7, 4.8 and 4.9 the values in Table 4.5 have been used as liquidity coefficients.

The net liquidity (NL) value for ACB is given below:

$$NL(ACB) = 31 \times .60 + 15 \times .40 + (-46) \times .20 = 15.4$$

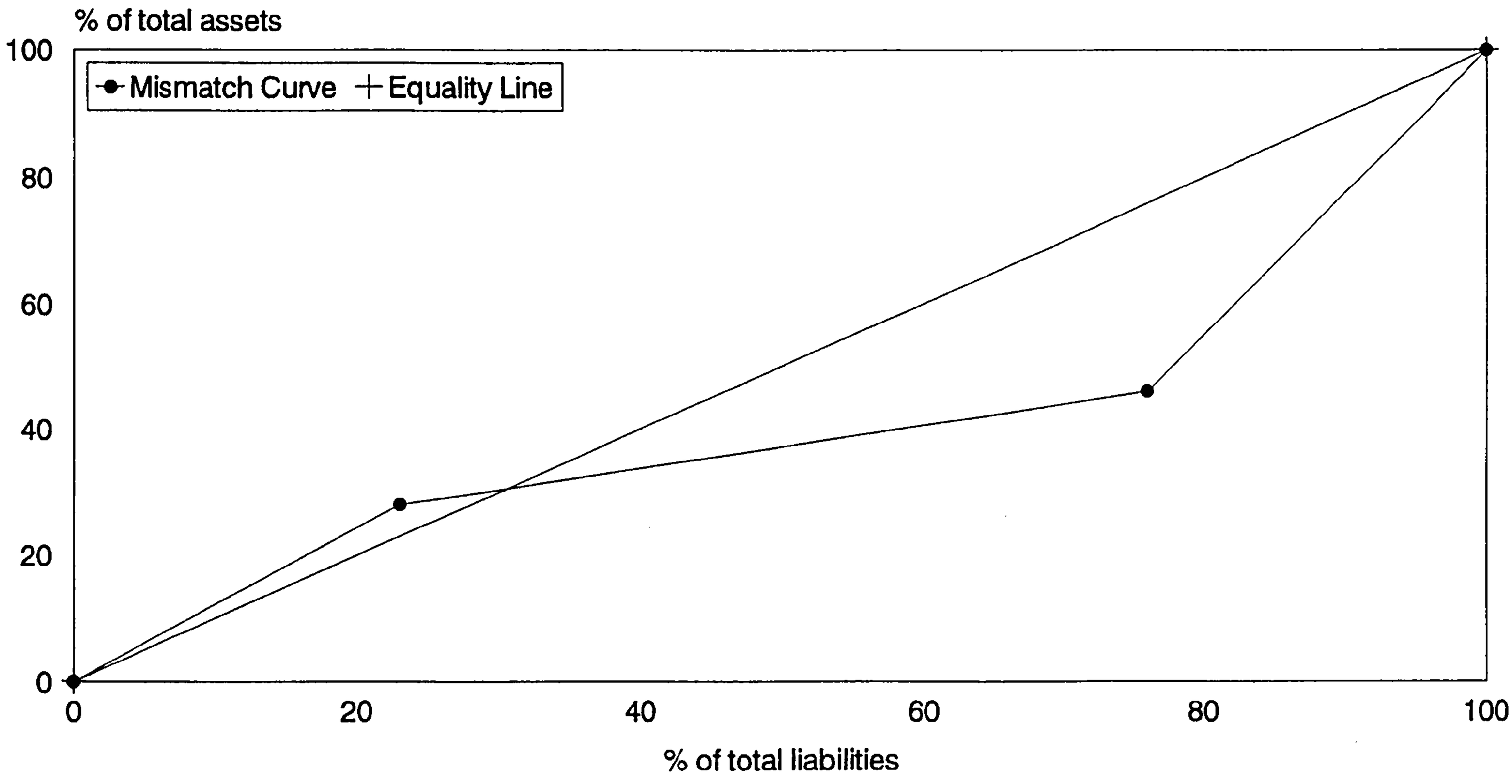


Figure 4.4 Mismatch Bank of Jordan (BJ).

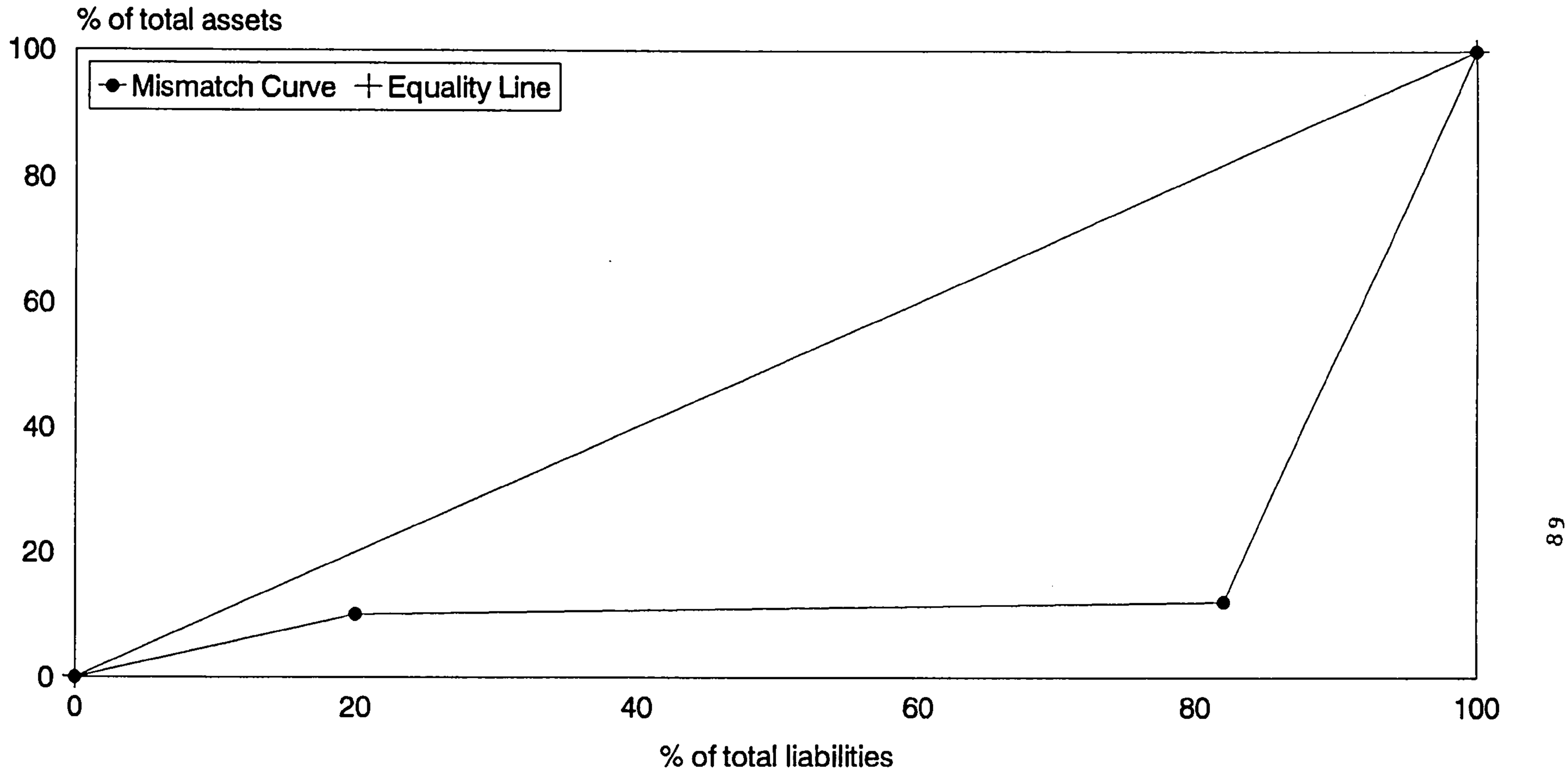


Figure 4.5 Mismatch National Westminster Bank (NWB)

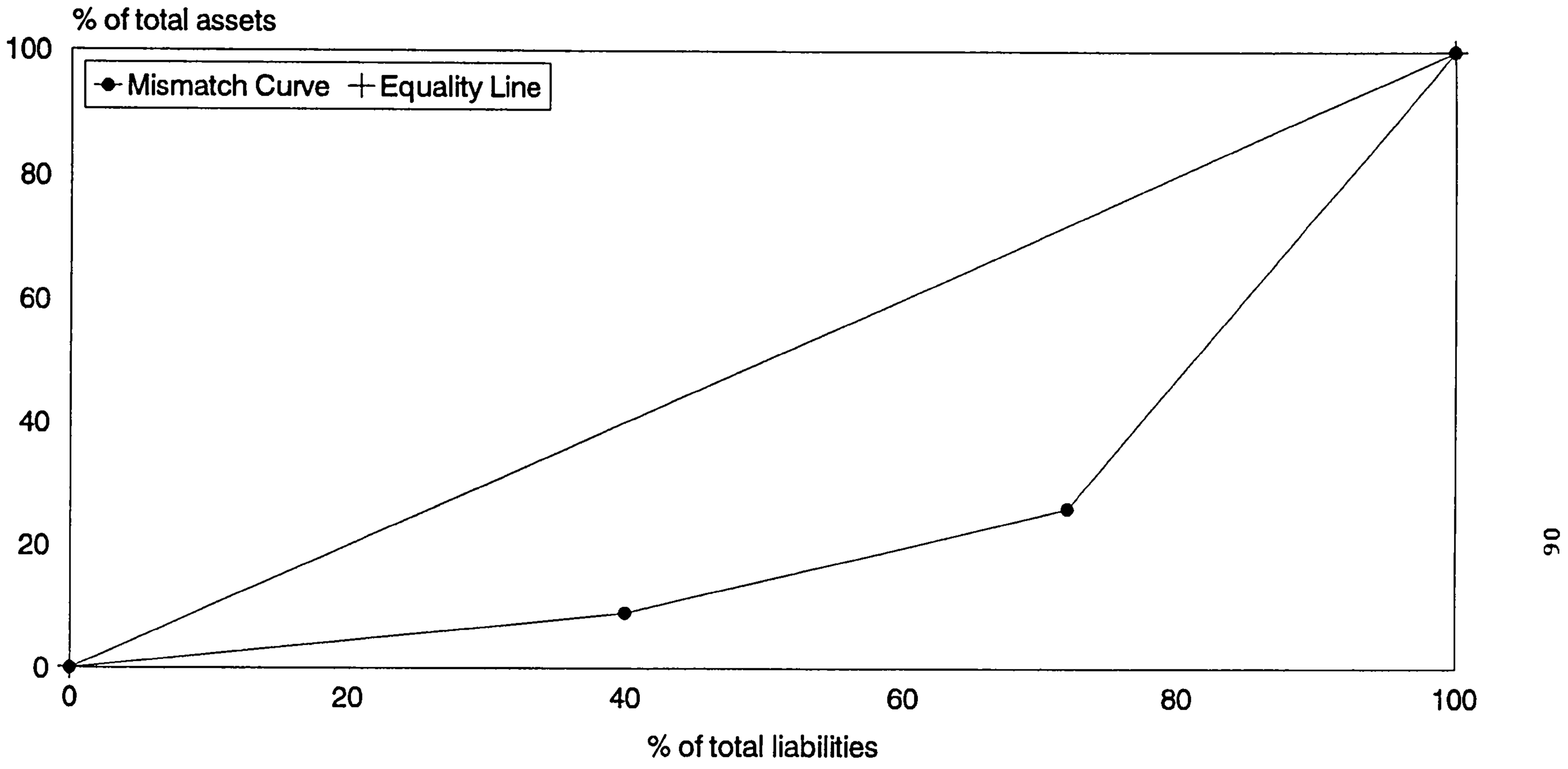


Figure 4.6 Mismatch Curve of American Banks (ACB).

Chapter 5

The Special Features of the Asset and Liability Management Problem of an Islamic Bank

5.1 Introduction

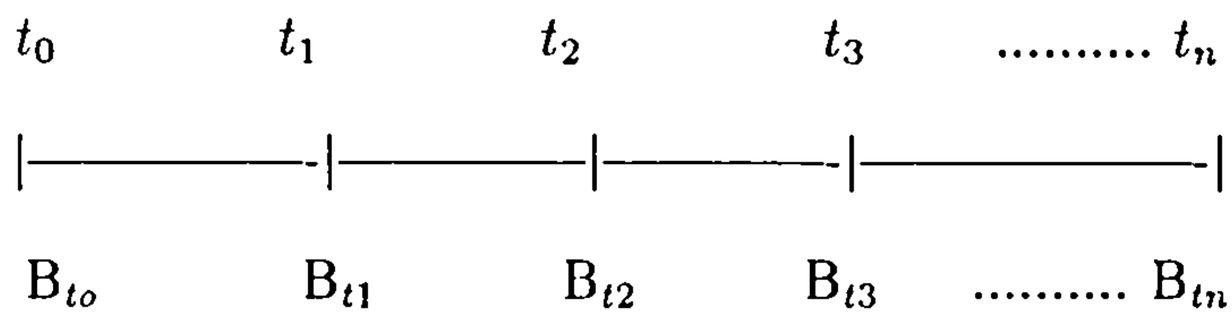
In the guest column of the Banking and Trade magazine (1988), Prince Muhammed Al-Faisal states " the future of IBs depends, to a large extent on their ability to adopt themselves to changing business environment, and to build the necessary management ability to meet the challenge ... one of the most important challenges facing IBs remains management and operational expertise". He went on arguing "... they [IBs] are at a considerable disadvantage in facing competition from conventional banks as they do not have adequate access to the money markets and cannot resort to conventional banks when they face a difficult liquidity situation". The main concern of this chapter, therefore, is to discuss the difficulties surrounding the work of decision makers of IBs in managing their assets, liabilities and capital accounts. To carry out

this task the sequence of the points discussed in this chapter is as follows: First, the ALM problem is discussed in general. Second, the special features of the ALM problem of IBs are discussed. Finally concluding remarks are drawn.

5.2 Statement of the problem

Financial intermediaries (FIs) are defined as firms whose primary function is the provision of financial services to their customers. They stand between two economic units; deficit units (whose activities require more funds than they have available from their own resources) and surplus units (whose activities require less funds than they have available). In order to carry out this function FIs hold claims on deficit units (ultimate borrowers) and issue claims for surplus units (ultimate lenders). The former type of securities is literally known as " primary securities ", while the other type of securities is known as " secondary securities ". Thus primary and secondary securities represent uses and sources of funds respectively. Therefore, the main task confronting the management of FIs is managing the uses and sources of funds, which are represented by assets and liabilities, in such a way as to meet the requirements of equity shareholders, deficit and surplus units and regulatory agencies.

Asset and liability management (dynamic balance sheet management or internal planning as some academics called it) is the phrase used by academics and bankers to describe the above mentioned problem which can be summarized diagrammatically as follows:



Where, t=represents time, with t_0 as the starting point of the planning horizon.

B_{ti} = the position of the balance sheet at t_i, i=0,1,2,...,n.

B_{t0} = the initial balance sheet at the starting point of the planning horizon.

The ALM problem, therefore, can be summarized as follows: given the position of the bank's balance sheet B_{t0} at t_0 (the initial period), the internal and external conditions (e.g. policy, legal, economic constraints,etc) at t_0, the expected conditions that may develop at the future time t_1, t_2, t_3, ... ,t_n, what will be the best "optimal" combinations of assets, liabilities and capital accounts at t_1, t_2, t_3, ..., t_n that allows the bank management to meet the requirements of the owners, deficit and surplus units and regulatory agencies? In other words, how can the management of the bank, or any other FI, structure the assets, liabilities and capital accounts of the bank in such a way as to satisfy the requirements of the interested groups (i.e. owners, surplus and deficit units, and regulatory agencies). Since the bank or any other FI is providing financial services to economic agents by transforming one type of securities (primary securities) into another type of financial instruments (secondary securities), it should like any other firm aim to produce its services at the lowest possible cost and earn the maximum income on its investments. In dealing with the ALM problem the management should pay attention to the following considerations, Mishkin (1989):

1. Make sure that the bank has enough ready cash to pay its customers (whether they are depositors or entrepreneurs) on demand. That is to keep cash on hand, short term assets [or any other arrangement that can guarantee the availability of cash (e.g. borrowed funds in the case of interest based institutions] that can

be converted into cash at the minimum cost. So, the bank should engage in liquidity management.

2. Minimize risk by acquiring assets that have a low rate of default risk and diversifying asset portfolio holdings. Thus, the bank should engage in asset management.

3. Acquire funds at low costs. That is the bank should engage in liability management.

4. Minimize the risk exposure of the bank to changes in rates of return through hedging or gap management (i.e. the spread between rates of return received and paid).

5. Observe regulatory requirements, especially the case of commercial banks. These requirements are designed to encourage safety and liquidity, as well as to promote the accomplishment of public policy goals, (Yeager and Seitz (1989)). In addition IBs are required to conduct their business operations within the framework defined by the Islamic Law (*Shari'ah*) (see chapter 3 section 2).

5.3 What is special about the ALM problem of Islamic Banks?

Chapter three describes how IBs conduct their business operations. Unlike the practice of conventional interest-based banks (IBBs), these intermediaries (i.e. IBs) have chosen the broad lines offered by Islamic Law (*Shari'ah*) (IL) in the sphere of finance as the one that governs their operations. This law does not consider interest as a legitimate way through which income can be generated, because, it (IL) considers

money as " what money does ", so it does not treat it as a commodity which has its own price. Furthermore, IL regards the interest earning as inequitable as it leads to the concentration of funds in the hands of few people or institutions (i.e. usurers), and because money does not earn money without the collaboration of labour. Therefore, these institutions (IBs) must conduct their business within the fields permitted by the Islamic Law. However, the working of these institutions in a world where the principles of Islam are not applied to all aspects of life creates problems for their management. That is why the ALM of these institutions is of a special nature. This special nature can be seen on two levels. These two levels are discussed below:

5.3.1 The nature of the business undertaken by these institutions

IBs have been established to offer banking services in accordance with the principles of Islamic Law. This statement is to be found in the internal regulations set out by the founders of these institutions. As we saw in chapter three this law excludes the practising of "*Riba* " (usury) from the banking business. Instead, IBs have adopted other modes of finance (e.g.*Mudarabah* (capital trust), *Murabahah* (Mark-up on sale),etc). However, these arrangements cannot be regarded yet as purely financial assets in this present state of development by IBs. That is in contrast to their counterparts (IBBs), IBs are mainly concerned and engaged in real investment opportunities. This is not to say that these institutions do not conduct operations which involve financial assets (e.g. buying and selling stocks of other companies) but just to emphasize the insignificant contribution of these operations to the overall operations carried out by these institutions, see for example Tables 3.5 and 3.8 of JIB pages 60 and 64. Therefore, the nature of the business undertaken by these institutions raises some practical and

managerial problems that should be taken into considerations by those responsible for the management policies of these banks. Among others, the following considerations are felt to be of great importance:

5.3.1.1 Liquidity problem

Several definitions have been introduced by economists to determine what is meant by liquidity. For the purpose of this discussion, liquidity is defined as the ability of the bank to meet the short-term requirements of its customers as they come due (deposit withdrawals, entrepreneurs need for working capital or any other instantaneous demand for cash). Clearly this definition emphasizes the fact that the bank should be able to provide cash to its clients so as they can meet their short term needs. The provision of liquidity in that sense depends upon several factors. These are the ease of access to money and capital markets, the holding of securities that can be sold on these markets with small or insignificant losses, the access to or development of interbank markets, the holding of cash and near-cash assets, receipt of new deposit accounts or fresh injection into the existing ones, and how to balance assets with liabilities. Clearly most of these options are not available to and cannot be used by IBs. The access to money and capital markets, especially money market, depends to a large extent on the holding of certificate of deposits (CDs), Treasury bills, bonds, stocks and other securities. Since debt securities cannot be included in the portfolio of IBs this means that a major part of the money and capital markets are not and cannot be utilized by these institutions. Moreover, the use of common stocks is very limited by IBs and these securities are more volatile than debt securities. What is left then is the last three options, that is, the holding of cash and near cash-items, receipt of new deposits and the maturity structure of assets and liabilities. In fact,

IBs rely heavily on the former factor, see for example Tables 4.1 and 4.2 page 74 But this does not solve all their problems. Suppose a businessman approaches an IB asking for financing working capital requirements and the businessman is not in need of a commodity or a machinery,etc but requires funds. The bank has two alternatives either to provide the requirements of this client on the basis of PLS principle or on the basis of interest free loans. The last option is not widely practised by IBs; (see Table 3.5 and 3.8 pages 60 and 64 respectively) and this option carries on an opportunity cost of not using money to generate income. The PLS choice, however, is very risky; it may take several months before the annual profit or loss is calculated and the account can be finally settled (Nienhaus (1986)). These problems have been recognized by IBs, who are therefore searching for new approaches and techniques. The development of good planning strategies may help in coping with these problems. Thus the application of methods, like OR techniques, may provide fruitful guide-lines that can help the management of these banks in structuring their assets, liabilities and capital accounts. This is because these type of techniques, as we will see in the later chapters, try to capture the managerial problems in a global context rather than concentrating on one aspect of the problem e.g. simulation techniques. Moreover, the interaction between assets, liabilities and capital accounts is taken into consideration and sources and uses of funds can be matched in a way that expresses the policies desired by the management of these institutions.

5.3.1.2 The risk involved in conducting banking business according to Islamic Law

In modern finance risk analysis has received considerable attention by financial analysts. Some analysts have gone further than that by arguing that modern investment

management is based on risk management e.g. Dobins and Witt (1983). This consideration has been derived from the fact that with every investment decision there is not only an expected return, but also a certain amount of risk associated with it. The investment decision, therefore, may be regarded as a trade-offs between risk and return; it is generally assumed that the larger the amount of risk the larger the anticipated return must be to compensate for that risk. But what is meant by risk? Generally speaking, risk may be defined as the probability of the occurrence of unfavorable outcomes, (Abdeen and Shook (1984)). In the banking field, there are several types of risk. Default or credit risk is one type, fluctuations in exchange rate is another, and changes in the rate of return (interest in conventional banks) is a third type, liquidity risk is a fourth type,etc. However, the presence of one type or the other depends upon the nature of the business undertaken. It is argued that default risk is associated with the investment and lending operations of all working FIs at least in the theoretical level, because the operations of FIs are conducted through the use of financial instruments. These securities do bear a risk of the possibility that the borrower or entrepreneur will not be able to repay the due amount back. The presence of risk relating to the variability of rates of return is expected to dominate the operations of those institutions that conduct their business on the equity basis, e.g. unit and investment trusts . It can be noticed from the discussion of how IBs conduct their operations (see chapter 3) that the work of these institutions is dominated the presence this type of risk, hence it is expected that this risk will be much higher in the case of IBs than it is for conventional banks. This is simply due to the fact that the operations of IBs on the assets side are dominated by investments in real (physical) assets and the fact that the risk of these assets is higher than that of monetary assets, especially marketable debt instruments. However, emphasis on this

type of risk should not be taken as an indication of the unimportance of other type of risks e.g. liquidity and default risks, but only to emphasize the importance of analyzing carefully this type of risk (i.e. variations of rates of return risk). To understand the risk associated with the business carried out by IBs it is important to analyze the different methods and approaches adopted by these institutions. We concluded chapter three by stating that investment activities conducted by IBs are carried out through direct investment, *Musharakah* (participation), *Mudarabah* (capital trust), *Murabahah* (Mark-up on sale) and *Ijara* (Leasing). Clearly the risk associated with the implementation of each method is not the same. Therefore the risk involved with each technique is discussed below:

5.3.1.3 Risk associated with direct investment

The direct involvement of IBs in investment opportunities can take many forms e.g. trading and management of real estate properties, precious metals, import and export purchase and rental equipment, establishing factories,etc. The involvement of IBs in direct investment in complicated projects that require special technical and managerial skills is minimal. Some IBs have restricted this involvement to certain levels e.g. JIB may invest funds in various projects directly, provided that the total permanent investments of the Bank does not exceed seventy percent of their total paid up capital and compulsory reserve, (Abdeen and Shock (1984)). Generally, the risk faced by IBs under this mode of finance does not differ from the risk faced by business project of other companies in the real sector of the economy (e.g. the automobile industry, the textile industry, etc). That is the drop in the value of the selected project, the variation of the rate of return, and default risk are three main factors that contribute to the size of the incurred risk. The issue of evaluating and selecting the project is of

vital importance. Moreover, the profitability and feasibility of these selected projects are very crucial for the results realized by the bank, and conducting the business according to this method requires specialized staff to be assigned for that purpose.

5.3.1.4 *Musharakah* (participation) Risk

In *Musharakah* mode of finance the bank and its client(s) contribute to the capital required to finance the project. The bank has the right to participate in the management, but it can delegate this to the client. It is important to point out that according to the Islamic Law(IL), the bank cannot guarantee the full repayment of the principal in the case of loss from his partner(s) except the case of dishonesty and negligence, (Mudawi (1986) and Abdeen and Shook (1984)). Thus there is a heavy burden on the management of the bank to take measures in order to minimize the risks attached to this mode of finance, because the presence of information asymmetries and 'moral hazard' problems, which characterize the financial market, make this contractual arrangement difficult to implement. Moreover, the detection of dishonesty and negligence is very difficult if not impossible to prove. Therefore, selecting partners with good experience, reputation in the community as a whole, and business community in particular, is of the upmost importance, letters of reference may provide some protection for the interests of the bank but are not adequate substitute for direct knowledge. Once again, a careful selection of partners with good and feasible projects is very important responsibility of the management of IBs. And it is expected that under this arrangement the monitoring cost or the involvement of the management in the day to day practices of the business, will add to the expenses of the bank.

5.3.1.5 *Mudarabah* (Capital trust) risk

Mudarabah has been defined as a contract that links two parties, one provides 100 per cent of the capital (the IB) and the other provides entrepreneurship and labour (the bank's client). It has been stated also that the profits, if any, are to be shared between the partners on a pre-determined mutually agreed proportions. However, if losses are to be the case, these will be incurred by the capital provider (the bank), except in the case where these losses are due to dishonesty and negligence of the work provider (the bank's client). That is why risk undertaken by the bank is assumed to be greater in the case of *Mudarabah* than in the case of *Musharakah*. Because under the latter the bank does not inject 100 per cent financing into the project, but shares this financing with other partners. Therefore, the loss is divided between them all. But in the case of *Mudarabah* the whole loss is incurred by the bank. For this reason, the ability of the bank to choose an experienced managing partner(s) who engages in efficient and moral practices determines the degree of risk taken, (Abdeen and Shook (1984)). What has been said about the two previous modes can also be said about the implementation of *Mudarabah* method: it requires the careful selection of projects and partners.

5.3.1.6 Risk associated with *Murabahah* (Mark-up on sale)

The risk involved in this method is different because it involves the sale on credit. The customer approaches the bank requesting that a particular item should be purchased on his behalf, with the promise that the client will purchase that item at the purchase cost plus the profit margin agreed upon in advance between the two parties at some agreed future date. According to some Islamic jurists, the customer is not obliged to purchase the item. Thus, if the customer refuses to buy the item the IB will seek

to sell that item to another client or store it in either case the IB will incur the risk of refusal by the customer. With respect to the risk of *Musharakah* and *Mudarabah*, the risk related to *Murabahah* is expected to be small. That may explain why this method is being implemented widely by IBs.

5.3.1.7 *Ijara* (Leasing) risk

The risk of leasing comes from the fact that the payment of the due amount from the use of the rented item depends upon the future profitability and the continuing generation of future cash flow. Hence, the use of this method requires careful planning and follow-up in order to ensure the adequacy of the rent and the preservation of the asset in good working condition to the end of the lease period. If the lessee refuses to buy the asset as stipulated by the contract (i.e. the case of *Ijara wa Iktina* (hire and purchase)), the bank will have to sell it on the market in order to recover its financial investment, (Abdeen and Shook (1984)). Theoretically, it seems that the risk attached to leasing contract is expected to be less than the risk related to *Musharakah* and *Mudarabah*, but higher than the risk associated with *Murabahah* mode of finance.

Having discussed the risk associated with each method of finance implemented by IBs, we should note that there are other types of risk. The newly developed methods applied by IBs and limited experience in their use is one type. That is because business community and other customers have not gained greater familiarity with these new modes of finance. Another important factor that may increase the degree of risk is the weak moral character of certain customers of IBs and the lack of ethical business practices in the community, as Khan (1985) notes " real progress of [Islamization] will have to come from a change of attitudes of those who are heavily engaged in the

present system (IBBs)". In order to minimize the risk involved in conducting their operations, IBs have adopted different measures. These are managerial, financial and legal ones (Abdeen and Shook (1984)). By managerial measures is meant the use of good planing and control techniques by the management of these banks, e.g. studying the projects that will be financed carefully by applying technical, managerial, financial and social conditions. The financial measures lie around the guarantees requested from partners when it is permissible, the application of ceilings to the amount specified for investment activities or investment mode of finance e.g. KFH states in its internal law that investment activities should not exceed 30 per cent of working capital or individual project financed by the house should not exceed 5 per cent of its working capital. The third category is that of legal measures. These are any legal regulations imposed from the authorities in a locality within which IBs operate and these regulations are helpful in minimizing the size of the expected risk (e.g. delay of payments from the customer). However, all these undertaken measures must not contradict the principles of Islamic Law (*Shari'ah*).

5.3.2 The environment through which Islamic Banks operate

The environments in which the IBs are located and operate are not purely Islamic ones. That is, the regulations that govern business and other aspects of life are not fully in accordance with the principles of Islam. Usurious transactions are still practiced within these communities and IBs are still working side by side with IBBs. Moreover, the regulations set by central banks (CBs) and monetary authority do not conform with the principles of Islamic Law (*Shari'ah*). That is why the management of these newly established banks need to give considerable attention to the problems

which arise from conducting business within these communities. As Qureshi(1983) states "... it will be wrong to think that gains of investments financing under shared risk can be realized soon after the switch-over to the new form of financial intermediation. A great deal of homework will have to be done before a meaningful and smooth change can be achieved". The problems that seem to affect the working of IBs are listed and discussed below:

5.3.2.1 Competition from conventional banks (IBBs)

Since IBs have been established in an environment within which IBBs operate, attention should be given to the nature of the services offered by IBBs. This is so, because both institutions are targeting the same customers (deficit and surplus economic units) and it is expected that both intermediaries put considerable effort in attracting more customers. Generally, the major contrast between IBs and IBBs lies on the investment contracts applied by both institutions. The investment (time) deposit accounts is one and the instruments applied to utilize funds is the other. As far as the former factor is concerned, IBBs offer time deposit accounts on the basis of pre-determined rates of interest. Thus, the holders of these type of deposits expect to receive back the deposited principal plus the interest payment at the due time, at the very least they are not exposed to negative return. Moreover, the Law in most countries guarantees this payment through special regulations such as insurance deposit schemes. On the other hand, IBs offer investment accounts on the basis of PLS principle. The application of which entitled the account holder to share in the realized profits from the operations of the bank as well as sharing any losses if this is the case. Here, the holder of investment account with an IB is exposed to negative return. For this reason it is important for the management of these institutions to

take measures that aid the appearance of their investment accounts. With regard this latter aspect, it has been proposed that these institutions (IBs) can seek insurance deposit schemes offered by independent companies. An example of that is provided by Faisal Islamic Bank of Sudan (FIBS) which started this scheme, (Salama (1986)). Other suggestions include the opening of different accounts, e.g. Leasing investment accounts, *Musharakah* investment accounts and so forth. The argument behind this suggestion is that the investment contracts applied by IBs do not all bear the same degree of risk, as we discussed in the previous section, so the customer will have the choice between different alternatives. However, the author believes that building up a good portfolio (i.e. selecting good projects with the application of the saying "do not put all your eggs in one basket", that is, the application of diversification principle is necessary to generate positive rates of return. In addition, having good plans and applying the measures described in the previous section (i.e. managerial, financial and legal measures) and informing customers about the services offered are also vital. Moreover, IBs should launch programs and schemes aiming at increasing the awarness of the public in general and business community in particular to to understand the way these new intermediaries operate. These, however, are all measures that can be applied by these banks (IBs) to gain sustained growth in the market. Therefore, financial innovation and marketing strategies should be sought by the management of these banks, subject to being conducted within the framework of Islamic Law (*Shari'ah*).

5.3.2.2 The Central Bank (CB) cannot be considered as the lender of last resort

One of the main functions of a central bank is to play the role of a lender of last resort for commercial banks in case of liquidity crisis. But in performing this function the CB provides liquidity to other banks in exchange for interest bearing instruments. The utilization of this contradicts the philosophy governing the operations of IBs. It has been proposed that the central banks, in the places where IBs operate, should look into ways and means of developing financial instruments which are interest free or instruments based on PLS principle, (Mudawi (1986)). On the other hand some economists have proposed the establishment of an International Islamic Bank (IIB) which could act as a clearing house for IBs, assist them in the very short term placement of surplus funds, and perform the function of lender of last resorts, (Nienhaus (1986)). The establishment of *Dar-Al-Mal-Islami* (DMI) (The house of Islamic Fund) has helped extending the activities of IBs from the national to the international level. DMI has many subsidiaries in many countries and work closely with many local Islamic financial institutions to provide financing on international level. *AL-Baraka* group is another Islamic financial institution that also works on the international level. It is important to note that the monetary authorities in the localities where IBs work should seek to introduce and accommodate special regulations and techniques that take into consideration the special nature of IBs. If this does not hapen IBs should seek to develop other ways that can help them in fulfilling their duties.

5.3.2.3 IBs have no access to money and capital markets

To perform its functions properly an FI should work within a well developed and organized financial system. Given the circumstances under which IBs function, they

have found themselves to be working at a considerable disadvantage as compared with conventional banks. This is so because, IBs have no access to money and capital markets through which financial instruments can be bought and sold. This limitation imposed upon the operational practices of IBs is due to the dominance of interest bearing instruments in these markets, notably government bonds and bills. Clearly, a thorough and deep investigation should be devoted to the development of markets and instruments, especially short-term ones, to accommodate excessive surplus or shortages of short-term funds. Moreover, the interbank links is being used by IBs, in a limited sense, that is IBs are opening and holding transaction accounts with conventional banks. This can be observed from the present practices of IBs, see for example Tables 3.3 and 3.7 pages 56 and 62 respectively of KFH and JIB respectively. It is obvious that the use of interbank links is still in its infancy, the KFH started using it in the last five years while JIB has not mentioned its usage.

5.4 Concluding Remarks

From the above discussion the following remarks can be drawn:

The ALM problem of IBs is special, in the sense that it needs treatment that takes into consideration the philosophy governing their operations. Moreover, the special nature of the ALM of IBs can be derived from the methods applied by them in conducting their business and the environment through which they operate, (i.e. an environment not governed by the principles of Islam).

The degree of risk incurred from the application of each mode of finance is not the same. Direct investment, *Musharakah* and *Mudarabah* are considered as the most risky means of financing. While *Murabahah* (Mark-up on sale) and *Ijara*

(Leasing) are regarded as the least risky modes.

To succeed in their practice IBs need to devote special care and consideration to their operating relationships and techniques, including financial, managerial and legal ones. In addition, they should evaluate projects carefully and select partners with good experience, reputation, honesty and so forth. Thus, they need to possess information about entrepreneurs not only as professionals but also as individuals too. The cost of delegated monitoring and control is expected to be high in comparison with their interest based counterparts.

There is a need to develop short-term certificates, so as to absorb the excessive short term funds that IBs have, as well as markets through which these instruments can be traded.

The monetary authority represented by central banks should take into consideration the special features that distinguish IBs from their conventional counterparts. It should be possible to accommodate new instruments that are based on the principles governing the operations of IBs if a thorough and deep investigations are carried out by the parties involved and practical steps are taken by the monetary authorities.

The growth and continuity of IBs, with present practices, depend to a large extent on them having strong relations with surplus and deficit economic units. Thus offering services to these parties should be given more consideration by the management of these institutions. Therefore, it is important to inform and explain clearly to customers the way business is being conducted by IBs, so as to eliminate the lack of awareness and familiarity of the business community and customers with the principles and new methods applied by IBs.

Diversification of investments through different opportunities is a key element in reducing the risk involved in carrying out their operations. Thus, the selection of diversified portfolios is an important element for future success.

Offering different investment accounts with different degrees of risk may help in attracting funds for investments e.g. offering *Murabahah* accounts,etc, and give customers a range of facilities with different degrees of risks.

Having good management and trained staff in the fields of management, Islamic Law, economics and project appraisal should be given considerable attention by those responsible for IBs. This is so because the performance of IBs is more dependent on the projects financed by them than are conventional banks. In addition, if the customers are deceived the impact of their criticism will not be limited to those who cover their operations under the name of Islam but this latter itself will be criticized.

Chapter 6

Literature Review

6.1 Introduction

In recent years, a great deal of effort has been devoted to the construction of analytical approaches to solve the Asset and Liability Management (ALM) problem of commercial banks. Most of these models have taken the mathematical programming form. In this study, the author is going to pursue this approach in discussing and developing an ALM model for an Interest-free Islamic Bank (IB). The main concern of this chapter is to review and discuss the work on mathematical programming as applied to banks ALM problem so that this study can be placed within the context of this literature.

6.2 Review of the previous work

Because of its vital importance for the internal policy of the bank, it is not surprising that many models have been suggested to deal with the ALM problem of commercial banks. These models range from simple rules of thumb to the more advanced

and sophisticated techniques. Attention in this review, however, is mainly limited to Operations Research (OR) techniques. The history of OR can be traced back to the Second World War when scientists concentrated on the analysis of military operations. After the war academics and managers realized that these tools can be applied to business and industrial operations and OR developed rapidly as a result. However, it was until the 1960s that bankers and specialists in the banking field realized the possibility of using this type of techniques in handling the decision problems faced by bankers, (Eilon and Fowkes (1972)). As far as the ALM problem is concerned, different models and approaches have been suggested and discussed by academics. These approaches can be grouped into three main categories, Cohen, Maier and Vander Weide (1981), (see Figure 6.1 for a summary of the different techniques suggested by academics):

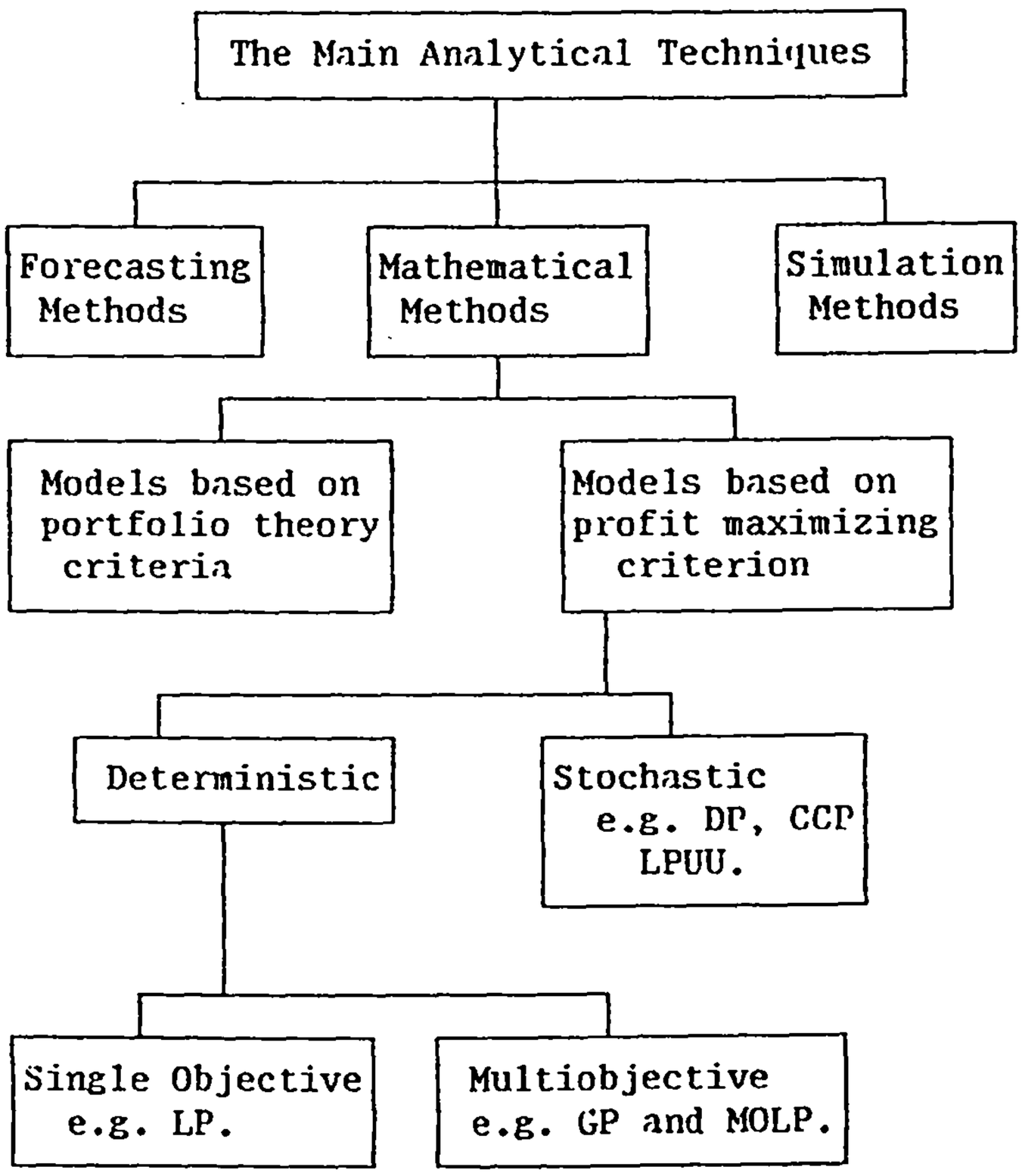
6.2.1 Forecasting models.

Sophisticated statistical models have been constructed by academics and applied by bankers in forecasting the level of deposits, loans, interest rates and other activities of the banking firm. In fact these types of models are one of the quantitative tools most widely used by banks. In two surveys conducted by McClure and Miller (1979) and LaForge and Wood (1980), in examining the use of OR techniques by large U.S. banks, forecasting models were utilized by 83 and 64 per cent of the examined banks respectively, (see Tables 6.1 and 6.2).

6.2.2 Simulation models.

This type of techniques is also widely used and accepted in solving the decision problems faced by bankers. In the same surveys conducted by McClure and Miller

Figure 6.1 Summary of Analytical Approaches Suggested to Solve ALM problem of Commercial Banks



DP = Dynamic Programming.
CCP = Chance-constrained Programming.
LPUU = Linear Programming Under Uncertainty.
LP = Linear Programming.
GP = Goal Programming.
MOLP = Multiobjective Linear Programming.

Table 6.1 Findings of McClure and Miller 1979.

O.R. Technique	Percent of banks using each method
Forecasting	83
Other Statistical Methods	79
Simulation	79
Linear Programming	37
Queuing Models	37
Decision Theory	21
Nonlinear Programming	19
Inventory Models	17
Integer Programming	15
Probabilistic Programming	13
Dynamic Programming	12
PERT, CPM, and Networks	10

Source: McClure and Miller 1979.
Note: These results were based on a sample of the 100 largest, (according to assets size), U.S. banks.

Table 6.2 Findings of LaForge and Wood 1980.

O.R. Technique	percent of banks using each method
Simulation	77
Regression/correlation	77
Linear Programming	41
Network Techniques	18
Queuing Theory	15
Integer Programming	10
Goal Programming	8
Nonlinear Programming	5
Markov Analysis	5
Inventory Techniques	5

Source: LaForge and Wood, 1980.

Note: These results were based on a sample of the 170 largest, (according to the amount of deposits), U.S. banks.

(1979) and LaForge and Wood (1980), 79 and 77 per cent of the examined banks used these techniques respectively. Moreover, Cohen, Maiser and Vander Weide (1981) reported that computer simulation models seem to be the most widely implemented type of management science aid in bank dynamic balance sheet management.

6.2.3 Mathematical models.

Although the implementation of these models is still in its infancy and they are quite difficult to formulate; these models have certain advantages over type (1) and (2) models. Foremost among these is the fact that these models help executives in determining the composition of assets, liabilities and capital over the planning horizon, while type(1) and (2) models concentrate on small parts of the ALM problem i.e. type (1) is merely concerned with forecasting the level of deposits, loans and interest rates and type (2) models concentrate on evaluating a small set of alternatives available to executives. Chambers and Charnes (1961) were the first to indicate how this type of models could be implemented by senior executives of banks. Their work was extended by Cohen and Hammer (1967,1972). Following the publication of this extended work several models and techniques have been suggested and some have been implemented by banks. Within this global context, two distinguished approaches have been stressed in recent years, Kusy and Ziemba (1986) :

6.2.3.1 Models based on the criterion of the portfolio selection process.

The portfolio theory developed out of the pioneering work of Harry Markowitz(1952,1959) and the work of William Sharpe, Jensen and others. This work was largely responsible for the building up of a specific model of the relationship between risk and the required return, (Yeager and Seitz (1989)). Markowitz developed the mean-variance

criterion (MVC) for selecting portfolios. According to the theory investors desire high returns but they are averse to high risk which is measured by the variance of the portfolio. Therefore, rational investors choose to hold efficient portfolios. An efficient portfolio is defined as "the one that maximizes expected returns for a given degree of risk, or alternatively, the one that minimizes risk for a given expected return", (Collier, Cooke and Glynn (1988)). In applying this criterion to the ALM problem researchers, e.g. Pyle (1971), assumed that returns are normally distributed and bank management utilizes risk averse utility function. Moreover, the value of an asset is a function of not only its return and variance, but also it depends on the covariance of its return with the returns of all assets included in the portfolio, (Kusy and Ziemba (1986)). Examples of the work that follow this line are the ones conducted by Brodt (1976,1978,1984,1988). Brodt's work is essentially an adaptation of the criteria suggested by Markowitz who measures risk by the variance, while Brodt measures it by either semi-absolute deviation or mean-absolute deviation. In fact, little work has been done in pursuing this approach. This may be due to the fact that in a practical banking context this approach involves the formulation of sophisticated models and requires complex computation. Its usefulness as a managerial tool is thus seriously limited. In addition, some academics have criticized this approach as being an unrealistic description of the behaviour of the banking firm, (Santomaro (1984)).

6.2.3.2 Models based on considering banks as firms seeking to maximize their expected profits.

According to this approach banks are merely regarded as firms like any other business firms in the economy. They utilize some "factors of production" (e.g. labour, deposits) as an input to produce their output (e.g. loans). We should note that what

FIs do produce is a controversial point, see Lewis and Davis (1987). What really concerns us here is that banks are fulfilling the two basic functions required to consider any business entity as a firm. These are production and distributive functions. It is well discussed in the literature of the banking firm that banks exist because; they are asset transformers (in the sense that transforming size, maturity, risk,etc of primary securities into secondary securities with different characteristics) and they are performing the brokerage function by possessing and providing information against commission fees. Models that have been constructed following this approach are either deterministic or stochastic.

6.2.3.3 Deterministic models.

Since the work of banks is undertaken in a world where uncertainty is associated with cash flows, cost of funds and rates of returns, some procedures must be provided to cope with this situation or assumptions must be made to simplify the real world. In fact, deterministic models have pursued the last option; that is assuming certain realization of random events. The most widely used technique in deterministic models is Linear Programming (LP). In two surveys cited earlier, LP ranked third, among the tools utilized by American banks, after Simulation and Statistical Forecasting methods. It is the pioneering work of Chambers and Charnes (1961) and Cohen and Hammer (1967,1972) who developed general models for the ALM problem using the intertemporal LP technique. In constructing their model Cohen and Hammer (1967) discussed the possibility of utilizing one of the following criteria as an objective function:

1. Maximizing the value of the shareholders' equity at the end of the final period of the planning horizon.

2. Maximizing the present value of the net income stream during the planning horizon.

3. Maximizing the present value of the net income stream during the planning horizon plus the present value of the shareholders' equity at the end of the final period.

In their formulation of the LP model Cohen and Hammer distinguish between two types of constraints: intra-temporal and inter-temporal constraints. The former refer to the constraints that must be met each point of time in the planning horizon e.g. policy, funds availability,etc. The latter type of constraints represents the links between the items of the balance sheet over the whole planning horizon. The most detailed constraint in their model is the Capital Adequacy Formula (CAF) of the Federal Reserve Board of Governors. The underlying concept of that formula is that the function of bank capital is to protect depositors against possible loss. That is under crisis circumstances, equity shareholders are exposed to any losses first, for more details of the concept and formulation of this formula see Cohen and Hammer (1967) and Beazer (1975). All subsequent deterministic models developed by other academics are indebted to the work of Chambers and Charnes (1961) and Cohen and Hammer (1967,1972) especially the latter. For this reason in what follows we will discuss briefly some of these contributions. However, the omission of other work should not be considered as a negative judgement of its quality. Myer Zu Selhausen (1970) developed an LP model in conjunction with a leading German Bank. This model consists of three interrelated and nested models, planning horizons of 90 days, one year and five years. Each of the three models consists of a full set of balance sheet variables, but the variables differ in their level of aggregation the short term model of 90 days being more detailed than the other two. The objective function

in the models is the maximization of the contribution to bank profit from raising and investing funds, subject to a block set of constraints (some of which have been regarded as sub-objectives e.g.limitation of risk). A slightly different approach has been suggested by Balbirer and Shaw (1981). A version of their model, in fact, has been implemented by the Central Carolina Bank and Trust Company. The authors constructed a single period LP model with the objective function of maximizing profits. In dealing with the multiobjective nature of the banking firm, three approaches have been suggested. The first is Goal Programming (GP). This technique recognizes the existence of multiple and possibly conflicting goals. Forston and Dince (1977) constructed an intertemporal GP model consisting of four quarters comprising a planning horizon of one year. A version of this model was implemented, as reported by the authors, in a small National Bank located in North Geogia. Gioakas and Vassiloglou (1991) developed a Goal Programming model for the commercial bank of Greece (CBG). In their construction of the model the authors have considered six goals. These include: the maximization of gross revenues resulting from the difference between the interest received and the interest paid, the target of this goal was set up to be equal to zero ensuring that income would be greater than or equal to expenses, the minimization of solvency risk which has been measured by the ratio of the bank's equity capital to its total weighted assets and the target of this ratio has been specified at the level of 8 per cent or more, the minimization of liquidity risk which has been defined as the ratio of liquid assets to current liabilities, the standard level determined by the management of the selected Greek bank was to maintain a level of this ratio at approximately 60 per cent, the achievement of a target level of deposits 23 per cent higher than the level of the previous year, and finally the achievement of a target level of loans of 21 per cent above the previous year's level. In addition,

institutional, financial, legal and policy considerations that reflect the environmental constraints of the bank, have been included in the model. The second approach is Multiobjective Linear Programming (MOLP). This technique attempts to optimize all objectives simultaneously subject to the specified constraints. This method has been proposed by Eatman and Sealey (1979). Their model includes three specific objectives; maximizing net after tax profit, minimization of capital adequacy ratio (the ratio of required to actual capital) and minimization of risk assets to capital. The authors solve the MOLP problem by using an algorithm developed by Milan Zeleny (1974). According to this algorithm a set of solutions can be obtained called non-dominant. A nondominated solution is the one where no objective value can be improved without harming one or more of other objective values. A nondominated solution is, therefore, equivalent to an efficient solution in portfolio analysis theory, (Eatman and Sealey (1979)). In order to arrive at a final solution, bank managers are presented with the set of possible solutions and then use their subjective preferences, experience and judgement to select the solution that is most favourable overall. The third technique is Polynominal Goal Programming (PGP). This method has been suggested by Tayi and Leonard (1988). However, their exercise was for expository purposes and it was based on the numerical example provided by Eatman and Sealey (1979). The PGP is similar to GP in the sense that it (PGP) tries to locate a single best compromise solution. In order to utilize this method the decision maker is requested to provide preference information concerning various trade-offs between the multiple objectives, which is then used to set up a single objective problem. At each interaction with the decision maker, a new single objective problem is solved so that the current solution is 'close enough' to the best compromise solution, Tayi and Leonard (1988). It should be noted that the multiobjective methods and their

solution techniques are grouped into three main categories, depending on when and how the preference information from the decision maker is used, see chapter 9 (pages) for these groupings. Before we end this part it is important to note the fact that the omission of uncertainty is a serious drawback of deterministic models. However, they have gained an enormous acceptance on the practical level. This is so because they are computationally tractable and they can be understood easily by decision makers. Kusy and Ziemba (1986) state that "the banking industry has accepted these models as a useful normative tools".

6.2.3.4 Stochastic models.

This type of model , as its name indicate, has tried to cope with the uncertainty inherent in the banking environment. This uncertainty includes uncertainty of cash flows, rates of return and costs of funds. Proponents of these models have argued that since probability distributions can be obtained for random events, the uncertainty should be incorporated in formulating the ALM problem. In their formulations academics have used mainly four mathematical techniques. These are Chance-constrained programming (CCP), Dynamic programming (DP), Multistage stochastic programming (MSP) (also known as Linear programming under uncertainty (LPUU)) and Sequential decision tree approach. CCP was suggested more than two decades ago by Charnes and Thore (1966) and Charnes and Littlechild (1968). But since that time no more work has been conducted using this approach. This is mainly due to its computational difficulty. As Cohen, Maiser and Vander Weide (1981) reported "... there have not been more recent papers of which we are aware of describing applications of this technique to bank dynamic balance sheet".

The application of DP to the ALM problem attributed to the work of Eppen and

Fama (1968,1969,1971) who modeled two and three assets problems. Their work was extended by Daellenbach and Archer (1969). A slightly different approach within the context of DP has been developed by Chen (1970). In this occasion Chen discusses the uncertainties surrounding the work of bankers. He considered three type of uncertainties as the most important ones : 1) - uncertainty of future prices on assets, 2) - uncertainty of returns of asset; these two type of uncertainties have been referred to as portfolio risk and; 3) - uncertainty of deposits levels, which the author regarded as liquidity risk. To take these kinds of risks into consideration Chen suggested that the management should study the prevailing conditions of the market within which assets can be bought/sold and then derive the probability distributions of future prices of assets. Chen defines the liquidity risk as the correlation between the future returns of assets and the magnitude of bank's liquidity need to meet deposits withdrawals. For a single period model the author suggested the use of quadratic programming. While in the multiperiod case he suggested the application of stochastic dynamic programming.

MSP is the third quantitative technique that has been suggested in dealing with the ALM problem under uncertainty. Cohen and Thore (1970) proposed the use of two-stage programming under uncertainty (which is a special case of the generalized MSP). This work was extended by Booth (1972). Booth reported that the extension dealt with the following aspects: 1) - in the Cohen-Thore model uncertainty was limited to the level of deposits only, while Booth's model incorporated the uncertainty of rates of interest, loan demands and non-deposit liability levels, 2) - Cohen and Thore's model is a single period model, whereas Booth's model is a two period model type; and 3) - the author claims that the data required as an input for his model can be obtained by bankers in a manner easier than that of Cohen and Thore model.

Aghili, Cramer and Thompson (1975) constructed a MSP model, which has been implemented by a small Midwestern bank. The aim of this exercise was to test the ability of two-stage programming in solving the ALM problem for senior executives. For that reason, they compared the results obtained by the model with the actual results of the small Midwestern bank for 1972. The authors cited the advantages of using MSP: 1) - it allows the bank to recover from a bad to another decision stage (that is why it is important in decision making to separate time decisions into stages), 2) - the formulated model is of the same size as LP models, so it can be easily solved by the LP algorithm; and 3) - in formulating a decision problem it is necessary to characterize future economic events with a finite set i.e. expressing uncertainty in the form of economic scenarios.

In the model developed by Aghili*et al* (1975) policy constraints were found to be the cornerstone of the model. When the model was applied to the data of the Midwestern bank, the authors found that the model produces results very similar to the actual ones, when the policy constraints were included. But when these constraints were omitted the model produces entirely unrealistic results. Therefore, they conclude that policy constraints are very important in modelling the ALM problem. Moreover, their work led them to claim that MSP is the technique that bridges the gap between theory and practice "... indeed it is our opinion that it [MSP] does bridge the gap between the theoretically desirable and practically reasonable, and above all can lead to better bank management".

Kusy and Ziemba (1986) have developed a multi-period LPUU model, taking into considerations uncertainties of cash flows, cost of funds and rates of return on investments. In their opinion bank management should pay considerable attention to the trade-off between risk, return and liquidity. A version of the model developed

has been applied by a Canadian bank as reported by the authors, (Vancouver City Savings Credit Union) for five years.

The fourth technique is sequential decision tree developed by Bradley and Crane (1972,1973,1976). The Bradley-Crane model depends upon the developments of economic scenarios that are intended to include the set of all possible outcomes. The scenarios may be viewed as a tree diagram for which each element (economic scenario) in each path has a set of cash flow and interest rates, (Kusy and Ziemba (1986)).

From the above discussion we can conclude that stochastic models are theoretically superior to deterministic ones. However, they have achieved little success in practice. Because of the computational difficulties associated with them, unfamiliarity of bankers with their mathematical requirements, the considerable information that they require and the undesirable features that they contain, (e.g. arbitrary constraints), (Kusy and Ziemba (1986)).

6.3 Assessment of the Previous Work and Avenues to be explored.

Having reviewed, in some details, the different approaches that have been taken by academics, attention is given to the assessment of that work. The purpose of this is to place the work carried out in this study within the context of the literature reviewed. It can be noticed that all Operational Research (OR) techniques, which have been suggested by academics to solve the ALM problem, share the same principle of optimizing an objective(s) subject to certain mix of portfolio constraints. Therefore, one of the distinguishing factors between different models is : what is it that is optimized?, and under what conditions?. All single objective determin-

istic models, and some stochastic models, have used Expected Net Present Value (ENPV) or contribution to profits from raising and investing funds as an objective criterion to be maximized. Of course, different arguments have been put forwarded for selecting one criterion or the other. Cohen and Hammer (1967,1972) have summarized these arguments. Those who used ENPV have put the following reasons for their selection : 1) not all earnings opportunities are explicitly incorporated as decision variables in the Linear Programming (LP) model, 2) increasing degrees of uncertainty are implicitly attached to more distant forecasts, and 3) it is felt that shifts in time pattern of the net income stream will affect the market 's valuation of bank's stock. However, difficulty exists when it comes to the matter of selecting an appropriate discount rate. That is why proponents of contribution to profit maximization have favoured its use, because it avoids the necessity for determining a discount rate. Multiobjective models, on the other hand, have used some other objectives such as providing sufficient liquidity, minimizing risk and maintaining adequate capital as well as profit maximization criterion which has been used widely in constructing single objective models, see Forston and Dince(1977), Eatman and Sealey(1979), Zaloom *et al* (1986) and others for more details. As far as the other part (i.e. constraints) is concerned, most if not all, academics have used the capital adequacy formula (CAF) developed by the examiners of the Board of Governors of the Federal Reserve system as the most important constraint. Because it is a very detailed and comprehensive formula and it involves many assets, some liabilities and capital items, (Cohen and Hammer(1967,1972) and Beazer(1975)). However, some other academics e.g. Zu Selhausen(1977) have regarded liquidity maintenance as the core of the model constraints. Clearly, emphasizing one constraint or the other depends upon the nature of the business undertaken by the institution, the environment

through which it operates and the regulations which govern its operations. The next step in assessing the reviewed work is to consider what is theoretically desirable and practically feasible. So far, it seems that the gap between the two is far from being narrowed. What is theoretically desirable is presented in stochastic models which incorporate uncertainty in the modelling process. While what is practically feasible has been presented in deterministic models (i.e. linear models). Many writers have noticed and reported this fact. For example, Eatman and Sealey(1979) have stated that "... the linear model, in one form or another, has proven to be the most useful in practical applications". Cohen and Thore(1970) have pointed out the same fact for American banks "the most successful technique that has actually been developed and implemented in any American bank ... is a large-scale intertemporal LP model". While other academics have stated the reasons why banking industry has not yet accepted stochastic models for example, Kusy and Ziemba(1986) state that "... stochastic models ... have achieved little success. This failure due to the inherent computational difficulties, the oversimplifications needed to achieve computational tractability and practioners' unfamiliarity with these models' potential". In their discussion of constructing a Goal Programming model Zaloom *et al* (1986) pointed out the same fact "techniques other than LP such as quadratic programming ... dynamic programming models have not been adapted for practical balance sheet management by the commercial banks since the specifications of these models are generally difficult and their mathematical solutions are costly to obtain and to interpret". Moreover, the worthiness of utilizing stochastic models depends upon having more information about the probability distributions of random variables. As Beazer(1975) noticed "... their [stochastic models] worth depends upon having more information about probability distribution than just expected value". Within the global con-

text of linear models two approaches have been suggested; single-and multi-objective models. Linear programming(LP) is the most formidable normative tool which has been implemented and accepted in the banking industry. However, this technique is still being criticized for its narrowness in limiting the utility function of the bank to a single criterion function to be optimized when the nature of the banking firm indicates the usefulness of considering the conflicting requirements of shareholders, depositors, borrowers and regulatory agencies. Goal programming(GP), multiobjective linear programming(MOLP) and Polynominal Goal Programming (PGP) are the three tools that have been proposed to deal with the multicriteria nature of the banking firm. Our discussion, however, will be limited to the first two techniques, because the latter requires an interaction between the decision maker and the analyst at each iteration stage in order to determine his preferences with respect to the objectives to be optimized. GP has been developed and used for practical purposes in at least one small national bank located in north Georgia, (Forston and Dince(1977)). Although GP recognizes the presence and importance of multiple and perhaps conflicting goals, the way used it tries to overcome this problem makes it a controversial technique. It first asks the management to set some targets for each goal and to put priorities on them - that is to rank them in order of importance, when this information is supplied GP tries to minimize the deviations from the targets set, (Levin, Rubin and Stinson(1986)). This procedure makes it rather a mechanical tool as Zeleny(1982) states "it [GP] still a rather mechanical technique plagued by insufficient theoretical elaboration, mediocre interpretations, and fast applications". Therefore, interpreting the results is a very difficult task "the interpretation of the criterion value ... can be very difficult. Since the goals are usually stated in different units, the criterion value is likely to be a mixture of "apples and oranges", (Forston and Dince(1977)).

MOLP, on the other hand, has not been developed for practical purposes yet. It has been proposed by Eatman and Sealey(1979), but their model was for expository purposes "the purpose of the model is to demonstrate the formulation of a MOLP and to present the results obtained from the procedure. As a result, the model is for expository purposes", (Eatman and Sealey(1979)). However, MOLP has some desirable features such as presenting the whole set of the non-dominated solutions which qualifies it to be regarded as a managerial rather than a mechanical tool. Eatman and Sealey(1979) pointed out that "MOLP appears to have a number of advantages over more traditional programming techniques. First, MOLP allows the introduction, in a feasible manner, of all the information required to achieve a utility maximization solution. Second, it avoids the appearance of being a purely mechanical decision-making technique because decision makers are allowed to choose explicitly the final course of action ... third, in order to implement the procedure, no major changes are required in most existing linear models of bank management".

On the basis of the above discussion, the author is going to develop linear models in the form of single and multiobjective processes. The techniques that are going to be used are LP and MOLP for solving the ALM problem of an interest-free Islamic bank. LP has been chosen, because of its simplicity and its acceptance by the banking industry on the practical level. While MOLP has been chosen for its desirable features and the fact that it has not been developed for practical use yet. Therefore, this study will allow the author to assess the usefulness of these techniques with respect to the actual portfolios achieved by the selected institutions, in one hand, and the improvements that can be gained from using MOLP with respect to the LP technique on the other hand. To end this section we can say that the author has given the following factors more considerations than others in developing an ALM model for an

interest-free Islamic bank :

1. Simplicity, so that the results can be understood easily by the senior executives; despite their unfamiliarity with these type of techniques.

2. Simultaneous considerations of assets and liabilities to satisfy basic accounting principles and match the liquidity of assets and liabilities.

3. Legal and policy constraints appropriate to the bank's operating environment.

The last two factors have been taken from the work of Kusy and Ziemba(1986) in their discussion of what an ideal operational model should contain.

6.4 Concluding Remarks.

From the above discussion the following remarks can be drawn:

Two different approaches have been stressed in recent years in dealing with the ALM problem; one based on the portfolio criteria (mean-variance) developed by Markowitz and others, and the other which regards banks as firms striving to maximize an objective function subject to one or more constraints reflecting the nature of banking as business activity. Clearly, these two views indicate the fact that a general model that expresses how banks behave have not been developed by academics yet.

Deterministic vs Stochastic models. We ended our previous discussion by stating that each one of these approaches has its merits as well as its demerits. Deterministic models are found to be superior on the practical level, but they suffer from the lack of treatment of uncertainty. Stochastic models, on the other hand, are theoretically superior in coping with the uncertainty problem.

However, they have failed to achieve the progress made by their counterparts. Beazer (1975) states "optimization is a way of organizing knowledge. It is not a means of reducing uncertainty or of making outcomes more predictable. For some one who has not reflected upon this, techniques like Chance-constrained programming, Two-stage programming under uncertainty and Bayesian sequential decision theory probably hold considerably more magic than ordinary Linear Programming ... their [stochastic models] worth depends upon having more information about probability distributions than just an expected value". Beazer argued further that "this should by no means be interpreted as disparaging to programming models that explicitly treat uncertainty. They can be extremely valuable. But unless one has the data that they require they are no more fruitful than simpler models".

Single vs Multi-objective models. In discussing the ALM problem few academics have dealt with the multiojective nature of the banking firm. Since the banking firm is an intermediary enterprise that tries to satisfy the requirements of different groups (i.e. stockholders, depositors, creditors and regulatory agencies), it is important for the management of the bank to incorporate the objectives of the interested groups. Zaloom *et al* (1986) state that "the conflict of interest among these groups makes the management of bank funds a complex task to deal with. It is not realistic to apply mathematical models that optimizes a single decision criterion".

Chapter 7

Survey Analysis

7.1 Introduction

As a part of the research a questionnaire was designed and sent to 17 operating interest-free IBs. The main aim of this questionnaire was to obtain information about certain aspects of the asset and liability management (ALM) of these institutions. Questions like: what are the main objectives of these banks? which agencies control the operations of these intermediaries? In addition, some other issues are covered; such as the nature of regulations imposed by regulatory agencies, investment policies, etc. The questionnaire was divided into five parts, each of which serve a particular purpose. The structure of the questionnaire is shown in Appendix 7.3. In addition to the questions asked in the structured sections a general question was added to give a chance for the management to suggest, add or comment on anything which they felt might be helpful to the research project. Adding this question to those in the other five parts, the total number of questions summed to 18.

7.2 Type of Responses Received and the Difficulties Faced

The questionnaire was sent on the 3rd September, 1990 and it was planned that by 15th October of the same year the responses would have been received. Unfortunately, only two questionnaires were received during the planned period. Therefore, a reminder was sent to those institutions which did not respond. As a result the number of replies increased to seven, but only after a long time, May 1991. This delay may have been due to the reluctant nature of the management of these institutions and the nature of the mail questionnaire. Surveys conducted by other researchers indicate this fact. For example, Ahmad [1] (1987) has reported that he has approached about 30 Islamic Banks (IBs) through the 4th and 5th annual meeting of directors of operations of these institutions and through mail as well. However, he only received 8 responses, which constitute 26 per cent of the sample size. Given these considerations and the nature of mail surveys which suffer from low response rates, it seems that 7 replies, which constitute 41 per cent of the sample size, is a reasonable rate. As Emory (1985) pointed out " mail surveys with a return of 30 per cent or so are considered satisfactory...". However, if the return rate is very low such findings are hard to be generalized. As Kerlinger(1986) states " as a result of low return in mail questionnaire, valid generalizations cannot be made". Nevertheless, these results when combined with other material, such as annual reports of these institutions and the findings of Ahmad(1987), will give an overview of what we are trying to obtain. As far as type of responses is concerned, 2 institutions have answered all questions, 2

[1] On the subject of "Development and problems of Islamic Banks". Moreover, he was (and still) working at the Jeddah based institution (i.e. Islamic Development Bank (IDB)).

answered 17 and 3 have answered 16 questions. Therefore, it has been decided that these returned questionnaires should be analysed and concluding remarks should be drawn. The list of the banks which responded is given below:

1. Islamic Bank of Bahrain (IBB), established in 1979.

2. Habib Bank Limited (HBL) (Pakistan), established in 1941, but commenced non-interest operations in 1985.

3. Tadamon Islamic Bank (TIB) (Sudan), established in 1983.

4. Qatar Islamic Bank (QIB), established in 1983.

5. Albaraka Islamic Investment Bank (AIIB) (Bahrain), 1984.

6. United Bank Limited (UBL) (Pakistan), 1959, but commenced Interest-free operations in 1985.

7. Islamic Bank International Denmark (IBID), 1983.

7.3 Analysis of the Obtained Results

Since the number of replies is very low, in most cases percentages have been used for analytical purposes. For questions which have been constructed in a ranking manner to test some specified hypotheses the Kendall coefficient of concordance (W) has been used. The reason for using this statistical test is that these questions have been designed on an ordinal scale basis and the sample size is very small. These two factors give the nonparametric [2] statistical tests, the category in which W falls, the advan-

[2]In statistics there are two types of statistical tests; parametric (e.g. t and F tests) and nonparametric (e.g. W and Spearman rank correlation coefficient r_s (rho)). The former group refers to the procedures used when certain assumptions, about the population from which the sample(s) is (are)

tage over their parametric counterparts. Siegel (1956) states "many of these tests [nonparametric] are identified as "ranking tests" and this title suggests their ... principal merit: nonparametric techniques may be used with scores which are not exact in any numerical sense; but which in effect are simply ranks ... [Another] advantage of the nonparametric tests is their usefulness with small samples ... If sample sizes as small as N = 6 [nonparametric tests] are used, there is no alternative to using a nonparametric statistical tests unless the nature of the population distribution is known exactly". Emory (1985) emphasizes the former factor stating that nonparametric tests "... are the only technically correct tests to use with ordinal data, although parametric tests are sometimes employed in this case". The analysis of the obtained results is presented part by part as follows:

7.3.1 The main objectives of Islamic Banks

In this first section of the questionnaire two questions were put. The main purpose was to identify the objectives targeted by Islamic Banks (IBs) and to indicate their degree of importance. Responses to question one [3] reveal that maximizing return to depositors (7 out of 7 have considered this objective as an important one) , minimizing risk of losses (scores 6 out of 7), maximizing profits (scoring 5 out of 7) and maximizing return to owners (with a score of 3 out of 7) are the main targeted objectives. In the space left for the management to name any other objectives six more objectives have been mentioned. Two of these objectives were indicated by two banks; these are developing and spreading the idea of Islamic Banking and providing banking facilities

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drawn, are met. Assumptions like : 1) the observations must be drawn from normally distributed populations, 2) the variables involved must have been measured in at least an interval scale, so that it is possible to use the operations of arithmetic (i.e. adding, dividing, finding means,etc), (Siegel(1956)). Whereas, the latter category of procedures depends on no assumption as to the form of the sample population parameters, see Siegel(1956) and Kerlinger(1986) for more details.

[3]Summery of the obtained results is displayed at Appendix 7.1 at the end of the chapter.

to as large a number of customers as they could, while the rest were each named by one bank only. These answers illustrate the diversity of objectives being sought by these institutions. That may explain the low value of W of the result obtained from the answers to the second question to give a clear evidence of an agreed upon order of the listed objectives. Because W stood at 0.25 and testing the significance of W at the significance level of 5% rejects the acceptance of the alternative hypothesis [4]. This finding indicate the multiobjective nature of these institutions and the importance of featuring the interest of depositors within the utility function of the bank because of the participatory nature of the business undertaken.

7.3.2 The restrictions imposed upon IBs by regulatory agencies

In this part, three questions were asked of the management of these intermediaries. The main information sought was that of identifying the type of regulations being imposed. The replies indicate that the central bank comes out top of the regulatory bodies and minimum cash holding is the main requirement imposed. All responding banks regarded the central bank as the principal regulatory agency; while 6 out 7 banks considered minimum cash holding as the main restriction imposed upon them. Moreover, replies to question five did support this latter finding. W stood at 0.56 and the null hypothesis, which states that the regulations imposed by regulatory agencies do not affect the portfolio holding of IBs, is rejected at the 5 per cent significance level. In fact an examination of the structure of assets of IBs indicates that cash holding

[4]See Appendix 7.2 for undersigning how to test the significance of W. We should be very careful with this type of results and conclusions, because we might commit type II error (i.e. accepting the null hypothesis when in fact it is false). The main reason for this caution is that the probability of commiting this type of errors as well as type I can be reduced if the sample size is increased. A measure which we have tried to adopt, but we could not achieve it because of the low response rate.

constitutes a major element in which funds are placed. Ahmad (1987) has discussed the problems of IBs and he found that "six [out of the 8 banks which replied to his questionnaire] reported that they had a problem of excess liquidity". In the sense that these institutions are holding much of their funds in the form of cash and reserves (i.e. statutory, general and sometimes provision for investment risk). This situation may due to several factors, as Ahmad pointed out, "excess of deposits, shortage of investment avenues, absence of long term investment opportunities, policy of central bank (i.e. asking for high reserve ratios, as high as 25 percent in some cases), and absence of very short term financial investment, etc ...". Therefore, the policy of the central bank is one of the factors that contributes to the presence of excess liquidity in IBs. In addition to central bank control, three banks also reported that their operations were being inspected by the religious supervisory committee. The main function of such committees is to make sure that the operations of the banks are fully conducted in accordance with the principles of Islamic Law (*Shari'ah*). This last feature represents the distinctive nature of these newly established institutions in comparison with interest-based banks.

7.3.3 The measures taken to protect the benefit of depositors and to minimize the risk of losses

The main concern of this part was to get some information about the measures taken by IBs to minimize the risk of losses and to protect the interest of depositors. For that reason three questions were asked of management. From the answers given the following factors were indicated by the management of IBs:

All responding banks regarded careful selection of partners and the asking for collaterals as the two main measures taken to minimize the risk of losses. 4 out

of 7 banks also reported the use of ceilings, (i.e. the amount to be invested in a particular operation should not exceed an upper limit), for certain risky investment operations (e.g. direct investment).

All responding banks indicated the fact that they sought collaterals from their customers to minimize the risk of losses.

6 out of 7 of the responding banks reported that investing in safe and quick return projects as the main measure taken to protect the benefit of the depositors. In fact the available data about IBs reveals that most funds of these institutions are being placed in trade, real estate and construction, the so-called soft areas of credit. Ahmad (1987) pointed out "in some banks trade financing constitutes up to 90 percent of total financing". In some banks about 98 per cent of the available funds are held in short term, quickly realizable projects, of the maturity extending up to one year, the Faysal Islamic Bank of Bahrain (FIBB), (FIBB annual reports(1988,1989)). Only three out of the 7 banks reported the practice of assigning special reserves for risky investment operations. The other factor mentioned by two of the responding banks was the undertaking of feasibility studies before taking on a new project.

7.3.4 Investment policy

This is the most important part of the questionnaire. Hence, it contains seven questions about the investment policy of these institutions. Most of the questions have been constructed in a form that allows us to test some specified hypotheses. Unfortunately, the results are not that encouraging, in the sense that these specified hypotheses are not supported empirically. The hypothesized relationships were as

follows:

1. It was hypothesized that Long-Term (LT) investment operations were affected by the following factors:

   - funds in long term investment accounts (FLIA)
   - liquidity requirement (LR)
   - Rate of return of the investment (RR)
   - the investment risk (IR)
   - social need of the investment (SN)

   Therefore it was supposed that the above factors will affect the long term investment. However, W stood at 0.237 a result which support the invalidity of this supposed claim in the statistical sense. But, we should be careful with this type of results and conclusions for the reasons spelled out in footnote 4 of this chapter.

2. what has been said above applies also to questions 9 and 10 in which the following two relationships were hypothesized:

   - It was hypothesized that the demand for cash holding (CH) was affected by the following factors:

   - volume of funds in current accounts (CA)
   - volume of funds in saving accounts (SA)
   - liquidity requirement (LR)
   - banking services (BS)

   But the calculated W stood at 0.41, which is a low value.

3. It was hypothesized as well that providing banking services (BS) was affected by the factors given below:

   - Return from banking services (RBS)
   - Social need for these services (SN)
   - Volume of funds in current and saving accounts (FCS)
   - Total funds (TF)

In this case as well the value of W, which stood at 0.087, failed to support the supposed hypothesis.

From the answers given to questions 11 and 12, it is revealed that the operations of IBs are dominated by three techniques. These are *Musharakah* (Partnership), *Murabahah* (Mark-up on sale) and cash holdings and accounts with other banks. 6 out of 7 of the responded banks have reported the use of *Mudarabah* (capital trust) and *Musharakah* in providing working capital to entrepreneurs. The annual reports of these banks do not give clear cut details of the significance contribution of each operation (i.e. *Mudarabah* and *Musharakah*). However, from the study conducted by Ahmad (1987) it has been found that "all the eight responding banks have reported to use *Musharakah* ... *Mudharabah* ... [has] been reported to be used by 7 banks". Therefore, it seems that *Musharakah* is one of the popular techniques employed by IBs. In the case of *Mudarabah* 3 out of 7 have reported its use for providing working capital to entrepreneurs and 3 out of 7 as well have reported its use for guaranteeing the necessary liquidity. In order to know the frequency of use of these different techniques, question 13 was included. Responses reveal that the most widely used techniques are *Murabahah*, *Musharakah* and *Mudarabah*. Although the value of W is insignificant, W stood at .29, we can state that *Murabahah* is the most popular

technique. This can be confirmed from the earlier finding and the findings of Ahmad (1987). In which he states "... the available evidence suggests that *Murabahah* is the most popular and most dominant technique of financing amongst the Islamic Banks studied". In addition to the methods discussed so far some banks reported the use of other instruments. The answers given by the management were reported in question 14 in which the management of the banks was requested to name any newly developed method(s) of channeling funds. The replies of these institutions were as follows:

- Tadamon Islamic Bank of Sudan has reported the use of *Muzarah* and *Istisnaa* for financing agriculture and industry operations respectively.

- Qatar Islamic Bank has reported the use of *Musawama* technique. But it did not specify for which sector of the economy is being used.

- Islamic Bank of Bahrain has reported the development of general and specific portfolios.

7.3.5 Relations with other institutions

In the last part of the questionnaire three questions were asked of the management of IBs regarding their links with other banks. As was expected, all the responding banks have reported that they do have relations with commercial banks in the form of transaction accounts. Only one bank (i.e. United Bank Limited) has reported the opening of deposit accounts with commercial banks. Five of the responding banks reported that they do have relations with other IBs in the form of current and investment accounts. These responses clearly indicate the importance of expanding the network of IBs nationally and internationally. Otherwise leaving this network as it is will limit the investment avenues of these institutions and their ability to diversify

risk as diversity of geographical location may bring new investment opportunities.

7.4 Concluding Remarks

From the above discussion the following remarks can be drawn:

Islamic Banks, like other financial intermediaries, should be looked at as multiobjective utility maximizing firms rather than limiting this utility to a single objective matter. Moreover, in this utility function the interest of depositors must be featured and should be given its importance because of the participatory nature of these institutions.

The central bank still is the main regulatory agency for IBs and apply almost the same regulations as those applied to interest-based banks. This practice indicates the fact that the special nature of these institutions has not yet been taken sufficiently into considerations. Besides the regulations imposed by the central bank, the operations of some IBs are also subject to religious supervisory committees to ensure the conformity of their operations with the principles of Islamic Law (*Shari'ah*).

Low risk and quick return projects dominate the portfolio holdings of these institutions. This fact is very clear in terms of techniques employed(e.g.*Murabahah*) and areas of investment (e.g. Trade and Construction sectors). This leads us to conclude that short-term operations dominate the business of IBs on the debit and credit sides. Ahmad (1987) states "the available data suggest that most of Islamic Banks are providing either short-term finance of six months or less or medium-term finance of one year or less ... generally speaking, it could be said

that IBs do not provide long-term finance and confine themselves to short-term and medium-term finance".

It appears so far that the investment avenues available to these institutions are still limited. This can be noticed from the relations with other institutions, especially commercial banks, which is merely limited to transaction accounts. This limitation can be reduced by the expansion of IBs domestically as well as internationally. In addition, thought needs be devoted to the development of short term securities and securities markets which do not violate the principles of Islamic Law (*Shari'ah*), to absorb the excess or shortage of liquidity which some institutions face.

Appendix 7.1 Summary of the Results Obtained

In this appendix the scores given by the management of the seven responding Islamic Banks are presented. These scores are then expressed in rank order manner so that the values of W can be computed and the problem of tied observations (this problem is treated in details in the next appendix) is taken into account.

1. **The scores given by the management of the seven responding banks.**

P1.Q2	**Scores advocated by**						
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS
a	-	-	8	3	4	8	8
b	-	6	-	2	3	6	6
c	8	8	4	4	1	7	6
d	6	7	7	1	2	8	8

P2.Q5	**Scores advocated by**						
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS
a	8	6	3	1	1	-	5
b	6	8	-	1	2	-	3
c	4	1	-	-	3	1	2

P4.Q8	Scores advocated by						
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS
a	8	8	4	1	4	8	6
b	7	7	3	4	2	1	3
c	5	5	4	2	3	8	8
d	7	6	2	3	1	8	5
e	6	1	2	5	5	8	6

P4.Q9	Scores advocated by						
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS
a	8	-	6	1	1	7	8
b	7	-	3	3	2	7	3
c	8	8	2	2	3	-	4
d	3	-	5	4	4	6	2

P4.Q10	Scores advocated by						
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS
a	4	8	6	3	2	8	7
b	6	1	3	1	1	8	6
c	8	7	4	2	3	1	7
d	-	7	6	4	4	-	8

P4.Q13	Scores advocated by						
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS
a	3	8	-	2	3	5	-
b	6	1	1	3	5	5	6
c	8	6	8	1	1	8	4
d	-	5	-	-	4	-	-

2. **Rankings of the scores presented above.**

P1.Q2	**Rank advocated by**							
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS	R_i
a	3.5	4	1	3	4	1.5	1.5	18.5
b	3.5	3	4	2	3	4	3.5	23
c	1	1	3	4	1	3	3.5	16.5
d	2	2	2	1	2	1.5	1.5	12
$\sum R_i$	-	-	-	-	-	-	-	70

$$\text{N} = 4\ ,\ \text{K} = 7\ ,\ \overline{R} = \frac{\sum R_i}{N} = \frac{70}{4} = 17.5\ ,\ \text{S} = 62.5,\ \text{W} = .255$$

P2.Q5	**Rank advocated by**							
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS	R_i
a	1	2	1	2	1	2.5	1	10.5
b	2	1	2.5	1	2	2.5	2	13
c	3	3	2.5	3	3	1	3	18.5
$\sum R_i$	-	-	-	-	-	-	-	42

$$\text{N} = 3\ ,\ \text{K} = 7\ ,\ \overline{R} = 14\ ,\ \text{S} = 33.5\ ,\ \text{W} = .56$$

P4.Q8	**Rank advocated by**							
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS	R_i
a	1	1	1.5	1	4	3.5	2.5	14.5
b	2.5	2	3	4	2	4	5	22.5
c	5	4	1.5	2	3	3.5	1	20
d	2.5	3	4.5	3	1	3.5	4	21.5
e	4	5	4.5	5	5	3.5	2.5	29.5
$\sum R_i$	-	-	-	-	-	-	-	108

$$\text{N} = 5\ ,\ \text{K} = 7\ ,\ \overline{R} = 21.6\ ,\ \text{S} = 116.2\ ,\ \text{W} = .237$$

P4.Q9	Rank advocated by							
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS	R_i
a	1.5	4.5	1	1	1	1.5	1	11.5
b	3	4.5	3	3	2	1.5	3	20
c	1.5	1	4	2	3	4	2	17.5
d	4	4.5	2	4	4	3	4	25.5
$\sum R_i$	-	-	-	-	-	-	-	74.5

N = 4 , K = 7 , $\overline{R}$ = 18.62 , S = 101.188 , W = .41

P4.Q10	Rank advocated by							
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS	R_i
a	3	1	1.5	3	2	1.5	2.5	14.5
b	2	4	4	1	1	1.5	4	17.5
c	1	2.5	3	2	3	3	2.5	17
d	4	2.5	1.5	4	4	4	1	21
$\sum R_i$	-	-	-	-	-	-	-	70

N = 4 , K = 7 , $\overline{R}$ = 17.5 , S = 21.5 , W = .087

P4.Q13	Rank advocated by							
Objects	IBB	IBID	HB	UB	QIB	AIBB	TIBS	R_i
a	3	1	3.5	2	3	2.5	3.5	18.5
b	2	4	2	1	1	2.5	1	13.5
c	1	2	1	3	4	1	2	14
d	4	3	3.5	4	2	4	3.5	24
$\sum R_i$	-	-	-	-	-	-	-	70

:

N = 4 , K = 7 , $\overline{R}$ = 17.5 , S 71.5 , W = .29

Exploratory notes of the abbreviations used in Appendix 7.1

- P_I. Q_I = stands for the part (P) and question (Q) in the questionnaire with (I) representing the number of the part and the question e.g. P_1. Q_2 stand for part (1) question (2).

- IBB = Islamic Bank of Bahrain
- IBID = Islamic Bank International Denmark
- HB = Habib Bank Limited
- UB = United Bank Limited
- QIB = Qatar Islamic Bank
- AIBB = Albarakah Islamic Bank of Bahrain
- TIBS = Tadamon Islamic Bank, Sudan
- a, b, c, d, and e represent the items of the questions.

Appendix 7.2 The Kendall Coefficient of concordance W

7.2.1 - Calculation and interpretation of W

W is a technique designed to measure the degree of agreement among K ranks of N objects or individuals e.g. in our questionnaire Part (1) Question (2) we are interested in measuring the correlation (i.e. the degree of agreement) between the ranks given by the K = 7 banks to the N = 4 objects. The value of W is given by the following formula:

$$W = \frac{S}{\frac{1}{12}K^2(N^3 - N)}$$

where, S = sum of squares of the observed deviations from the mean of $R_i(\overline{R})$

$S = \sum(R_i - \overline{R})^2$

$\overline{R} = \frac{\sum R_i}{N}$

K = number of sets of rankings

N = number of entities (objects or individuals) ranked.

$\frac{1}{12}K^2(N^3 - N)$ = the maximum possible variation in sums of ranks if there was perfect agreement in the rankings. Example of how W is calculated for $P_1.Q_2$

$$\overline{R} = \frac{\sum R_i}{N} = \frac{70}{4} = 17.5$$

$$S = (18.5 - 17.5)^2 + (23 - 17.5)^2 + (16.5 - 17.5)^2 + (12 - 17.5)^2 = 62.5$$

$$\frac{1}{12}K^2(N^3 - N) = \frac{1}{12}(7)^2(4^3 - 4) = 245$$

Therefore,

$$W = \frac{62.5}{245} = 0.255$$

Interpretation of W, Kendall (1948a) suggests that the best estimate of the "true" ranking of the N objects is provided, when W is significant, by the order of the various sums of ranks(i.e. R_i). If one accepts the criterion which the various respondents have agreed upon (as evidence by the magnitude and significance of W) in ranking the N entities, then the best estimate of the "true" rankings of those entities according to that criterion is provided by the sums of ranks.

e.g. in our case of $P_2.Q_5$, where W stood at .56, of the rank advocated by the management of the seven responding IBs, the listed objects are ranked as follows:

- a object is number (1) with 10.5 (R_i) i.e. minimum cash holding.
- b object is number (2) with 13 (R_i) i.e. general relationships among assets and liabilities.
- c object is number (3) with 18.5 (R_i) i.e. minimum amount of capital.

When the value of W is significant, the next logical step is to test the significance of W. In doing so two options are available depending on the size of the sample. If this size is small special Table has been worked out and certain critical values have been calculated; and if the sample size is large the distribution of W is approximated to Chi-square test (χ^2). In the case of small size samples the

special Table is used when the range of N is from 3 to 7 and K ranges from 3 to 20. This special Table is used to compare the observed value of W with the critical value of W displayed in the Table. If an observed value of W is equal to or greater than that shown in the special Table for a particular level of significance then H_0 may be rejected at that level of significance and vice versa. Example $P_2.Q_5$ of the rank order advocated by the seven responding IBs in our case: the observed W = .56 and;

the critical value of W = .329 at the 5% level of significance.

Therefore, H_0 the null hypothesis of this question; the listed factors do not affect the portfolio holdings of IBs is rejected. See Siegel *et al* (2nd ed) (1988) for more details.

7.2.2 - The problem of tied observations

Sometimes two or more observations will receive the same score on the same variable. The effect of these tied observations is to depress the value of W as found by the formula presented in Appendis 7.2.1. When tied scores occur, each of them is assigned the average of the ranks that would have been assigned had no ties occur, this is the usual procedure for assigning ranks to tied observations. If the proportion of ties is small, that effect might be neglected, and hence the the formula in Appendix 7.2.1 might still be used. On the other hand if the proportion of ties is large, a correction factor might be introduced which will increase slightly the value of W over what it would have been if uncorrected. The correction factor is given by the following formula, Siegel(1956) :

$$T = \frac{\sum(t^3 - t)}{12}$$

Where, t = the number of observations tied at a given rank.

$\sum$ directs one to sum over all groups of ties within any one of the K rankings.

The new corrected formula of W is given below :

$$W_c = \frac{S}{\frac{1}{12}K^2(N^3 - N) - k\sum_T T}$$

Where, $\sum_T T$ directs one to sum the values of T for all the K rankings.

Applying the above formula to the data presented in Appendix 7.1, the following results have been found :

Question	$P_1.Q_2$	$P_2.Q_5$	$P_4.Q_8$	$P_4.Q_9$	$P_4.Q_{10}$	$P_4.Q_{13}$
Value of W_c	.266	.56	.26	.45	.09	.30

The above results shows the small proportion of ties in the obtained data. That is why the value of W_c has not changed so much from the value of W.

For further reading and details about W see S. Siegel (1956) and Siegel *et al) (2nd ed) (1988) "Nonparametric Statistics for the Behavioural Sciences".*

Appendix 7.3 Questionnaire for the Management of Islamic Banks

Please tick the appropriate box (es)

Part One(1)

1- Which of the following are the main objectives of the Bank ?
(you can tick more than one box)

a- Maximizing profits

b- Maximizing return to owners

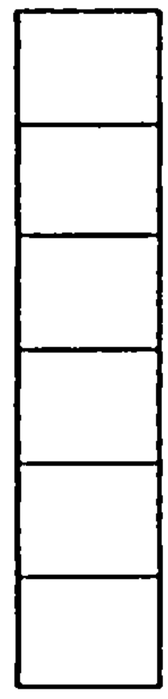
c- Minimizing the risk of losses

d- Maximizing return to depositors

e- Others- specify-

1- .....

2- .....



2- Rank the following objectives according to their order of importance?
(higher numbers indicate higher priority)

1 2 3 4 5 6 7 8

a- Maximizing profits

b- Maximizing return to owners

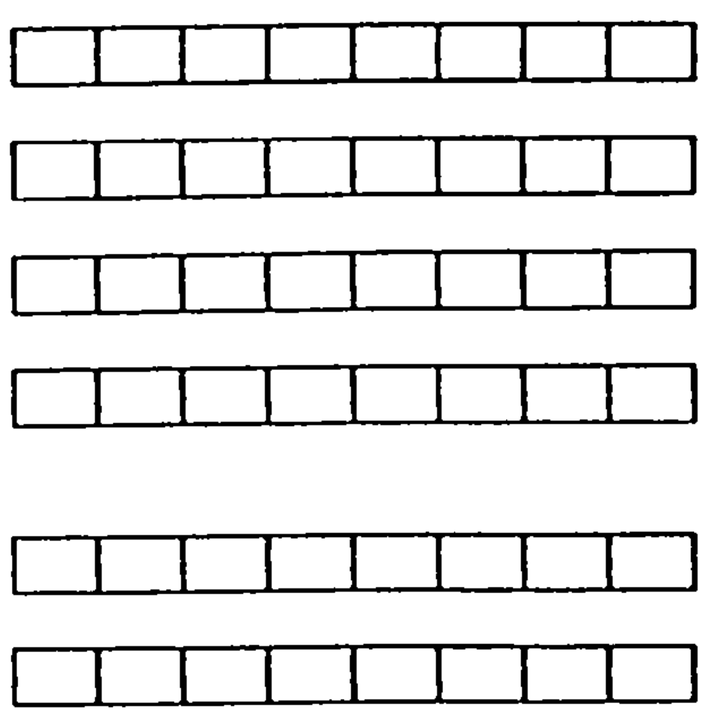
c- Minimizing the risk of losses

d- Maximizing return to depositors

e- Others - specify-

1- .....

2- .....



Part Two(2)

3)-Which of the following agencies controls the operations of your bank ?
(you can tick more than one box)

a- The Central bank
b- Others - specify

4- Which of the following restrictions are being imposed on your bank ?
(you can tick more than one box)

a- Minimum cash holding or other short term reserve assets ratios

b- General relationships among assets, liabilities and equity (e.g risk-asset to capital ratio)

c- Minimum amount of capital

d- Others - specify - 1- .....

2- .....

5- How strongly do the following affect your portfolio holdings ?

	1	2	3	4	5	6	7	8
a- Minimum cash holding or other short term reserve assets ratio								
b- General relationships among assets liabilities and equity (e.g risk-asset to capital ratio)								
c- Minimum amount of capital								
d- Others - specify- 1-								
2-								

Part Three(3)

6- Which of the following measures are taken by your bank to minimize the risk of losses ? (you can tick more than one box)

a- Careful selection of partners (i.e partner's previous experience, reputation in the community, letters of reference)

b- Asking for collaterals .

c- Putting ceilings to certain risky investment operations(e.g direct investment)

d- Others-specify- 1-.....

2-.....

7- Which of the following measures are taken by your bank to protect the interest of depositors ? (you can tick more than one box)

a- Assigning special reserves for risky operations

b- Insuring deposits

c- Investing in safe and quick return projects

d- Others-specify- 1- .....

2- .....

Part Four (4)

8- How strongly do the following affect your decision to undertake long rather than short term investment ?

1 2 3 4 5 6 7 8

a- Volume of funds in long term investment account

b- liquidity requirements

c- Rate of return of the investment

d- The investment risk

e- Social need of the investment

f-Others-specify-

1- .....

2- .....

9- How strongly do the following affect your demand for cash holding ?

	1	2	3	4	5	6	7	8
a- Volume of funds in current accounts								
b- Volume of funds in saving accounts								
c- Liquidity requirements								
d- Banking services								
e- Others-specify-								
1-								
2-								

10- How strongly do the following affect your decision to provide banking services ?

	1	2	3	4	5	6	7	8
a- Return from bank services								
b- Social need for these services								
c- Volume of funds in current and saving accounts								
d- Total funds								
e- Others-specify-								
1-								
2-								

11- By which of the following methods do you provide working capital to entrepreneurs ? (you can tick more than one box)

a- Mudarabah and Musharakah contracts(i.e profit and loss sharing principal)	
b- Beneficiary loans (i.e interest free loans)	
c- Others-specify-	
1-	
2-	

12- By which of the following means do you guarantee the necessary liquidity ? (you can tick more than one box)

a- Cash holdings and accounts with other banks

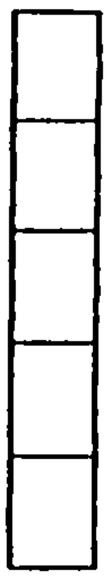
b- Rental contracts (i.e leasing(Ijara) contracts)

c- Sales contracts (e.g Murabahah)

d Others-specify-

1- .....

2- .....



13- Rank the following methods according to their degree of usability ? (higher numbers indicate higher degree of usability)

	1	2	3	4	5	6	7	8
a- Mudarabah (i.e.capital agency)								
b- Musharakah (i.e.partenership)								
c- Murabahah (i.e.mark-up-onsale)								
d- Ijara (i.e.Leasing)								

e- Others - specify -

1- .....

2- .....

14- Have your bank developed a new method(s) for channelling funds ? (name please)

1- .....

2- .....

3- .....

Part Five(5)

15- With which of the following institutions do you have accounts or any other arrangements ? (you can tick more than one box)

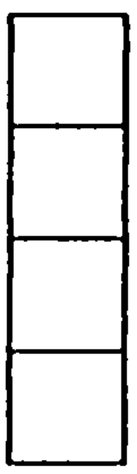
a- Islamic banks

b- Commercial banks

c- Others-specify-

1- .....

2- .....



16- What type of accounts do you have with Islamic banks?
(you can tick more than one box)

a- Current accounts

b- Investment accounts

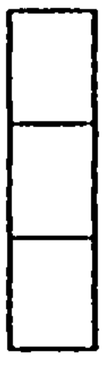
c- Others-specify- .....

17- what type of accounts do you have with commercial banks ?
(you can tick more than one box)

a- Transaction accounts

b- Others-specify- 1- .....

2- .....



18- Do you have any thing to add ? (e.g suggestions, comments)
(please write it down in the space given below)

.....

.....

.....

Chapter 8

A Single Objective Optimization Model of the Asset and Liability Management Problem of an Islamic Bank

8.1 Introduction

The main concern of this chapter is to develop a one period certainty model for the asset and liability management (ALM) problem of an Islamic Bank (IB). The technique used to derive this model is Linear programming (LP). The results of the developed model will be compared with the actual results of two practicing institutions. These are Kuwait Finance House(KFH) and Jordan Islamic Bank(JIB) for the planning periods of 1988 - 1989 and 1987 - 1988 respectively. That is, given the conditions and the initial balance sheet of each bank at the end of 1988 and 1987 what will be the optimal balance sheet that will optimize the objective functions of the banks at the

end of 1989 and 1988 obtained by applying the LP technique? In order to achieve this, the sequence of the chapter goes as follows: assumptions to simplify the real world are stated first, the model is developed next, the results of developed model are compared with the actual results of the two selected institutions and finally concluding remarks are drawn.

8.2 Assumptions to simplify the real world working of IBs

In order to develop the single objective optimization model (SOOM) the following assumptions are initially stated :

1. The IB is assumed to be acting as a profit maximizing firm. There are certainly many other objectives that can be optimized e.g. maximizing the return to equity shareholders, but we selected the objective of profit maximizing in the belief that this objective will serve the interests of both equity shareholders as well as depositors. This is so, because the maximization of the profits assigned to each one depends upon the maximization of the results achieved by the bank's operations, especially investment ones. This is due to the participatory nature of the profit and loss-sharing (PLS) system.

2. The bank is using financial instruments that bear little risk. In other words the bank is applying *Murabahah* (Mark-up on sale) and *Ijara* (Leasing) techniques in employing its investments funds.

3. The bank accepts two types of accounts: investment and non-investment accounts. The first category includes funds deposited for investment purposes

and saving funds whose owners authorize the bank to employ their funds in investment projects. The funds in this category are entitled to share in profits as well as losses if this is the case. Thus investment funds are accepted on the PLS basis. The second category consists of demand deposits and non-investment saving accounts. This type of deposit does not generate income and it is not subject to any loss. Moreover, holders of these accounts can withdraw their funds on request.

4. The planing horizon is assumed to be a single period of one year.

5. Funds are utilized on the basis of short and long term maturities. Short term operations are those employed in projects that terminate at the end of the planning period. Long term operations, on the other hand, are those projects accepted on yearly basis but they are renewable at the end of each planning period.

6. The bank is exempted from paying taxes.

7. Fixed assets are assumed to be constant over the planning period.

8. Paid-up-capital is also assumed to be constant over the planning period.

9. Rates of return generated from the employment of funds are fixed and known.

8.3 The single objective optimization model

In Chapter (5) the asset and liability management (ALM) problem faced by the senior executive of a bank has been summarized as follows: Given the initial balance sheet (B_{t_o}) at the beginning of the planning period (t_o) the senior executive seeks to

determine the components of the balance sheet of the bank that will optimize (i.e. maximize in our case) the objective function at the end of the planning period (t_1). But, in achieving this aim the decision process of our senior executive is subject to internal and external conditions. Internal constraints, like the percentage of investment funds devoted to a particular sector of the economy, and external constraints like the reserve requirements asked from regulatory authorities. Therefore, the SOOM model consists of two essential elements. These are: the objective that will be optimized and the constraints which limit the optimization of this objective. In what follows we will develop an LP [1] model for an interest-free Islamic Bank (IB).

8.3.1 The Objective Function

In Islamic Banking literature as well as in practice, the institution(i.e. IB) obtains funds from internal (i.e. paid up capital, reserves and retained earnings) and external (i.e. deposits) sources and uses these funds to finance investment and banking service operations. The bankers, however, should know exactly the percentage contribution of each source in the case of mixing both sources so as to determine the PLS ratio that will be applied to the actual results of the operations, especially in case of losses. Since we are assuming that the bank is seeking to maximize the total profits (TP) realized from banking and investment operations, spreading resources among profitable and low-risk projects will, therefore, be the main target of the management of the IB. Hence, the objective criterion can be stated symbolically as follows:

$$\text{Max (TP)} = R_{if} IF + R_s SF$$

[1] See Appendix 8.1 for understanding the basic requirements of applying LP technique and other essential features.

Where, TP = the contribution value of total profits

R_{if} = the rate of return realized from investment operations.

R_s = the rate of return realized from banking service operations.

IF = the amount of funds assigned for investment projects .

SF = the amount of funds assigned for banking service operations.

We should note that the bank is not utilizing the whole of its investment funds in one operation and is not applying one mode of finance for the use of these funds. Therefore the rate of return R_{if} is broken down into the rates achieved through each mode of finance (i.e. in our case the rates of return realized from *Murabahah* (R_m) and *Ijara* (R_l) (Leasing) modes of finance).

8.3.2 Constraints

Generally speaking, constraints can be grouped into two main categories; namely intratemporal and intertemporal relationships, (Cohen and Hammer (1967,1972)). The first category includes the relationships that must be met at each point in time of the planning horizon. The second represents those constraints that link variables of the model over the span of the whole planning horizon. Since we are interested in developing a single period optimization model the intertemporal links are not discussed here. On the level of the intratemporal constraints the following relationships are considered :

8.3.2.1 Balance sheet constraints

These constraints simply ensure the equality between total assets on one hand and total liabilities plus shareholders's equity on the other. Since assets and liabilities of an FI represent uses and sources of funds respectively, these constraints, ensure as

well that the uses of funds do not exceed the available resources.

8.3.2.2 Legal constraints

Monetary authorities, represented by central banks, may oblige commercial banks to hold certain minimum amounts of cash, or any other liquid assets, as statutory reserves. Minimum amount of cash to meet daily operations are also required. In addition to these some banks maintain an optional reserves called general reserve. Above all IBs are requested by the Islamic Law to take all necessary measures in order not to practice usurious transactions (e.g. borrowing on the basis of interest in case of liquidity problems or any other matter that arises.)

8.3.2.3 Policy constraints

These are the most important ones, because they reflect management attitudes and raise the most difficult decisions in the construction of the ALM model in such a way as to take into consideration the trade-offs that exist between risk, return and liquidity. In this category of constraints no general rules can be applied to all banks. What can be said is that the management of any institution usually puts some upper or lower bounds upon the financing of the operations carried out by the bank, determine how much funds should be employed in each activity and so forth. Above all the planned activities must be taken in the light of the environmental and legal surroundings.

8.3.2.4 Market constraints

This type of constraint represents the limits imposed on the bank's freedom of action by other institutions carrying out the same work in the market place. One of the major restrictions facing IBs is the acceptance of investment deposits on the PLS principle.

Thus, in contrast to depositors of interest based banks, investment accountholders in IBs are liable to negative returns when the bank incurs losses from its investment portfolio. Therefore, as these newly established institutions want to have a sustainable share in the deposit market they need to take this and other factors into consideration and try at all costs, except violating the principles of Islamic Law (*Shari'ah*), to avoid losses in their operations.

In order to develop the single objective optimization model the following variables and constants are defined:

- On the assets side:

  CLA = the amount of cash and other short term liquid assets kept with the bank or with other banks for liquidity and banking service purposes.

  MF = the amount of funds employed through *Murabahah* mode of finance.

  LF = the amount of funds employed through *Ijara* or Leasing mode of finance.

  IF = the total amount of funds employed in investment operations. (IF = MF + LF)

  OA = the amount of funds employed in other assets.

  FA = the amount of funds used in fixed assets.

  TA = the amount of total assets. (TA = CLA + IF + OA + FA)

- On the liabilities side:

  CD = the total amount of money generated through current and call accounts.

  SD = the amount of money attracted through saving accounts.

  LID = the amount of money attracted through limited investment accounts (i.e. short term investment deposits).

  UID = the total amount of money attracted through unlimited investment accounts (i.e. long term investment deposits).

ID = the total amount of funds generated through investment deposit accounts.

(ID = SD + LID + UID)

CID = total amount of funds in CD and ID (CID = CD + ID).

DFI = the amount of funds generated from deposits of other FIs.

D = the amount of total deposits. (D = CID + DFI)

PUC = the amount of paid-up-capital.

SR = the amount of funds held as statutory reserves.

GR = the amount of funds held as general reserves.

SR_o = the amount of total statutory reserves at the beginning (t_o) of the planning horizon.

GR_o = the amount of total general reserves held at the beginning (t_o) of the planning horizon.

E = total amount of shareholders' equity. (E = PUC + SR + GR)

OL = total amount of other liabilities.

TL = the amount of total liabilities. (TL = D + E + OL)

- Other variables and constants:

R_{if} = the rate of return realized from investment operations (IF).

R_s = the rate of return achieved from the employment of funds in banking service operations (CLA).

R_m = rate of return obtained from the employment of funds through *Murabahah* (MF) mode of finance.

R_l = rate of return obtained from the employment of funds through *Ijara* or leasing (LF) mode of finance.

TC = the amount of total costs.

TP = the amount of total profits (TP).

NP = the amount of total net profits.

SRIR = the amount of funds assigned as special reserve for investment risk. This amount is assigned in good times to cover the expected losses in bad ones and this policy is adopted by JIB in our situation.

SIA = total amount of funds generated through special investment deposit accounts and this method too is used by JIB. These funds are employed by the bank on behalf of depositors in specific projects recommended by them.

FSP = total amount of funds assigned for the special projects determined by the depositors.

SHP = total amount of shareholders part in the realized profits.

DP = total amount of depositors part in the realized profits.

Brp = the PLS ratio assigned to the bank from profits realized from mixing its funds with those of depositors.

Drp = the PLS ratio assigned to the holders of investment accounts deposits from the sharing of their funds in the projects selected by the bank and financed by the mixing of both sources of funds (i.e. those of the bank with those of depositors).

s = the percentage ratio added to the statutory reserves from net profits (NP).

r = the percentage ratio added to general reserves from net profits (NP).

MCR = minimum amount of cash requirements.

DER = debt to equity ratio, relates D to E.

g = the value of the DER ratio.

CR = capital ratio, relates E to TA.

k = the value of the CR ratio.

FUR = funds utilization ratio, relates IF to ID and E.

h = the value of the FUR ratio.

LR = liquidity ratio, relates the most liquid assets (CLA) to total assets (TA).

l = the value of the LR ratio.

FCD = the amount of CD accounts forecasts.

FID = the amount of ID account forecasts.

FD = the amount of total deposits D forecasts.

FIF = the amount of total IF forecasts.

FTA = the amount of total TA forecasts.

FCID = the amount of total CID forecasts.

The last six variables (i.e. the forecasted ones) have been derived by fitting a simple regression line to the time series of the relevant data. In this analysis time or a coded variable is treated as the independent variable and the variable concerned (e.g. TA) is treated as the dependent variable. Various methods are utilized for forecasting purposes. These methods can be classified into four main categories; time series techniques, causal models, qualitative methods and marketing approaches, (Collier, Cooke and Glynn (1988)). The method we have selected lies in the area of the first category (i.e. time series models). This type of techniques assume that the future value of a variable is related to the past values of the variable arranged in time series. The application of these techniques is useful in the short run, the absence of disturbance to the environment and where there is a definite upward or downward trend in the time series data, (Collier *at al* (1988)). Two main reasons can be given to justify the use of this type of forecasting as far as this current study is concerned. First, is the fact that the available data is not suitable for the use of other techniques, especially causal models. Second, most of the data presented in Tables 8.11 and 8.12 have

shown an upward trend during the years under observation.

I - The Objective function: The bank is seeking to maximize the amount of total profits (TP) generated from banking (CLA) and investment (IF) operations. This function can be stated mathematically as follows:

$$Max(TP) = R_s CLA + R_m MF + R_l LF \tag{8.1}$$

It is worthy to note that R_s, R_m and R_l should represent the marginal profits realized after subtracting marginal operating costs associated with each operation. Unfortunately, the available data is not detailed enough so that this step is carried out. Therefore, total costs (TC) are subtracted as a whole from total profits.

However, the above maximization is subject to the following constraints:

II - 1- Objective constraints(OBC): These constraints reflect the policy adopted by the bank with respect to the sharing of the realized profits from the operations carried out by the bank and financed by its funds in conjunction with those of depositors.

$$SHP = R_s CLA + Brp[R_m MF + R_l LF] \tag{8.2}$$

$$DP = Drp[R_m MF + R_l LF] \tag{8.3}$$

$$NP = SHP - TC \tag{8.4}$$

The inclusion of the above three statements depends upon the policy adopted by the institution concerned. Some IBs share the whole realized profits with their

depositors (e.g. KFH), whereas others share only the outcome of investment operations (i.e. the outcome of the operations in which depositors'funds have been employed) (e.g. JIB). In the latter case these equations are included. On the former case only the following equation is included.

$$NP = TP - TC \tag{8.5}$$

II - 2- Balance sheet constraints(BSC): These constraints are included simply to satisfy the accounting requirements that total assets (employment of funds) is equal to total liabilities plus shareholders equity (sources of funds).

$$TA = CLA + IF + OA + FA \tag{8.6}$$

$$IF = MF + LF \tag{8.7}$$

$$D = CD + DFI + ID \tag{8.8}$$

$$ID = SD + LID + UID \tag{8.9}$$

$$E = PUC + SR + GR \tag{8.10}$$

$$TL = D + E + OL \tag{8.11}$$

$$TA = TL \tag{8.12}$$

II - 3- Legal constraints (LGC): These constraints reflect the restrictions imposed on the management of the institution by regulatory authorities, especially the central bank, and those regulations specified in the internal regulations that govern the operations of the bank.

$$CLA \geq MCR \tag{8.13}$$

$$SR = SR_o + s * NP \tag{8.14}$$

$$GR = GR_o + r * NP \tag{8.15}$$

$$SR \leq PUC \tag{8.16}$$

II - 4- Policy constraints(POC): These constraints reflect the interrelationships between the variables of the balance sheet adopted by the management of the bank where such upper, lower or other relations are set out.

$$D \leq g * E \tag{8.17}$$

$$E \leq K * TA \tag{8.18}$$

$$IF \leq h * (E + ID) \tag{8.19}$$

$$CLA \leq l * TA \tag{8.20}$$

We should note that there are other policy constraints which reflect the particular situation of each bank. Therefore, the development of these constraints is left to the section when we compare the results of the developed model with those of the selected banks.

II - 5- Market constraints (MRC) : These simply represent the upper/lower limits which certain variables cannot exceed. Examples of these are as follows:

$$CD \leq FCD \tag{8.21}$$

$$ID \leq FID \tag{8.22}$$

$$IF \leq FIF \tag{8.23}$$

$$D \leq FD \tag{8.24}$$

$$TA \leq FTA \tag{8.25}$$

Having presented in some details the different components of the model, attention is given to know precisely what the model is going to do. In other words what is the decision task to be determined by the model?. The decision to be reached by the model is to determine the structure of the balance sheet that will maximize the contribution to total profits at the end of the planning horizon. That is to determine how much money is going to be employed through CLA, MF, LF and consequently IF modes of finance and what proportion of funds is going to be attracted through CD, ID and E so as to maximize the total profits (TP) of the bank. Therefore, the variables just mentioned are treated as decision variables and the rest, such as OA, FA, OL and DFI, are considered as constants or balancing items whose inclusion is important to satisfy accounting requirements.

8.4 Comparing the results of the single objective optimization model with the actual results of two practising IBs.

In this section the above developed single objective optimization model (SOOM) is used to generate the components of the balance sheets of two practicing IBs. Thereafter, a comparison is made between the results obtained by the model and those actually achieved. Our main candidates for carrying out this task are Kuwait Finance House (KFH) and Jordan Islamic Bank (JIB). Before we start examining the results of the model as compared with those actually achieved, it should be noted that the ideal way to conduct this comparison is to use the same data and date that the management use in their planning. Unfortunately, this was not possible. Nevertheless, the available data extracted from the annual reports of the selected banks and other material provide a benchmark on the nature of the results and managerial implications that these models can provide.

8.4.1 Comparing the SOOM's results with actual ones for KFH

In order to generate the 'optimal' components of the balance sheet of KFH by implementing an LP model, the period of 1988 - 1989 has been chosen. That is, assuming that we are at the beginning of the planning period 1988 - 1989 (i.e. the end of the financial year 1987 - 1988), what will be the structure of the balance sheet that will maximize the total profits (TP) of the House at the end of 1989 by utilizing the LP model? The main source of obtaining

the necessary data was annual reports of KFH from 1979 through 1989. It was hoped that the monthly (or at least quarterly) movements of sources and uses of funds as well as profit and loss statements would be available so that the structural coefficients and other inputs of the model could be derived from quite a large sample; unfortunately this could not be achieved. Therefore, it has been decided that the available data will be used for analytical purposes. Some of these data have been treated as inputs while others have been used for comparison purposes. The main data used as inputs are given[2] in the Table below:

Table 8.1 The data inputs of the SOOM model for KFH.

item	value of the variable or coefficient
total cost(TC)	13 (mKD)
fixed assets(FA)	18 (mKD)
paid-up-capital(PUC)	26 (mKD)
forecasted volume of deposits(FD)	1198 (mKD)
volume of statutory reserves at t_o (SR_o)	17.4(mKD)
volume of general reserves at t_0(GR_o)	1.2 (mKD)
forecasted IF (FIF)	953(mKD)
forecasted CID (FCID)	1061(mKD)
forecasted TA(FTA)	1297 (mKD)
forecasted CD	155(mKD)
minimum cash requirements(MCR)	$25\% * CD + 10\%$*ID
reserve ratios(r and s)	10%
debt to equity ratio(g)	20
capital ratio (k)	8%
liquidity ratio(l)	15%
rate of return generated from (CLA)R_s	3.5%
rate of return generated from (MF)R_m	6%
rate of return generated from (LF)R_l	5%
amount of funds of OA	10(mKD)
amount of funds of OL	50 (mKD)

[2]See Appendix 8.2 for data used to generate the results of the SOOM model and how it has been compiled.

Note: mKD denotes for millions of Kuwaiti Dinars.

Using the above data and the structure of the LP model given in Appendix 8.3, the LP6 package [3] was used to generate the optimal solution of the developed model. The obtained results are presented in the Tables below:

Table 8.2 The Balance Sheet of KFH generated by the SOOM model at the end of 1989.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	176.27	15	CD	155	13.2
IF	931.91	79.3	DFI	38.23	3.2
CW	38.96	3.3	ID	878.33	74.7
OA	10	0.9	E	53.58	4.6
FA	18	1.5	OL	50	4.3
TA	1175.14	100	TL	1175.14	100

The other results which might be helpful in the comparison task are given in the Table below:

Table 8.3 Values of other variables obtained by the SOOM model for KFH.

item	TP	NP	MF	LF	SD	LID	UID	D	SR	GR
mKD	57.9	44.9	512.5	419.4	535.8	74.7	267.7	1071.6	21.9	5.7

To complete the picture for comparison reasons the actual results achieved by the management of KFH are presented in the Tables below:

[3] LP6 is a small scale Linear Programming package that allows the user to input, solve and manipulate small linear programming models on a PC computer developed by D.SHEARN lecturer at the Management School, Sheffield University. See Appendix 8.3 for the whole structure of the SOOM model utilized to generate the components of the balance sheet for KFH for the year 1989.

Table 8.4 The actual Balance Sheet of KFH at the end of 1989.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	162.2	14.3	CD	128.6	11.4
IF	889.9	78.6	DFI	100.2	8.8
CW	51.4	4.5	ID	804.5	71.1
OA	10.4	1	E	51.1	4.5
FA	18	1.6	OL	47.9	4.2
TA	1131.9	100	TL	1131.9	100

Note: values in this and the previous Tables are expressed in millions of Kuwaiti dinars (mKD).

Table 8.5 Values of other variables generated actually

item	TP	NP	MF	LF	SD	LID	UID	D	SR	GR
mKD	47.9	33.3	494.7	395.2	509	12.3	283.2	1033.4	18.6	1.6

Note: values in this and the previous Tables are expressed in millions of Kuwaiti dinars (mKD). The above results have been compiled from the annual report of 1989.

8.4.1.1 Discussion and some explanation of the obtained results.

Having presented the results generated by the model in conjunction with those actually achieved, attention is given to the discussion of these results. This discussion, however, is to be carried out in two phases: Firstly, an evaluation of the models' results is dealt with by comparing them with those actually achieved; secondly, some important managerial aspects of the model are discussed in the light of the optimal results generated by the LP technique (i.e. some points such as shadow prices and sensitivity analysis of the optimal results of the model.)

1. **The first phase: comparison between the two results.** On the level of the first phase, the following general remarks are made, see Tables 8.2, 8.3, 8.4 and 8.5:

The volume of total assets(total liabilities), in terms of millions of Kuwaiti Dinars (mKD), obtained by the model is greater, by almost 3.8 per cent, than that actually achieved. This is due to the fact that input data have been forecasted (i.e. relying on time trend of time series data as the sole independent variable), which has led to the overestimation of the values of the forecast variables (e.g. forecasted total assets (FTA) = mKD 1297). This is so because in the real world the pattern and behaviour of these variables cannot be explained by time trend only. If we have relied on time series analysis alone the time trend would have been considered as only one component of the time-series data, because other components such as seasonal and cyclical variations are also important. Therefore, relying on time trend alone made us accept the upward trend of the variables forecasted. In addition, the behaviour of these variables is certainly affected by other independent variables (e.g. the volume of funds generated from investment deposits(ID) is more likely to be affected by the expected rate of return offered by the bank as one of the factors which affects the supply of funds to these accounts relative to that available from other IBs and non-IBs, likewise the volume of funds assigned to investment operations (IF) is also more likely to be affected by the expected rate of return offered by entrepreneurs). However, this may explain only part of the story; referring to the annual report of KFH for the year 1989 we discover that there is a decline in the volume of total assets in the year 1989 from that of 1988. And the fact is that this shrinkage is not caused by a decline in the value of investments or funding sources,

but due to a drop in the value of exchange deposits with other financial institutions(FIs). This factor is, in fact, clear from the position of these items (i.e. deposits from and with other FIs). On the assets side (CLA item of 1988 stood at mKD 280.3 (counting for 23.9% of TA) and 20.7% was been kept as deposits with other FIs leaving the rest (3.2%) as cash and balances with banks; whereas in 1989 the CLA item stood at mKD162.2 only (see Table 8.4) representing 14.3% of TA with 10% of TA only kept as deposits with other FIs. The same feature can be noticed on the liabilities side for the item of deposits from other FIs. This item stood at mKD163.6 (13.9% of TL) in 1988; however the same item accounted for mKD100.2 (8.8% of TL see Table 8.4) in 1988. Therefore taking the face value of total assets(total liabilities) for the year 1988, which stood at mKD1172.8, and comparing it with that generated by the model mKD1175.14 we might be led to conclude that the results obtained by the model are much better than those actually achieved. This should not be the case because the foregoing discussion emphasizes the importance of the quality of the input data and the impact of not capturing in the model some of the problems faced by decision makers in the real world. And the omission of these problems in the modelling process may be the result of their difficulty or the inability of the model builder to detect them at the stages of building up the model.

The value of total profits (TP) generated by the model (TP = mKD57.9) is higher than the volume of profits actually achieved (TP = mKD47.9) (a difference of 20.8%). This divergence between the two values may

due to several factors. The obvious one is the fact that the values of the forecasted variables are too high as discussed in the previous point. Another factor may be that risk has not been taken into consideration. The most important factor, however, is that the analysis ignores completely changes in relevant economic variables external to the bank, such as interest rates, exchange rates and the rate of inflation. It is, therefore, expected that in an environment characterized by certainty the best and logical selection of the program is to choose the combination of assets and liabilities that gives the highest rate of return. However, this is not the case in the real world where the policy of the management is undertaken in the light of the trade offs that exist between risk and return. Hence at this stage we can state that the inclusion or treatment of risk is a very important part which the model did not take into account. The way we have calculated the rates of return R_s, R_m and R_l, may be a fourth factor that have attributed to this discrepancy between the profits realized by the model and those actually achieved. This is so because, first we have assumed that the House is utilizing two modes of finance for channeling investment funds. Second, we have considered the CLA funds in whole as being utilized for banking services and in fact this is not the case. Because as a part of the CLA there is the cash and balance with banks item included which generates zero rate of return.

From the values presented in Tables 8.2 and 8.4 we can notice that there is almost a perfect matching between the sources and uses of funds. Short term funds have been used to finance short term operations (see

CLA on the assets side and CD and DFI on the liabilities side). The same thing can be noticed for investments operations (IF) and ID and E the source of financing these operations. Though, the values do have some discrepancies which may due to the aggregation nature of the presentation of financial reports of the House which does not define clearly the maturity class of each category in the balance sheet, but the general overview is that there is a tendency of conducting this policy. This presence of matching between sources and uses of funds may due to the fact that the options available for IBs to meet liquidity requirements are limited (i.e. no access to the money markets, interbank markets and the like). Therefore, it might be the case that in order to avoid the practice of *Riba* (usury) (e.g. borrowing on the basis of interest to meet liquidity requirements) this policy has been adopted in the case of IBs. Therefore, the volume of funds assigned for banking services constitues a part of the funds in the CLA item.

After making the above general remarks it is important to turn now to such a more detailed comparison between the two results. In this case much emphasis is placed on the percentage presentation, (what is literally known as common size presentation of the balance sheet of banks) in Tables 8.2 and 8.4. A quick reference to the percentage values in these Tables indicates that the results obtained by the model are almost identical to those actually achieved. Having said that, however, the two blocks of the balance sheet did not have the same features. The assets side of both results are more similar than those of the liabilities. Since it is almost impossible to achieve perfect result by applying such models, discussion

is, therefore, limited to the most important variables (i.e. decision variables). These are CLA and IF on the assets side and CD, ID and E on the liabilities side. Limiting the discussion to these variables can be justified by the fact that these variables have considerable impact on the policies adopted by the management of the bank and therefore the maximization of the profits generated from the operations carried out. Moreover, in the case of the model other variables have been treated either as balancing items (i.e. CW on the assets side and DFI on the liabilities side) or as constants (i.e. OA and FA on the assets side and OL on the liabilities side). Clearly, limiting the discussion to the variables mentioned earlier gives a good indication that the model has captured some elements which enables managers to choose a policy that reflects the way they assign funds to the available opportunities. In the case of the model this is very obvious for the two constraints of liquidity ratio(LR) and funds utilization ratio (FUR) (see Appendix 8.3 for the specification of these two constraints). The first one(i.e.LR) reflects the desired level of liquidity to be maintained and the second reflects the matching of sources and uses of funds policy adopted. Thus it can be confirmed that the most important constraints are the policy ones, because they represent the attitude and response of the management to the different forces that affect their decision process. However, discussion of the importance of these constraints and their managerial implications is deferred to the next section.

We can say that in general the results generated by the model are similar to those actually achieved. But it is too early to draw definite conclusions and suggest that implementing such models will bring the desired results

that the management look for.

8.4.1.2 The second phase: some useful implications of the post-optimal analysis of the optimal solution.

As we stated at the beginning of this discussion, the evaluation or assessment of the results generated by the model is in two parts; the first has been dealt with fully in the previous section; the other is the main concern of this section. This second phase concentrates on the utilization of some important features of the post-optimal analysis of the LP technique. In this respect I am going to take few examples to show how this analysis can be conducted, the interested reader can consult Beazer(1975) for the use of this analysis with respect to banks and Williams(1990) for the general use of this analysis to any LP application. The elements analyzed are the following:

(a) The funds utilization ratio (FUR) constraint and its shadow price. As we stated in Appendix 8.1 that with each constraint in the optimal solution there is a shadow price associated with it. What are the managerial aspects of this information? The output for the optimal solution in our model produced a shadow price associated with this constraint (i.e. FUR) equal to 5.7%. That means any marginal (Δ) increase(or decrease) of the resources available for investment operations (IF) will result in an increase (or decrease) to total contribution of profits (TP) by an amount equals to $\Delta * 5.7\%$. For example, lets assume that instead of utilizing full ID and E for financing IF we have reduced it by 5% (i.e. IF $\leq .95$(ID + E)). We should note, however,

that this analysis deals with marginal variations (i.e. small changes) in the right hand side of the stipulated values of the model, but for illustration purposes we have set out the value of Δ at the level of 5%. This decrease is equal to mKD46.59 (i.e. it is equal to the value of IF in optimal solution (mKD931.9) times 5%). The total contribution of profits (TP) will be decreased by mKD2.65 (46.59 * 5.7%). Therefore the new value of TP, after this reduction and rearrengement of the optimal solution, will be equal to mKD55.2. In fact solving the LP program by LP6 package with the forementioned reduction (i.e. IF $\leq$ .95(ID+E)) will produce the same volume of total contribution profits mKD55.2. What does this whole process and result tell the decision maker? It tells him simply that if he has available funds (i.e. ID + E) for financing investment projects (IF), and there is a cost (or rate of return) of this source, and he selects a policy greater than the stipulated value of IF in the market constraint he should be able to make extra rate of return that equals to 5.7% for each marginal increase in the use of the available funds. On the other hand, if he (i.e. the decision maker) does not make full use of the available resources then there will be an "opportunity" cost equals to the foregone profits (e.g. mKD2.65 in our case) if the funds had been used for that particular purpose. It should be emphasized that there is an upper (mKD953 + Δ_u %953) and lower (mKD953 - Δ_l %953) limits within which these changes can take place. In most packages the values of these limits are produced with the optimal solution. However, LP6 does not provide this piece of information. Hence we are unable to

derive the values of these limits. It is enough for the decision maker at this stage to realize that increasing (or decreasing) the amount of available resources cannot be carried out without limits (e.g. there are market constraints on the bank's ability for maneuvring these funds and so forth). Moreover, the type of analysis we have just conducted is very simple. In the sense that many factors have not been taken into consideration. The source of funds is one of these. In this analysis source of funds has been treated as exogenous (pre-determined) and as such bankers have no control over its volume. In the practices of banking bankers can exercise some control over this factor. This feature is very clear in the case of interest-based banks where liability management has emerged as a very important tool through which bankers have become very aggressive in obtaining funds from different sources (e.g. money markets, interbank markets, Eurocurrency markets,etc) other than the traditional (i.e. deposits) way of acquiring funds. In addition, the development of financial instruments such as negotiable certificates of deposits, soaring interest rates during the 1960's and 1970's, high competition between FIs and deregulation movement of the 1970's and 1980's have played very important role in the emergence of liability management. In the case of IBs, however, this is not the case, because the development of markets and financial instruments are still under way. The main element that these banks use to obtain funds is to offer a competitive rate of return to investment accountholders. This in turn requires investing funds in profitable projects. This may explain why our analysis has concentrated on the assets side

assets side (i.e. uses of funds) of the balance sheet.

(b) The same analysis can be applied to the liquidity ratio (LR) constraint or any non-binding [4]. In our case, the LR constraint has a shadow price associated with it in the optimal solution. The value of this price is equal to 3.6%. Since the CLA item has been assumed to be used in financing bank service operations, the shadow price therefore represent the rate of return by which an increase (or decrease) in the level of CLA with respect to TA will result in an increase (or decrease) in total profits by an amount equals to the value of the shadow price(3.6%) times the quantity by which the level of CLA is increased or decreased. Moreover, the shadow price, in this case, could be interpreted as the "cost of borrowing" to meet liquidity requirements or the foregone "opportunity cost" rate of return of having too much idle cash (i.e. liquidity excess.)

The above discussion illustrates how important and useful are the managerial implications that can be gained from the application of such models, and how the output of the optimal solution can be used to evaluate different courses in the decision making process. Hence, the application of optimization techniques, such as LP, should not be presented as a mechanical tool of obtaining the optimal solution, but it should be presented as a managerial tool that helps the decision maker to evaluate different

[4] A constraint is said to be non-binding if the left-hand side quantity in the optimal solution is less or greater than, depending on the inequality sign, the stipulated value of the right-hand side, and therefore it has a zero shadow price and it does not affect the optimal solution. It should be noted, however, that there might exist situations in which the constraint might be non-binding even if it is equal to the stipulated right-hand side value. This situation occurs if the removal of this constraint does not affect the optimal solution, (Williams(1990)).

alternatives.

8.4.2 Comparing the balance sheet obtained by the SOOM model with the actual balance sheet of JIB

For generating the values of the 'optimal' balance sheet for JIB by implementing the LP program, the planning period of 1987 - 1988 was chosen. It would have been much better if the same planning period was chosen for both institutions, but it was impossible to obtain necessary data for JIB for the year 1989. Therefore, the main decision to be examined using the program is to determine the structure of the balance sheet of JIB at the end of the financial year of 1987 - 1988. In other words, assuming that we are at the beginning of the planning period of 1987 - 1988, i.e. the end of the financial year of 1986-1987, what structure of the balance sheet will maximize the profits of the JIB at the end of 1988 by implementing the LP program?. As it was the case of KFH the main sources of information are annual reports of Jordan Islamic Bank from 1979 through 1988. Now we turn to the main components of the LP program for JIB. The data used as inputs of the model is given in the Table below[5]:

Table 8.6 The data inputs of the SOOM program of JIB

item	FA	TC	PUC	SR_o	GR_o	FSP	SIA	$SRIR_o$
value(mJD)	4.6	2.29	6	3.1	.6	15.3	15.9	3.5

[5]See Appendix 8.3 for the whole structure of the LP program used to generate the variables of the balance sheet of JIB for the year ended 1988 and Appendix 8.2 for how the data has been compiled and how the estimated inputs have been obtained.

Continued Table 8.6.

item	FCD	FID	FD	FTA	FIF
value(mJD)	34.8	149	183.8	215.5	122.5

Note: mJD denotes for millions of Jordanian Dinars.

In order to generate the structure of the balance sheet the data provided in the Table above have been used in conjunction with the structure of the LP program for JIB given in Appendix 8.3. The results obtained are given in the Table below:

Table 8.7 The balance sheet of JIB generated by the SOOM model at the end of 1988

Assets	mJD	% of TA	Liabilities	mJD	% of TL
CLA	72.5	33.6	CD	26	12
IF	122.5	56.8	ID	141.9	65.8
FSP	15.3	7.1	SIA	15.9	7.4
OA	0.9	.4	SRIR	4.5	2.1
FA	4.6	2.1	E	10.2	4.7
			OL	17.3	8
TA	215.8	100	TL	215.8	100

The other data which might be helpful for comparison reasons are presented in the Table below:

Table 8.8 The value of other variables determined by the SOOM model

item	SR	GR	TP	TC	NP	SHP	DP	D
value(mJD)	3.36	.86	12	2.29	2.68	4.97	6	183.8

Note: values of the variables in this and the previous Tables are denoted in terms of millions of Jordanian dinars (mJD).

Having presented the results generated by the model, the actual results achieved by the management of JIB are presented next. The value of the balance sheet actually achieved is given in the following Table:

Table 8.9 The actual Balance sheet of JIB at the end of 1988

Assets	mJD	% of TA	Liabilities	mJD	% of TL
CLA	74.7	33.6	CD	38.7	17.4
IF	124.1	55.8	ID	142.6	64.1
FSP	15.9	7.1	SIA	17.1	7.7
OA	2.8	1.3	SRIR	4.2	1.9
FA	4.9	2.2	E	10	4.5
			OL	9.8	4.4
TA	222.4	100	TL	222.4	100

The value of other variables which might be helpful in comparing the actual with the calculated results of the model are presented in Table 8.10 below:

Table 8.10 Values of other variables actually achieved

item	SR	GR	TP	TC	NP	SHP	DP	D
value(mJD)	3.2	.75	10.4	2.7	1.15	3.1	5.6	177.8

Note: values in this and the previous Tables are expressed in terms of millions of Jordanian dinars (mJD).

8.4.2.1 Discussion and some implications of the obtained results.

As in the case of KFH, the same methodology is pursued in analysing and interpreting the results of Jordan Islamic Bank(JIB). That is, the analysis is carried out on two levels: the first is the comparison between the results generated by the model and those actually achieved; the second is a reflection on some managerial implications of the results of the model.

(a) **The first phase: comparison between the two results.**

Looking at the results presented in Tables 8.7, 8.8, 8.9 and 8.10 the following general remarks can be drawn :

– The volume of total assets(total liabilities), in terms of millions of Jordanian Dinars, generated by the model are close to those actually obtained (there is a difference of only mJD6.6(3%)). This closeness can be explained by the fact that the assumed upward trend of the forecasted variables has been captured by the linear equation of time trend analysis. This is quite apparent in Table 8.12 in Appendix 8.2, where it can be noticed that the upward trend of these variables has grown steadily in the years under observation. This, however, is not the case for KFH which was hit by the collapse of the real estate and construction markets in 1984. The other factor which might explain this closeness is the fact that JIB is a small size bank therefore it may have followed a conservative policy in its employment of funds. This in turn makes it easier for the model builder to capture and formulate these policies. For instance, take the funds utilization ratio(FUR), which relates IF on one hand and ID and E on the other, actually this ratio stood at 81.3% which is almost equal to that of the model (80.5%). The case of special reserve for investment risk (SRIR) is a testimony of the conservative policy of the management of the bank.

– The value of profits in both cases is close as well. However,the profits generated by the model are slightly higher than those actually achieved (by 15%). This may due to the treatment of CLA item which has been used as a block invested in banking service operations. However, in reality part of this fund is kept as an idle cash or balances with banks and it, therefore, does not generate

any income. In addition, we can notice in Tables 8.8 and 8.10 that net profit(NP) of the model is much higher than that of the actual case. This may due to the omission of other expenses such as taxes and other allowances decided by the management of the bank and the unrealistic assumption of constant costs.

- From Tables 8.7 and 8.9 it is apparent that the bank is playing the role of liquidity destruction rather than liquidity creation (see Chapter 4). This is clear from the comparison between the items of CLA on the assets side and CD on the liabilities side, where the former is higher than the latter by almost double in the actual case and more than double in the case of the model. This indicates the fact that most, if not all, IBs are ensuring their liquidity reqiurements through cash and balances with other banks (CLA) item.

Once again the foregoing discussion illustrates the importance of having strong methods or techniques of estimating the required data of the model so that it can have the power to generate the course sought by the decision maker.

We turn now to the common size comparison of the results presented above, where attention is directed towards the most important items of the balance sheet. These are; CLA and IF on the assets side and CD, ID and E on the liabilities side. If we take the assets side it is clear that the results in both situations are the same. In the case of CLA item it is a coincidence that the results are exactly the same, because we have calculated the expected ratio of this variable with respect to

total assets as the average of the actual ratios of the values over the years under observation. However, in the case of IF it seems that the FUR ratio, as explained in the previous point, has expressed the policy adopted by the management. On the liabilities side, however, the situation is not the same. Two items (i.e. ID and E) yield close results, whereas in the case of CD there was a divergence of more than 5% between the two percentages. This may due, in the case of the model, to the relationships that link CD with other variables in the model especially TA and D. With respect to TA, CD is linked with it through the liquidity ratio (LR). And as we noticed in the first point of the general remarks the value of TA of the model is less than that of the actual case. With regard to D, CD is related to it through the equality between total deposits (D) and the different types of other deposits, especially the case of SIA which has been assumed as constant. Therefore, the equality prevents CD from exceeding an upper limit.

We can conclude that in small size banks the adopted policies of the management are not very sophisticated. And, therefore, the application of models such as LP technique can capture these policies.

(b) **The second phase: some implications of the values of the optimal solution.**

In the previous section we have seen how important is the funds utilization ratio (FUR) relationship in deciding the optimal course of the balance sheet. Accordingly, the shadow price associated with this constraint is very important for the decision maker in evaluating the

different options available. In the optimal strategy arrived at the value of this shadow price is negligible as it is almost equal to zero. That means if we increase FUR, let say by $\Delta = 5\%$, the value of total contribution (TP) remains the same and therefore the new solution is the same as that obtained when FUR was equal to 80.5%. Thus, this value of FUR represents an upper limit of the interval within which the shadow price could have a meaningful interpretation. Moreover, the constraint (IF $\leq$ 122.5) has a shadow price associated with it equals to 8.2% (rate of return of IF) which means that if we could seek other investment opportunities it is likely that any marginal increase of the available resources will offer us a rate of return equals to 8.2%. If we turn now to the other side of the coin and assumed that the management has selected an FUR course equals to 75% (instead of 80.5%). In this case the shadow price associated with FUR constraint is equal to 8.2%. This tells the management that it has a chance of increasing its total profits (TP) by an amount equals to 8.2% times the marginal increase of sources available to finance IF (Δ). For example, let $\Delta =$ 5%, this will take us to our initial optimal course and the increased amount of profits is equal to 8.2% times mJD5.97 = mJD.49. Adding this to the amount of current total profits will produce the mJD12 total profits of the initial balance sheet. However, we should be very cautious with this type of analysis in deriving any general conclusions since it does not take marginal costs into account. Hence, knowing whether or not an incraese in the available resources will be profitable requires taking into consideration all factors that affect profitabilty.

The above analysis is almost the same for the liquidity ratio (LR) constraint where the shadow price associated with this constraint is equal to 2.7%. However, there is only one addition to that is the fact that this shadow price can be interpreted as the "cost of borrowing"to meet liquidity requirements or the "opportunity cost" of having too much idle cash (liquidity excess.)

The foregoing discussion illustrates the importance of giving a lot of consideration to the investment portfolio to maximize profits and its trade-off with liquidity requirements.

8.5 Concluding remarks

In the light of the above results and from the discussion that followed the following general remarks can be made:

The general performance of the model is quite encouraging, in the sense that the results generated by the SOOM program for both institutions are not very different from those actually achieved. This, in fact, illustrate the fact that this program has captured to some dedree the policies adopted by the management of these institutions (e.g. the FUR and liquidity requirements). Having said that, it should be noted that the results of the SOOM program for JIB are better, in their closeness, than those of KFH. This may due to the reasons (i.e. size of the bank and the conservative policies adopted by the management) stated in the first phase of the discussion of the results of JIB.

The managerial implications of the model (i.e. post-optimal analysis of the SOOM program) are as important as obtaining the optimal solution itself. We have seen how much important information can be obtained from this analysis. Although, our discussion was limited to few aspects we can state that the application of LP or any Operational Research (OR) technique should not be presented to the decision maker as a mechanical tool for obtaining the optimal solution rather as a managerial tool that will help the decision maker to evaluate different alternatives.

The importance of having robust methods or techniques of estimating the required data. Therefore, having good models or methods that can capture the factors affecting the behaviour of the variables concerned is a preliminary prerequisite of generating promising results from the implementation of optimization techniques.

It is quite apparent how important are the policy constraints adopted by those responsible for handling the ALM problem in the bank. This is not a surprising finding, because these constraints represent the attitude and response of the management to the different factors that affect their decision making process.

The model did not take risk into considerations. From the discussion of the ALM problem it was clear that the treatment of risk is one of the crucial factors that affects the ALM problem. LP technique can be used to handle this by assuming different economic scenarios and solving for each but it is a cumbersome and time consuming process. One way of taking risk into account is dealt

with in the next chapter where risk will be treated as an objective to be optimized in itself.

The capital ratio constraint of these institutions did not have an effect on the optimal course arrived at. This may give an indication that the role of capital in Islamic Banks is not like that played by capital in conventional banks. If it (i.e. capital) has any such role, this might be limited to protecting funds deposited in current accounts and therefore the requirements are less than those in conventional banks. In most developed countries regulatory authorities requires a ratio of at least 8% of total capital with respect to total risk weighted assets.

Although, minimum cash requirement and other legal ratios are quite high they do not appear to have a great impact on the optimal solution of the model. This may due to the prudent policies adopted by the management in both institutions especially JIB.

The matching of sources of funds policies are quite clear in the policies pursued by the management of these banks. However, the measures taken in each bank are not the same. Kuwait Finance House keeps a low ratio of cash and balances with other banks in relation to total assets, whereas Jordan Islamic Bank keeps a high one. This difference in policy may reflect the different in size between the two intermediaries and the fact that KFH is working in a high income country with a well developed banking system and the government can be expected to intervene to rescue banks, as it did the crisis of 1982.

Appendix 8.1 Some essential features of the LP technique

Linear programming (LP) can be defined as "the analysis of problems in which linear function of a number of variables is to be maximized (or minimized) when these variables are subject to a number of linear inequalities[or qualities]", Beazer(1975). It appears from this definition that the essential features of an LP program are the optimization of a linear function subject to a set of mathematical relationships, such as equations, inequalities, logical dependencies, etc, which correspond to some more down-to-earth relationships in the real world. Therefore, the general form of an LP program can be stated in mathematical notations as follows, Beazer(1975):

$$\text{Maximize (Z)} = \sum_j C_j X_j$$

subject to

$\sum_j a_{ij} X_j \leq b_i$, i = 1.....n, and $\quad X_j \geq 0$

or Minimize (Z) = C* X

subject to AX $\leq$ b , $\quad$ X $\geq$ 0

A is a matrix of structural coefficients and b is a vector of stipulation values for the amounts of resources available. C is a vector of criteria, either prices, costs or rates of return. A, b and C are parameters of the problem; only the vector of the activity level, X, can be varied to affect the solution of the problem. The decision maker is interested in choosing a program, an X vector, that optimizes his criterion function.

From this discussion we can summarize the following essential features of an LP program, Williams(1990):

i. There is a single linear expression (the objective function) to be optimized (maximized or minimized).

ii. There is a series of constraints in the form of linear expressions (equalities or inequalities) which can take one of the forms $\leq$ or $\geq$ or $=$.

iii. Non-negativity constraints (i.e. the vector of the activity level must be greater or equal to zero.)

In addition to the above basic features the story of LP technique, however, do not stop here. Other very important aspects are noteworthy. The foremost, among others, is the post-optimal analysis which concentrates on the economic interpretation of the obtained results. This includes the dual model, sensitivity analysis and some other features. However, we will describe briefly in what follows the first two factors (i.e. the dual model and sensitivity analysis) and their usefulness in deriving such implications of the optimal solution.

i. **The dual problem.** Associated with any Linear programming(LP) problem is another problem known as its dual. With

each maximization original (or primal) problem is its minimization dual program and vice versa. Although the idea of duality is mathematical in nature, it has some very important economic interpretation. Having said that we are, in fact, not going to concentrate on the analysis of duality in this study for two reasons. First and foremost, is the fact that duality requires the building up of another new LP model which is beyond the scope of this study, although this model can be derived from the primal one. Second, values of the variables obtained in the optimal outcome of the dual model are equal to quantities called shadow prices which we are going to discuss in the next paragraph. These values usually appear naturally in most packages if the simplex method is applied.

ii. **Sensitivity analysis.** The main theme of this analysis is to study the effects of changes in the data as used inputs on the optimal course arrived at. These changes cover the following:

   - Changes in the right hand side coefficients or changes on the restrictions imposed as constraints on the program being optimized (e.g. the amount of resources available). In LP problems each constraint has associated with it a quantity known as shadow price which can be interpreted as the managerial effect of increases(or decreases) in the capacities, Williams(1990).
   - Changes in the coefficients of the criterion function. This could be a unit of profit contribution or cost.

- Changes in the input/output (or interior) coefficients associated with each activity or resource.

It should be stated that all of the above changes can take place only within an interval. That is this changes can be carried out only within such upper and lower values; these values are called limited ranges of the variable or constraint concerned.

Before we end this Appendix it is important to point out that two important steps as perceived by the author are very important in the modelling process. These are: firstly to recognize that such actual problem can be approximated to an LP or any other OR program. Thus defining the problem and formulating it is a very important and crucial step; secondly, interpreting the optimal solution and discussing the likely implications of such results. Certainly, there are some other steps which cannot be underestimated especially the step of obtaining the optimal solution. However, the existence of powerful microcomputers with efficient packages had made this step much more easier. Accordingly, such big practical problems are possible to be tackled. Nevertheless, understanding the way how the solution been obtained helps decision maker to understand and analyse the results much better.

Williams(1990) is a very useful reference of discussing the above and other related topics. Therefore, the interested reader can consult this reference.

Appendix 8.2 The data used to estimate the forecasted variables and some other input data of the model

The data used as inputs of the model can be grouped into two categories; the one that deals with Kuwait Finance House(KFH) and the other that deals with Jordan Islamic Bank(JIB).

i. **The data used to estimate variables of the model for KFH.**

The Table below presents the values of the variables, to be forecast, over the last nine years:

Table 8.11 Past values of some variables over the last nine years for KFH.

year	CD	TA	D	CID	IF	DER%	LR%
1980	29.2	168.4	148.6	148.6	133.9	286	22
1981	55.2	351.1	294.1	294.1	272.5	162	19
1982	70	568.7	473.1	473.1	303.7	133	21.04
1983	79.6	799	697.8	697.8	633.3	198	15.06
1984	69.1	845.7	731.6	710.9	676	204	13
1985	123.3	803.9	734.1	724.3	619.4	202	10
1986	133.4	861.8	793.9	758.7	689.9	199	10
1987	107.8	1057.5	979.2	840.5	763.2	197	19
1988	143.3	1172.8	1082.6	918.9	805.5	195	24

The above values have been compiled from annual reports of KFH from 1980 to 1988. And the mKD denotes for millions of Kuwaiti dinars and variables are as defined in section 2 of this chapter.

ii. **The data used for estimating the forecast values for JIB.**

Table 8.12 Past values of the variables to be forecast

year	CD	TA	ID	IF	D	LR%	R_{if}%	DER
1980	4.8	15.4	6.8	6.7	11.6	43	8.6	5.8
1981	12.2	31.6	13.1	14.2	25.3	43	8.5	8.4
1982	16.3	45.3	19.4	26.4	35.7	28	9.4	8.5
1983	20.7	71.4	37.8	37.6	58.5	36	8	13.2
1984	22.3	102.1	60.5	63	82.8	27	7.3	17.9
1985	23.7	126.7	79.1	71	102.8	31	7.6	21.4
1986	26.4	161.6	99.9	95.4	126.3	28	6.7	13.1
1987	31.2	197.4	127.2	109	158.4	33	7.07	15.8
1988	35	222.5	172.7	124.1	207.7	33.6	7.7	17.5

The above values have been compiled from annual reports of the Bank from 1980 through 1988.

In order to arrive at the values of the forecasted variables the coded method [6] of Ordinary Least Squares (OLS) of the linear trend of time series analysis has been used. Therefore, the equation used for this purpose is assumed to take the following form:

$$Y_t = a + b * X$$

Where, Y_t = the actual values of the variable concerned(e.g. TA).

X = represents time, or any satisfactory codes.

a = the Y intercept of the trend line, or the trend value when X=0.

b = the slope of the trend line, or change in Y_t per unit of time.

The formulas of calculating a and b are given below:

$$a = \frac{\sum(Y_t)}{n}$$

$$b = \frac{\sum(X)(Y_t)}{\sum(X^2)}$$

We should note that the method of assigning codes differs from the case of even to odd data cases (i.e. the number of periods involved). Since our data involves odd number, the following example is given below to demonstrate how the values of a and b have been arrived at: In order to derive these values the following computation is needed. It is presented in the Table below:

[6] In most practical applications analysts have used codes rather than the actual time periods as the independent variable. The main reason of this is to facilitate calculations, and as a matter of fact any convenient coding system is satisfactory; for most applications, the greatest efficiency is achieved if codes are assigned to time periods in such a way that the sum of the codes is zero (0), (Daniel and Terrell (1975)).

Table 8.13 The computation needed to estimate the coefficients of a and b.

year	Y_t(CDKFH)	year code(X)	$\sum XY_t$	$\sum X^2$
1980	29.2	-4	-116.8	16
1981	55.1	-3	-165.3	9
1982	70	-2	-140	4
1983	79.6	-1	-79.6	1
1984	69	0	0	0
1985	123.3	1	123.3	1
1986	133.4	2	266.8	4
1987	107.8	3	323.4	9
1988	143.3	4	573.4	16
$\sum$	810.7	0	785	60

Note: CDKFH represent current deposits for KFH and are denoted in millions Kuwaiti dinars.

From the above Table the values of a and b are computed as follows:

$$a = \frac{\sum(Y_t)}{n} = \frac{810.7}{9} = 90.07$$

$$b = \frac{\sum(X)(Y_t)}{\sum(X^2)} = \frac{785}{60} = 13.08$$

Substituting for the values of a and b in the equation above gives the following estimated equation for CDKFH:

$$Y_t = 90.07 + 13.08 * X$$

For the year 1989 X = 5, therefore the forecasted value of CDKFH for this year is:

$$Y_{89} = 90.07 + 13.08 * 5 = 155.47$$

With the same procedure values of the other variables can be obtained. However, the Microfit 3.0 [7] has been used to obtain the estimated equations. The estimated equations and the forecasted values of the variables are presented in the Table below:

[7] Micrifit 3.0 is an interactive econometric software package written especially for microcomputers, and specifically designed for the econometric modelling of time series. For more details see the user's manual guide published by Oxford university press 1991.

Table 8.14 the estimated equations and the forecasted values of the variables used as inputs in the LP models of KFH and JIB.

The variable	the estimated equation	forecasted values
CDKFH	$Y_T = 90.1 + 13.07 * X$	$CD_{89} = 155.45(mKD)$
TAKFH	$Y_t = 736.54 + 112.13 * X$	$TA_{89} = 1297(mKD)$
IFKFH	$Y_t = 544.15 + 81.95 * X$	$IF_{89} = 953.9(mKD)$
DKFH	$Y_t = 659.44 + 107.54 * X$	$D_{89} = 1198.54(mKD)$
CIDKFH	$Y_t = 618.52 + 88.64 * X$	$CID_{89} = 1061.72(mKD)$
CDJIB	$Y_t = 21.4 + 3.35 * X$	$CD_{88} = 34.8(mJD)$
IDJIB	$Y_t = 68.5 + 20.14 * X$	$ID_{88} = 149(mJD)$
TAJIB	$Y_t = 108.22 + 26.89 * X$	$TA_{88} = 215.8(mJD)$
IFJIB	$Y_t = 60.82 + 15.42 * X$	$IF_{88} = 122.5(mJD)$
DJIB	$Y_t = 89.9 + 23.49 * X$	$D_{88} = 183.8(mJD)$
DERJIB	$Y_t = 13.5 + 1.44 * X$	$DER_{88} = 19.3$
FURJIB	$Y_t = .87 - .017 * X$	$FUR_{88} = 80.2\%$
$R_{if}JIB$	$Y_t = 6.35 + .46 * X$	$R_{if88} = 8.2\%$

Note: in the case of KFH, X = 5 and for JIB, X = 4 and mKD and mJD denote for millions of Kuwaiti dinars and Jordanian dinars respectively.

The main criterion used to judge the outcome of the estimated equations was R^2, the coefficient of determination. That is why some other equations are not included. Examples of these are the rates of returns of the different operations of KFH (i.e. R_s, R_m and R_l). In this situation the average of the actual values of the last three years have been taken as a projection for the year 1989. The R^2 of the equations presented in Table 8.14 are given in the Table below:

Table 8.15 The values of R^2 of the equations presented in Table 8.14

The variable of the equation	R^2 value
CDKFH	.85
TAKFH	.91
IFKFH	.86
DKFH	.94
CIDKFH	.88
CDJIB	.96
IDJIB	.95
TAJIB	.98
IFJIB	.99
DJIB	.96
DERJIB	.58
FURJIB	.75
R_{if}JIB	.54

Appendix 8.3 The structure of the LP programs used to generate the optimal balance sheets of Kuwait Finance House(KFH) and Jordan Islamic Bank(JIB).

i. **The structure of the model used for KFH.** As we described at the beginning of the chapter (section 2) the LP program comprises of two main parts; constraints and objective function.

Constraints of the model.

There are five groups of constraints:

1.1 - Objective constraints.

$$TP = .035 * CLA + .06 * MF + .05 * LF$$

$$NP = TP - TC$$

1.2 - Balance sheet constraints:

$$TA = CLA + IF + OA + FA$$

$$IF = MF + LF$$

$$CID = CD + ID$$

$$ID = SD + LID + UID$$

$$D = CID + DFI$$

$$E = PUC + SR + GR$$

$$TL = D + E + OL$$

$$TA = TL$$

1.3 - Legal constraints:

$$CLA \geq .25 * CD + .10 * ID$$

$$SR = SR_o + .10 * NP$$

$$GR = GR_o + .10 * NP$$

$$SR < PUC$$

1.4 - Policy constraints.

$$D \leq 20 * E$$

$$E \leq .08 * TA$$

$$IF \leq ID + E$$

$$CLA \leq .15 * TA$$

$$MF = .55 * IF$$

$$LF = .45 * IF$$

$$SD \leq .50 * D$$

$$UID \geq .25 * D$$

$$ID \leq .85 * CID$$

1.4 - Market constraints.

$$D \leq 1197.19$$

$$IF \leq 953$$

$$CD \leq 155.45$$

$$CID \leq 1061$$

$$TA \leq 1297.19$$

The objective function.

$$Max(TP) = .035 * CLA + .06 * MF + .05 * LF$$

ii. The structure of the model for JIB.

Constraints of the model.

1.1 - Objective constraints.

$$SHP = .027 * CLA + .0246 * IF$$

$$DP = .0492 * IF$$

$$NP = SHP - TC$$

1.2 - Balance sheet constraints.

$$TA = CLA + IF + FSP + OA + FA$$

$$D = ID + CD + SIA$$

$$E = PUC + SR + GR$$

$$TL = D + E + SRIR + OL$$

$$TA = TL$$

1.3 - Legal constraints.

$$CLA \geq .25 * CD + .10 * ID$$

$$SR = SR_o + .10 * NP$$

$$GR = GR_o + .10 * NP$$

$$SRIR = SRIR_o + .0082 * IF$$

1.4 - Policy constraints.

$$D \leq 19.3 * E$$

$$E \leq .08 * TA$$

$$IF \leq .80 * ID + .80 * E$$

$$CLA \leq .336 * TA$$

1.5 - Market constraints.

$$CD \leq 34.8$$

$$ID \leq 149$$

$$TA \leq 215.8$$

$$IF \leq 122.5$$

$$D \leq 183.8$$

The objective function. $Max(TB) = .027 * CLA + .082 * IF$

Chapter 9

A Multiobjective Optimization Model of the Asset and Liability Management Problem of an Islamic Bank

9.1 Introduction

The main concern of this chapter is to relax some of the assumptions made in developing the single objective optimization model (SOOM). The foremost, among others, is the multiobjective nature of the ALM problem of an IB. Hence the single objective approach taken in the previous chapter is replaced by an approach of optimizing a multiobjective function within which the interest of depositors is featured. The sequence of the points covered in this chapter goes as follows: the multiobjective nature of the banking firm is dealt with in the second section. The MOOM model is developed next and, then the results generated from its application are compared with

those results actually achieved by the management of KFH and JIB. Some managerial implications of the results of the MOOM model and a comparison of these results with those of the SOOM model are covered in the fifth section. Finally concluding remarks are drawn.

9.2 The multiobjective nature of the banking firm

Much of the literature of the firm has been dominated by the explicit assumption that firms are regarded as business entities that try to maximize a single objective function in the terminal wealth of the owners or any other appropriate single criterion function (e.g. maximizing the net present value). Although those writers who have pursued this line have noticed and acknowledged the multiple criteria nature of the firm, it was until the Second World War, as noted by Zeleny(1982), that such serious and "scientific" attempts started to appear in addressing this fact (i.e. the multiple criteria of the firm). The multicriteria nature of the firm are derived from the fact that firms are the product of the efforts of human beings; as such the ultimate objectives of these firms are determined and shaped by the objectives of the persons who have an interest in the existence of these firms. As a consequence, managers of firms try to satisfy the objectives of the interested groups who are involved in the affairs of these firms. Zeleny (1982) quoted the following statement of professor Leibenstein (1976) "only individual members of firms have motives, and the meaningfulness and nature of firm motives depend on the study of individual motives. In other words, whether or not it is proper, meaningful or useful to view firms as profit maximizers becomes a problem to be subjected to analysis and solution and is not something about which we simply make assumptions at the outset. It will all depend on the analysis of individual

behaviour, of the interaction of individuals within groups, and the behaviour of the groups that constitute the firm which will determine the answer". If this is the case the banking firm, therefore, is no exception. We have seen in chapter 5 that the ALM problem that the management of any bank tries to resolve centres around how to structure assets, liabilities and capital accounts in such a way as to satisfy the requirements of the interested groups (i.e. the owners, deficit and surplus economic units and monetary authorities). An elaboration is, therefore, needed to examine the objectives that each group is aiming to attain from the involvement in the affairs of the banking firm. Since the banking firm is regarded as a financial intermediary (FI) that stands between two parties, the interests of these parties is of vital importance to the management of these institutions in determining the objectives of the firm. In addition, the interest of the owners and monetary authorities are very important too; because the former are the main founders of these institutions and the latter keep a very close and an open eye on the operations of these intermediaries. In what follows we will examine briefly the requirements of each group. Table 9.1 is presented to summarize some of the motives and objectives of the groups that have interest in the business affairs of the banking firm.

Table 9.1 Summary of some of the requirements of the groups that have an interest in the affairs of the banking firm

Groups	Examples of some of their requirements
Surplus economic units (SEU)	liquidity, minimization of the risk of the lending process, safe place of keeping their funds, reasonable rate of return,etc
Deficit economic units(DEU)	low cost of borrowing, amount of funds available at particular time, keeping these funds as long as possible,etc
Shareholders (owners)	high rate of return which may require investing in long term risky projects, low risk,etc
Monetary authorities	safety of depositors which may require high reserves and considerable amount of capital kept as cushion for that purpose,etc

The above Table demonstrates clearly the multiple criteria nature of the banking firm and hence the real dilemma that the management of these institutions face. In explaining this dilemma Zaloom *et al* (1986) pointed out that "bank fund managers must respond to a number of interest groups each with different objectives. These interest groups include the stockholders, depositors, regulatory agencies and the creditors. The stockholders prefer to see the bank as a profit making institution. Depositors prefer the bank to be a safe place to keep their savings. Regulatory agencies whose main function is to minimize bank failures and to protect the depositors' interest, would like to see more capital so as to reduce the risk. The stockholders, on the other hand, would like to use more borrowed funds, the provision of which is cheaper than capital. They also are ready to accept more risk, provided that there is a higher rate of return...". The foregoing discussion clearly illustrates the multiple criteria nature of the banking firm and the fact that the management of these institutions should take these multiple criteria into account in determining the target objectives to be optimized. Most writers who have discussed the ALM problem of banks, and

have tried to construct analytical models to solve it, have noticed the multiobjective nature of the banking firm. For example, Cohen and Thore (1970) recommended that bank managers should take the trade-offs between liquidity, profit and risk into consideration in structuring the bank assets and liabilities "... the nature and the magnitude of the trade-offs which exist between yield, liquidity and risk must be considered by bank managers". Kusy and Ziemba (1986) state that the ALM problem of a bank centres around "... how to structure a bank's assets and liabilities to make optimal trade-offs among risk, return and liquidity". Despite this observation by these writers and others, most or the majority of them have constructed single objective optimization techniques. This may due to two main reasons: first, the late emergence of the algorithms that solve the family of techniques that incorporate the multiobjective nature of the firm; and, second, the complexity of these algorithms as such practical applications are difficult to handle. Nevertheless, since the late seventies the area of multiple criteria decision making has received considerable attention from analysts and management scientists. According to Evans (1984) the methods that deal with multiobjective decision criteria are classified into three groups according to the three pure approaches of articulation of the decision maker's preference structure: the first group contains techniques prior articulation of preferences (prior to the optimization process). Techniques which employ this type of prior articulation of preferences can involve the explicit use of a value function as in the direct assessment and the maximization of the decision maker's value function, or the implicit use of a value function as in goal programming, (Evans(1984)). The main disadvantage of such prior approaches is the difficulty which the decision maker has in specifying the required preference information, (Evans (1984)). However, recent surveys indicated that GP is one of the methods that is gaining considerable attention in the

implementation in the decision making process; see Baston(1989) for more details of such applications. This acceptance of decision makers of the application of goal programming may possibly due to its great flexibility in accepting numerous constraints and goal priorities, Bashir(1982). The second group is the class of methods that use progressive articulation of preferences (during, or in sequence with, the optimization process). These methods often involve an interactive decision maker/computer approach. The techniques applied in this area are similar to those of the first group in the sense that they try to find one best-compromise solution. The algorithms developed to solve this type of problem typically are initiated through the finding of an optimal solution to a single objective problem, related in some way to the original multiobjective problem. The decision maker is then required to provide some information concerning his preference structure over the multiple objectives, relative to the outcome arising from this solution. Using this preference information, the algorithm sets up a new single objective problem for next iteration. Iterations continue until the decision maker or the computer program, based on some externally defined criterion, decides that the current solution is "close enough" to a best compromise solution, Evans(1984)). A typical example of this type of techniques is Polynominal Goal Programming. The third category includes methods that use the approach of a posteriori articulation of preferences (after the optimization process). Methods in this category are concerned with finding all or most of the efficient solutions [1] to the decision making problem. These solutions are presented to a decision maker(s) who chooses one solution as the best from this set of efficient solutions through some process set by the decision maker himself. The main advantage of this approach is that only the "more is better" assumption is required in order to generate all efficient

[1]See Appendix 9.1 for a definition of an efficient solution used in multiobjective programs.

solutions. A specified value which represent a particular decision maker's preference structure of the objective function is not required prior to the optimization process. Multiobjective Linear Programming (MOLP) [2] is a typical example of this last type of technique. These techniques have three main disadvantages: first, the algorithms themselves are often very complex and hence difficult for decision makers to understand; and, second, many real problems are too large to solve using this approach; and, third, the number of efficient solutions generated is often too large and hence imposes a considerable cognitive burden on the decision maker to analyse them effectively, (Evans(1984)). However, the cognitive burden of some of these problems has been reduced as explained in Appendix 9.1.

9.3 The multiobjective optimization model of an interest-free IB

One of the main features that characterizes the operations of IBs is the fact that investment accountholders are treated the same way as equity shareholders. That is, getting their principal back and obtaining a positive rate of return on these funds depends entirely on the outcome of the projects financed by these funds (see chapters 3 and 5). It is therefore apparent that the management of IBs should optimize a multiobjective function within which the interest of these depositors must feature. It would have been much more easier for the management to accomplish this task if the interest of these depositors did not contradict or at least did not conflict with those of equity shareholders. However, this is not the case as the discussion that follows will demonstrate. According to the method of profit distribution in IBs the maximization

[2]See Appendix 9.1 for understanding some of the basic features of the MOLP technique.

of profit objectives of equity shareholders and investment accountholders depend, among other factors, upon two elements. These are the rate of return achieved from investment projects and the profit sharing ratios assigned to each group. We may recall equations 8.2 and 8.3, from chapter 8 page 167, to elaborate on this point. These two equations were specified respectively as follows:

$$SHP = R_s CLA + Brp[R_m MF + R_l LF] \tag{9.1}$$

$$DP = Drp[R_m MF + R_l LF] \tag{9.2}$$

Where, SHP = total share of equity shareholders in the profits realized by the bank.

DP = total share of investment accountholders in the profits realized by the bank.

Other variables as defined in chapter 8 page 163.

This analysis assumes that investment accountholders share the outcome of investment operations only. If we ignore for the time being the first part of the right-hand side of the first equation (i.e. $R_s CLA$) and replace SHP and DP by their equivalent values. That is:

SHP = $R_e E$ and DP = $R_{id} ID$, where R_e = the rate of return on equity shareholders funds (E),and;

R_{id} = the rate of return on investment accountholders funds (ID), the following equations are obtained:

$$R_e = \frac{1}{E} Brp[R_m MF + R_l LF] \tag{9.3}$$

$$R_{id} = \frac{1}{ID} Drp[R_m MF + R_l LF] \tag{9.4}$$

If we add further that, $R_m\text{MF} + R_l\text{LF} = R_{if}IF$, then the new equations will be stated as follows:

$$R_e = BrpR_{if}\frac{IF}{E} \tag{9.5}$$

$$R_{id} = DrpR_{if}\frac{IF}{ID} \tag{9.6}$$

It is clear from the above equations that:

R_e is a function of Brp, R_{if} and $\frac{IF}{E}$. That is R_e = f(Brp, R_{if}, $\frac{IF}{E}$); and R_{id} is a function of Drp, R_{if} and $\frac{IF}{ID}$. That is R_{id} = f(Drp, R_{if}, $\frac{IF}{ID}$). The only factor, from the above equations, that has a positive impact simultaneously on both R_e and R_{id} is R_{if}. That is the rate of return achieved from the outcome of investment operations (i.e. IF). However, even this factor does illustrate the conflict of interests of equity shareholders with those of investment accountholders. If the management tries to maximize the profits of both parties through this factor, i.e. R_{if}, this may require investing in long-term risky projects which may be acceptable to equity shareholders but it may not appeal to investment accountholders. This is simply because those latter ones may emphasize the safety of their funds. This safety may require investing in low-risk short-term investment projects. Adding to that the fact that most of the funds of these accountholders are of short and medium term maturities this will increase the pressure on the management to consider the interest of these depositors in determining the target objectives.

If we turn now to the other two factors (i.e. the profit sharing ratios (Brp and Drp) and the volume of funds assigned for investment operations (IF)), then the conflict of interest of the two parties is much clearer. We may recall that Brp + Drp = 1, then if management tries to maximize the share of profits to any group through the

utilization of the profit sharing ratio, this will be on the expense of the other. That is if the management tries to maximize R_e through Brp this will reduce the share of investment accountholders (i.e decrease in the value of Drp) and vice versa. The same argument could be applied to the volume of funds assigned to finance investment operations. If the management wishes to maximize the profits of equity shareholders, through IF, that may require an increase in ID and decrease or at least a fixed amount of E (look at $\frac{IF}{E}$ in equation 9.5) and the reverse is true for investment accountholders (see equation 9.6). From this brief discussion we may be able to conclude that maximizing profits for both equity sharholders and investment accountholders should be of high priority to the management of IBs. However, achieving this aim of conflicting interests may be a very difficult task to accomplish. Hence, an optimization technique is needed that can help in finding a solution to this conflict of interests using all available factors.

On the other hand reconciling the above mentioned conflict of interest of both equity shareholders and investment accounholders is not the only difficulty that the management of IBs face in determining the structure of assets, liabilities and capital accounts of their intermediaries; there is the risk element that must be taken into consideration. Taking this factor into account is derived from the fact that with each earning opportunity there is a probability of facing certain volume of risk associated with this opportunity. Hence it becomes clear that in order to maximize profits for equity shareholders and investment accountholders, the management of IBs must take necessary measures to protect the position of the bank from the inherent risks in the banking field. From the discussion in chapter 5 of the special nature of the ALM problem of IBs two types of risk were found to be very important; these are investment (i.e. variations of rates of return) and liquidity risks. The first type (i.e.

investment risk) deals with the uncertainty that characterizes the outcome of investment operations. It is therefore the responsibility of the management to study and analyze the probability distributions of rates of returns of the assets included in their portfolios in order to determine how much risk they are willing to take for achieving the desired rates of return. In finance theory this risk is usually measured by the variance of the portfolio (σ^2) [3] or its square root (σ). The main element used by financial managers to reduce the size of this risk is diversification [4], that is by spreading financial resources over different projects and sectors of the economy and even through geograghical diversification (i.e. investing in countries other than the domestic one). In short, reducing the size of this risk requires the adherence to the proverb "do not put all your eggs in one basket". Therefore, the investment risk that IBs face could be dealt with in the light of the guide-lines provided by portfolio theory. In this case the management of an IB will select the structure of assets, liabilities and capital accounts that maximizes the expected rate of return for a given volume of risk attached to it or vice versa. However, this type of risk (i.e. investment risk) could be dealt with from a different angle; that is it could be treated as an upper limit which cannot go above certain maximum accepted level. This level could be argued to be a zero rate of return from investment operations. This is because setting this maximum level to zero could at least virtually guarantee the safety of the principals of investment

[3] There are other measures used by academics like mean absolute deviation and semi-absolute deviations, see Brodt(1976,1978) and Zeleny(1982).

[4] The gains in risk reduction from portfolio diversification depend inversely upon the extent to which the returns on securities in a portfolio are positively correlated. Ideally the securities should display negative correlation. This implies that if a pair of securities has a negative correlation of returns, then in circumstances where one of the securities is performing badly the other is likely to be doing well, and vice versa in reverse circumstances. Therefore the 'average' return on holding the two securities is likely to be much 'safer' then investing in one of them alone ... in normal circumstances ... most securities will display a degree of positive correlation, as well are likely to be influenced by external trends in the economy. Nevertheless, there will still be some gains from risk diversification as long as the securities are not perfectly positively correlated, Allen(1983).

accountholders. In this study, however, it seems that risks of this type do not have a great effect on the total risk that the management has to face. This can be justified by the fact that the practices of IBs are still dominated on the assets side by low-risk and quickly realizable investment assets in real estate and trade sectors of the economy, as the empirical findings in chapter 7 indicate as well as the findings of Ahmad(1987). This, however, by no means should be considered as an underestimation of the size of this risk in the case of IBs, but it is only used as a justification of our certainty assumption about the rates of return on the operations of IBs in this analysis. We turn now to the second type of risk; that is liquidity risk. This type of risk could be defined as the possibility that the bank or any credit institution could run out of cash because of deposit withdrawals, requests of customers, especially those the bank has established relationships with, to meet borrowing needs, or any other immediate requests for cash. In order to quantify this type of risk it is important to spell out the sources that contribute to the presence of this type of risk and the necessary measures taken to reduce its size. As far as the sources are concerned in IBs they do not differ from those we have just listed. However, we will pay particular attention to deposit withdrawals. IBs accept basically two type of deposits those that can be withdrawn on demand (e.g. demand deposits) and those that can be withdrawn at least after a short notice (e.g. 30, 60 or 90 days). Hence since IBs accept the latter ones for specific and determined periods of time, it is left therefore that the main concern is demand deposits. So, how can IBs meet the withdrawal of this type of deposit? We have discussed this problem in chapter 5 where we found that IBs meet the requirements of liquidity requests through three main sources. These are the holding of vault cash and other short term assets, new deposits or injection into the existing ones and the maturing assets. It is the first factor which is our main concern in this discussion

because it is under the direct control of the management. Moreover, the management of IBs rely heavily on it to meet their liquidity requirements. It is therefore important to derive such a quantitative measure that links this factor (i.e. cash and other liquid assets) with the main source of deposit withdrawals (i.e. transaction deposits). In interest based banks in most developed countries the relationship between the two variables is usually specified by the monetary authorities as a minimum requirements that must be met (e.g. In the US for instance vault cash plus Federal reserve deposits (legal reserve) must be at least 12 percent of transaction account balances, Yeager and Seitz (1989)). In the case of IBs we can argue that the management of IBs should regard this minimum requirements as a goal to be attained, because of the limitation use of other ways (e.g. borrowing on the basis of interest rate) of meeting liquidity requirements. And we will argue further that vault cash and other short term liquid assets plus legal reserves should at least be kept as an amount that equals the amount of transaction deposits, because achieving this target could at least ensures the confidence of depositors that their bank is not in a position of bieng unable to meet its obligations of deposit withdrawals. Using the variables we have introduced in chapter 8, this goal could be stated as follows:

$$CLA + SR \geq CD$$

dividing both sides of the above equation by CD will produce the following equation:

$$\frac{CLA+SR}{CD} \geq 1$$

From the above discussion we can conclude that in determining the structure of the assets, liabilities and capital accounts the management of IBs should optimize a utility function within which at least three main objectives are included. These are:

1. Maximizing the share of profits of equity shareholders.

2. Maximizing the share of profits to investment accountholders.

3. Minimizing the amount of risk involved.

It becomes clear that conventional Linear Programming (LP) can no longer be applied in this situation. A Multiobjective Linear Programming (MOLP) is therefore suggested to solve the multiobjective ALM problem of IBs. Since the first two objectives (i.e. number 1 and 2) have been specified in the previous chapter and treated as constraints in that occasion, we are not going to repeat the process carried out there. Hence, these two objectives are kept as specified in equations 9.1 and 9.2. However, for the third objective a quick reference is given below of how we are going to incorporate it in the MOOM model. We have stated this objective as a goal to be attained and as a matter of fact we know that Goal Programming deals with this type of specification . We have learnt from Zeleny (1982) [5] that in the case of a single goal in a particular Goal Programming problem this can be converted easily to the optimization of the objective function itself instead of optimizing the deviations [6] (i.e

[5]The following example is extracted from Zeleny (1982) to demonstrate how this can be done: Suppose that there is only one goal, to attain at least a minimum profit of 12 dollars. This single goal problem can be specified as follows:

$$\text{Minimize } d^-$$

subject to

$$4x_1 + 3.2x_2 - d^+ + d^- = 12 \text{ and feasible set X.}$$

Our goal, then, is to minimize underachievement of the target profit, and we do not care if we overachieve; that is, d^+ can be as large as possible. Minimizing d^- amounts to minimizing 12 - $(4x_1 + 3.2x_2)$, which is the same as maximizing $4x_1 + 3.2x_2$.

[6]The GP technique assumes that all goals or objectives can be quantified and ranked. It is possible with GP to put weights on the goals or objectives which represent a hierarchical in which goals should be satisfied. Thus GP asks management to set some estimated targets for each of their goals and to put priorities on them, that is, to rank them in order of importance. When this information is supplied, GP tries to minimize the deviations from the targets that were set. It begins with the most important goal and keeps on until the achievement of a less important goal would cause management to fail to achieve a more important one, (Levin, Rubin and Stinson (1986)). In short, in the GP the manager sets levels which he would like his objectives to reach, and see if there

the under- and over-achievements) from the target goal. Thus in our case we have the following goal:

$$CLA + SR - CD \geq 0$$

In the case of Goal Programming this problem would be specified as follows:

Minimize d^-, subject to:

$$CLA + SR - CD - d^+ + d^- = 0$$

Where, d^- = the underachievement of the target objective; and

d^+ = the overachievement of the target objective.

It should be noted that the value of d^+ is not as important as d^-, because in the case of d^- we would like it to be as small as possible therefore we should minimize it. The above specification is equivalent to the following statement (see footnote 5):

Max(Z) = CLA + SR - CD, subject to the specified constraints.

It is clear from the above treatment of the multiple criteria nature of IBs that the MOOM model differs from the SOOM model in the inclusion of objectives other than the single maximization of profits assumed in the latter. Hence the constraints developed and spelled out in chapter 8 are still applicable in the case of the MOOM model.

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is a solution which attains all these goals, or if not, find one which is close to doing so, (French, Hartly, Thomas and White (1986)).

9.4 Comparing the results of the MOOM model with the actual results of KFH and JIB

Having identified and specified the objectives to be included in the MOOM model, the next step is to generate the values of the items of the balance sheets of the institutions selected. After the completion of this task a critical assessment of the obtained results is carried out. To accomplish this latter task the results generated through the application of the MOOM model are compared with those actually achieved by the management of KFH and JIB. Hence the main theme of this section is to discuss these points in some details. In order to do that the same planning periods are chosen as those in the case of the SOOM model. That is the planning periods of the financial years for both institutions are 1988 - 1989 and 1987 - 1988 respectively. Moreover, the same data input and constraints developed in chapter 8 are used to generate the items of the balance sheets through the application of the MOOM model. Therefore, the same reservation made about this comparison task in the case of the SOOM model is still valid. That is the ideal way to compare the results of the MOOM model with those actually achieved would have been to utilize the internal data that the management have used for their planning and decision activities.

9.4.1 Comparing the MOOM's results with the actual ones of KFH.

For generating the optimal balance sheet of KFH for the year ended 1989 through the application of the MOOM model, the structure of the model displayed in Appendix 8.3, plus the inclusion of the risk objective to be optimized were combined to produce the structure of the MOOM program for KFH. Thus in the case of KFH two objectives

were included only. These are profits and risk. The reason of including profit as a single entity was due to the policy adopted by the management of the House that investment accountholders share in all profits realized from the operations of the bank see chapter 8 pages 167 and 168 for more details). Hence, the two objectives to be optimized are stated as follows:

$$MaxTP = R_s CLA + R_m MF + R_l LF \tag{9.7}$$

$$MaxVLR = CLA + SR - CD \tag{9.8}$$

Where, TP = the amount of total profits realized from the operations of the House, and;

VLR = the amount of the volume of liquid assets kept as cash or as legal reserves over the volume of funds attracted through current accounts (CD).

The above described structure of the MOOM model has been input to ADBASE [7] to calculate the values of the items of the balance sheet. The results of one of the efficient extreme points [8] obtained are summarized in the following Tables:

Table 9.2 Values of the objective functions generated by MOOM model

Item	TP	VLR
Value(mKD)	52.7	55.3

[7]ADBASE is a software package developed by Professor Steuer (1991) for solving multiple objective linear programs for all efficient extreme points and all unbounded efficient edges.

[8]ADBASE has generated 6 efficient extreme points and we have selected this extreme point on the basis that it might provide a reasonable strategy, in our point of view, of a combination between risk and return. The significance of other points and their usefulness are discussed in the next section.

Table 9.3 The Balance Sheet of KFH generated by the MOOM model at the end of 1989.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	173	15	CD	139.1	12.1
IF	840.7	72.9	DFI	123.6	10.7
CW	111.7	9.7	ID	788.2	68.3
OA	10	0.9	E	52.5	4.6
FA	18	1.5	OL	50	4.3
TA	1153.4	100	TL	1153.4	100

The other results which might be helpful in the discussion process are given in the Table below:

Table 9.4 Values of other variables obtained by the MOOM model for KFH.

item	NP	MF	LF	SD	UID	D	SR	GR
mKD	49.7	462.4	378.3	525.4	262.7	1050.8	21.4	5.2

The results actually achieved by the management of KFH are presented in the Tables below:

Table 9.5 Values of the objective "functions" actually achieved

Item	TP	VLR
Value(mKD)	47.9	52.2

We should note, however, that in this case VLR has been extracted from the annual report of the House for the year ended 1989 and therefore we cannot claim that this has been regarded as an objective to be optimized. Its inclusion in this manner, however, is to make comparison between the two results convenient and possible.

Table 9.6 The actual Balance Sheet of KFH at the end of 1989.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	162.2	14.3	CD	128.6	11.4
IF	889.9	78.6	DFI	100.2	8.8
CW	51.4	4.5	ID	804.5	71.1
OA	10.4	1	E	51.1	4.5
FA	18	1.6	OL	47.9	4.2
TA	1131.9	100	TL	1131.9	100

Note: values in this and the previous Tables are expressed in millions of Kuwaiti dinars (mKD).

Table 9.7 Values of other variables generated

item	NP	MF	LF	SD	LID	UID	D	SR	GR
mKD	33.3	494.7	395.2	509	12.3	283.2	1033.4	18.6	1.6

Note: values in this and the previous Tables are expressed in millions of Kuwaiti dinars (mKD). The above results have been compiled from the annual report of KFH for the year ended 1989.

Discussion of the results obtained.

In the light of the above results the following general remarks are made:

The amount of total profits generated through the model is higher than that actually achieved by the management of the House by a difference of almost 10 per cent. The discrepancy between the two values may due to two main reasons: first, is the assumption we have made that the House is applying two modes of finance only to channel its funds. This assumption may have affected the results achieved by not including some other modes of finance (e.g construction work) which may generate negative or at least very low rates of return. The second reason is the treatment of funds in the CLA item. The funds placed in this item have been considered as a single block that generates rates of returns from banking service operations; however, part of these funds are kept as cash and balances with other banks. This latter element does not generate any returns to IBs because interest is not practised' and the absence of short-term avenues based on the principles of Islamic Law (*Shari'ah*), through which these funds can be placed. Having said that, however, we should note that the value of

total profits achieved by the MOOM model are much closer to the actual ones than those obtained through the application of the SOOM model. This may due to the incorporation of risk in the modelling process, as the next point will demonstrate.

The values of the other objective function in the actual and MOOM model cases are almost equal. There is a difference of mKD 3.1 only (i.e. the value of VLR generated through the MOOM model is higher than the value of VLR achieved actually by 6 per cent). Moreover, if we calculate the values of the ratio $\frac{CLA+SR}{CD}$ in both cases we will find that these values are exactly the same.

$$\frac{CLA+SR}{CD} \text{ (in the case of MOOM)} = 1.3975 \approx 1.4$$

$$\frac{CLA+SR}{CD} \text{ (in the actual case)} = 1.4$$

The closeness of the results in the two cases might due to the fact that IBs, as explained in the previous point, still meet their liquidity requirements mainly through these elements (i.e. CLA and reserves). That is why it may be the case that the management of these institutions, in determining the composition of the assets and liabilities of their intermediaries pay considerable attention to liquidity risk and how can it be met through the variables under their direct control. This policy might have been pursued by the management of KFH. Although we cannot claim that we have found such a clear indication to this policy in the available material, it is clear from the examination of the pattern of the growth of these variables (i.e. CLA and reserves) over the years under observation that they constitute important elements of the balance sheet.

The value of total assets(total liabilities), in terms of millions of Kuwaiti Dinars (mKD), generated by the model is greater than that actually achieved by the management of KFH at the end of 1989. The difference, however, is not that significant. It constitutes 2 per cent (mKD 21.5) only between the two items. This slight difference between the two values might be the result of two factors. First, the way we have forecast the values of TA(TL) in the case of the model. That is we have considered time trend as the sole independent variable. In the real world, however, TA(TL) as well as other variables might be better considered as variables that are affected by other factors, see chapter 8 page 175 for more details of this point. The second factor is related to an element which the model did not take into account. This element is the reduction of the value of deposits kept in the House or funds deposited with other financial intermediaries as explained in the previous chapter, see pages 175 - 176. Nevertheless, these general remarks have given a good indication of how important is the treatment of risk and its incorporation in the MOOM model.

After making these general observations we turn now to compare some other results obtained through the application of the MOOM model. In this case our discussion is mainly limited to the most important variables. These are CLA and IF on the assets side and CD, ID and E on the liabilities side. These variables, in the case of the model, have a great effect on the objectives to be optimized (i.e. profits and risk). Moreover, their contribution to the size of the balance sheet is quite considerable. Whether in the case of the model or in the actual case this contribution did not go below the level of 85 per cent of total assets (total liabilities). The general outlook of the results generated through the model are close to those actually achieved. However, the two blocks of the balance sheet with respect to these variables did not show the same

pattern. The results of the liabilities are more close than those of the assets ones (note we are talking about the percentage values of the balance sheets). If we looked now to the values of the whole variables we may be able to conclude that the MOOM model has captured the policies adopted by the management of the House. The main thing that the MOOM model has taken into account is the treatment of risk and its minimization. Although in this situation our discussion was limited to one type of risk, that is liquidity risk, it has in fact affected the course of the results achieved by the MOOM model and makes its results much closer to those actually achieved than under the SOOM model.

9.4.2 Comparing the MOOM's results with the actual ones of JIB.

In the case of JIB three objectives have been incorporated in the MOOM model. These are: maximizing share profits of both equity shareholders and investment accountholders, and minimizing liquidity risk. The inclusion of these three objective functions due to the policy adopted by the management of the bank. According to this policy the share of investment accountholders in the profits realized by the bank is limited to the outcome of investment operations, see chapter 8 pages 168 - 169. In order to generate the values of the balance sheet items the structure of the MOOM model comprising of the constraints displayed in Appendix 8.3 and the objectives presented below has been submitted to ADBASE software package to calculate the values of the items of the balance sheet for JIB at the end of 1988. The objective functions are as follows:

$$MaxSHP = R_s CLA + Brp[R_m MF + R_l LF] \tag{9.9}$$

$$MaxDP = Drp[R_m MF + R_l LF] \tag{9.10}$$

$$MaxVLR = CLA + SR - CD \tag{9.11}$$

Where, SHP = total amount of shareholders share in the profits realized.

DP = total amount of depositors share in the profits realized from investment operations.

VLR = The amount of liquidity requirements kept as cash and other short term assets or as reserves over the value of funds attracted through current deposits (CD).

The results obtained through the application of the MOOM model [9] are presented below:

Table 9.8 Values of the objective functions.

Item	SHP	DP	VLR
Value(mJD)	4.9	5.8	45

Table 9.9 The balance sheet of JIB generated by the MOOM model at the end of 1988

Assets	mJD	% of TA	Liabilities	mJD	% of TL
CLA	72.5	33.6	CD	30.9	14.3
IF	118.5	54.9	ID	137	63.5
FSP	15.3	7.1	SIA	15.9	7.4
OA	4.9	2.3	SRIR	4.5	2.1
FA	4.6	2.1	E	10.2	4.7
			OL	17.3	8
TA	215.8	100	TL	215.8	100

The other data which might be helpful for comparison reasons are presented in the Table below:

[9] Only one efficient extreme point has been generated.

Table 9.10 Values of other variables determined by the MOOM model

item	SR	GR	TC	NP	D
value(mJD)	3.36	.86	2.29	2.58	183.8

Note: values of the variables in this and the previous Tables are denoted in terms of millions of Jordanian dinars (mJD).

The actual results generated by the management of JIB are presented in the following Tables:

Table 9.11 Values of the objective functions actually realized

Item	SHP	DP	VLR
Value(mJD)	3.1	5.6	39.2

Table 9.12 The actual Balance sheet of JIB at the end of 1988

Assets	mJD	% of TA	Liabilities	mJD	% of TL
CLA	74.7	33.6	CD	38.7	17.4
IF	124.1	55.8	ID	142.6	64.1
FSP	15.9	7.1	SIA	17.1	7.7
OA	2.8	1.3	SRIR	4.2	1.9
FA	4.9	2.2	E	10	4.5
			OL	9.8	4.4
TA	222.4	100	TL	222.4	100

The values of other variables which might be helpful in comparing the actual with the calculated results of the model are presented in the Table below:

Table 9.13 Values of other variables actually achieved

item	SR	GR	TP	TC	NP	D
value(mJD)	3.2	.75	10.4	2.7	1.15	177.8

Note: values in this and the previous Tables are expressed in terms of millions of Jordanian dinars (mJD).

Discussion of the obtained results.

From reference to the results presented in the Tables above, the following general observations are made:

With respect to the values of the objective functions, the only values that are close to each other are those of DP. In this case the value of DP generated through the MOOM model is higher than that actually achieved by a difference of 3.8 per cent only. However, the values of other objective functions did show a great divergence between the two results. The biggest difference is that between SHP of the model and SHP achieved actually (a difference of 58 per cent), whereas in the case of VLR there is a difference between the two results of 15 per cent. The discrepancy between the two results may due to the CLA factor and the assumption of constant costs in the case of SHP and the actual value of CD in the case of VLR. In the former case (i.e. SHP) funds placed in the CLA element has been treated as one block. That is these funds have been considered to be used in financing services which generate rates of return to the bank. In reality part of these funds are kept as vault cash and balances with other banks for liquidity purposes. Therefore this part of CLA does not generate any income. The effect of the assumption of constant costs is very plausible in making the profits of shareholders greater than the actual case (i.e. the assumed value of costs is equal to mJD 2.29 whereas the actual cost is mJD 2.7). In the latter case, i.e. the case of the VLR objective function, the difference between the two values may due to the value of CD actually realized, because it is higher than that generated through the model. For this reason as well the values of the ratio $\frac{CLA+SR}{CD}$ are not so close to each other.

$\frac{CLA+SR}{CD}$ (the case of the MOOM model) = 2.45

$\frac{CLA+SR}{CD}$ (the actual case) = 2.00

The values of total assets (total liabilities) in both cases are not far from each other. This may due to the fact that the upward trend in the values of TA(TL) over the years under observation has been captured by the time trend equation used to forecast the value of TA(TL) for the year ended 1988 as well as other reasons as spelled out in chapter 8 pages 186 - 187.

It can be noticed that the bank is meeting its liquidity requirements mainly through the CLA factor. In both cases (i.e. the actual as well as the case of the MOOM model) the value of CLA is much more higher than the values of CD. In the case of the model the ratio $\frac{CLA}{CD}$ is more than double, whereas in the actual case this ratio is almost equal to double.

Having made the above general remarks, attention is now focused on comparing the two results in more detail. In this case much emphasis is placed on the percentage presentation of the items of the balance sheets. Moreover, discussion will focus mainly on the variables that have a very important influence on the objectives assumed to be optimized in the case of the model. These variables are CLA and IF on the assets side and CD, ID and E on the liabilities side. If we look at the percentage contribution of these variables to the volume of total assets (total liabilities), see Tables 9.9 and 9.12, we will notice how close the results are in both situations. The largest difference is that of between CDs and it is slightly above 3 per cent. In the actual case CD is equal to 17.4 per cent of total liabilities, while the percentage of CD with respect to total liabilities in the case of the model is equal to 13.4 per cent. This closeness of results might due to the fact that policy constraints and objectives formulated in the model might have been captured or at least are very close to those adopted by the management of the bank. The reason why this might be the case is the small size of the bank; therefore its management might have pursued a conservative

policy in structuring the assets and liabilities of the bank. In addition, in the process of determining the components of the balance sheet it might be the case that the management is paying considerable attention to meet its liquidity obligations and ensuring them through the variables under their direct control. Further management have allocated a certain percentage of profits realized from investment operations in good times in order to cover any losses in bad times (the element of the balance sheet used for this purpose is SRIR). From this brief discussion one might conclude that the general performance of the MOOM model is quite good in the sense that it was able to incorporate some of the policies that might have a great influence on the decision process of the decision maker(s) and the results of the MOOM model have dominated those actually achieved.

9.5 Some Managerial Implications

In section 2 of this chapter we have discussed the methods available of tackling multiple objective programs. In that discussion it was stated that MOLP falls in the category of methods that find all or most of the efficient solutions. However, most of the available packages locate efficient extreme points only, because the number of all efficient solutions might be countless. Nevertheless, our main concern is not this. Our main interest is what do these results mean or offer decision maker(s)? In calculating the items of the balance sheet of KFH ADBASE generated 6 efficient extreme points. One of these points has been analyzed in the previous section, the remaining are presented in Appendix 9.2. This simple exercise tries to find the nondominated solutions and present them to the decision maker(s) to select the "best" overall solution which might fulfil the utility being optimized. The results presented to our decision maker

in the case of KFH can be grouped under three main preferences:

1. The first is the one in which the overriding concern of our decision maker is profits. This preference could be met by selecting one of the set of the four solutions (i.e. extreme points 1, 2, 3 and 5). One of these solutions (i.e. extreme point 5) has generated the same results as those of the single objective optimizing model (SOOM). Therefore, if the decision maker is trying to maximize profits whatever the level of risk then he should select one of these solutions.

2. The second is the one in which the decision maker is trying to maximize profit but on the same time is paying attention to the level of risk that is going to face. This policy might be the case of extreme point 6 which we have discussed in the previous section.

3. The third is the one in which the overriding factor of our decision maker is the minimization of risk. This policy is presented in the efficient extreme point number 4.

The above discussion shows how the results of the MOLP technique might provide decision makers with explicit trade-offs that are required between nondominated solutions. Based on these trade-offs and the decision maker preferences for the various objectives, a multiobjective maximizing solution can be selected. In this case the MOLP allows the introduction of the utility function into the decision making process without requiring its prior explicit introduction into the model.

9.6 Concluding Remarks

From the above results and the discussion that followed the following remarks are made:

The general performance of the model is quite encouraging in the sense that the results generated through the MOOM model have captured some of the policies that might be pursued by the management of the selected institutions. This might be applied to funds utilization ratio (FUR) and liquidity requirements (LR) constraints and the inclusion of the risk objective function.

The incorporation of risk objective function in the MOOM model has affected the results and have made these results closer to those actually achieved. This might imply the fact that liquidity risk is given considerable attention by the management of these institutions. This is not a surprising finding since these institutions are working in localities within which the established available means of meeting liquidity requirements cannot be used by them because of the prohibition of paying or receiving of interest.

The development of the MOOM model does not require much change to the work carried out in the case of the single objective optimization model SOOM model.

The managerial implications of the obtained results are quite useful. The decision maker is not required to set up a prior target to his objectives. On the contrary, he will have the opportunity to use his preferences and skills to select the policy which he thinks is going to optimize his utility function.

The main source of ensuring liquidity is CLA and reserves as it was found in the previous case of the SOOM model. This is not strange since short term interest

instruments are excluded and the limitation of the avenues of exploiting these short term funds on the basis of Islamic Law (*Shari'ah*).

Appendix 9.1 Some essential features of Multiobjective Linear Programming Technique

MOLP is a technique that uses the concept of nondominant solution. The MOLP, therefore, attempts to optimize all objectives simultaneously subject to the specified constraints. The output of the procedure is a set of solutions which is said to be non-dominated. A nondominated solution is a solution for which no objective function can be improved without some impairment of other objectives, (Eatman and Sealy (1979)). The nondominated solution concept, provided by the MOLP, is equivalent to an efficient solution in the theory of portfolio analysis. When the set of efficient solutions is obtained, managers use their subjective preferences, experience and judgment to choose the solution that is more preferable to them. The utility function is thus introduced by the bank managers themselves and does not require explicit specification, (Eatman and Sealy (1979)). Therefore, the best "overall" solution chosen by the management depends on their utility function and their evaluation of the trade-offs that can be derived from the solutions, (Eatman and Sealy (1979)). In summary, in the MOLP the manager is trying to find all the efficient solutions, with the property

that there is no other solution which is better or as good as it in all the objectives, (French, Hartley, Thomas and White (1986)). Thus, the multiobjective mathematical program (MMP) can be stated as follows: the MMP is an algorithm which tries to assist a decision maker in the problem of selecting values for each n decision variables, x = (x_1, x_2, ... x_n) in order to optimize p(p $\geq$ 2) objective functions f_1(x), f_2(x), ... f_p(x), subject to various constraints on the decision variables. Mathematically the MMP program can be summarized as follows:

Optimize F(X) = [f_1(x), f_2(x), ... f_p(x)], subject to x $\in$ X.

Algorithms that solve these types of programs utilize the concept of efficient solution to be obtained. An efficient solution x^E to the above problem is a feasible solution, $x^E \in X$, for which does not exist any other feasible solution, x $\in$ X, such that $f_i(x^E) \leq f_i(x)$ for all i = 1,2, ... p, and $f_i(x^E) < f_i(x)$ for some i = 1,2,3, ... p, (Evans(1984)). The algorithms developed to solve multiobjective programs can be divided into two categories, Evans(1984):

1. Those which concentrate on finding all efficient extreme points, examples of the work carried out in this category are to be found in Steuer(1971, 1991).

2. Those which concentrate on finding all efficient points, regardless whether these points are extreme or not, example of this work are Yu and Zeleny (1975) and Ecker(1980).

Each of the above approaches has its merits and demerits. The first category of algorithms produces some of the efficient points (i.e. extreme ones) and hence reduces the long list from which the decision maker is going to choose the "best" overall solution. However, in many problems the best-compromise solution is an efficient point that is not an extreme point of the constraints set, (Evans(1984)). Academics, who

have developed algorithms that lie in the area of the second category, have taken this argument to develop methods that generate all efficient solutions. Evans(1984) states that these algorithms are often unsatisfactory for the reasons stated in page 217 and the fact that these algorithms usually produce an infinite number of efficient solutions. To overcome these problems Steuer (1976) developed a procedure for eliminating many of the efficient points prior to the optimization by assigning lower and upper bounds to weights attached to each of the objectives. Zeleny (1982), on the other hand, has developed the method of "disposal ideal" for reducing the set of efficient solutions generated from MMP. The method used to reduce the set of efficient solutions is by removing each solution which results in an outcome which is at a certain distance or further from the " disposal ideal". For more details on this staff see Evans (1984) and Zeleny (1982). The latter is extremely recommended for understanding the multicriterion simplex method which is usually used in packages to derive the set of efficient extreme points.

Appendix 9.2 The other Results generated by the MOOM model for KFH

In this appendix the other five extreme efficient solutions derived by the MOOM model for KFH are displayed.

1. **The results of the efficient extreme point number 1.**

Table 9.14 Values of the objective functions

Item	TP	VLR
Value(mKD)	57.9	43.1

Table 9.15 The Balance Sheet of KFH generated by the MOOM model at the end of 1989 extreme point 1.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	176.27	15	CD	155	13.2
IF	931.91	79.3	DFI	38.23	3.2
CW	38.96	3.3	ID	878.33	74.7
OA	10	0.9	E	53.58	4.6
FA	18	1.5	OL	50	4.3
TA	1175.14	100	TL	1175.14	100

The other results generated by the model are given in the Table below:

Table 9.16 Values of other variables obtained by the MOOM model for KFH.

item	NP	MF	LF	UID	D	SR	GR
mKD	44.9	512.5	419.4	878.33	1071.6	21.9	5.7

2. **The results of the efficient extreme point number 2.**

Table 9.17 Values of the objective functions

Item	TP	VLR
Value(mKD)	57.9	43.1

Table 9.18 The Balance Sheet of KFH generated by the MOOM model at the end of 1989 extreme point 2.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	176.27	15	CD	155	13.2
IF	931.91	79.3	DFI	38.23	3.2
CW	38.96	3.3	ID	878.33	74.7
OA	10	0.9	E	53.58	4.6
FA	18	1.5	OL	50	4.3
TA	1175.14	100	TL	1175.14	100

The other results generated in this point are given in the Table below:

Table 9.19 Values of other variables obtained by the MOOM model for KFH.

item	NP	MF	LF	SD	UID	D	SR	GR
mKD	44.9	512.5	419.4	535.8	342.5	1071.6	21.9	5.7

3. **The results of the efficient extreme point number 3.**

Table 9.20 Values of the objective functions

Item	TP	VLR
value(mKD)	57.9	43.1

Table 9.21 The Balance Sheet of KFH generated by the MOOM model at the end of 1989 extreme point 3.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	176.27	15	CD	155	13.2
IF	931.91	79.3	DFI	38.23	3.2
CW	38.96	3.3	ID	878.33	74.7
OA	10	0.9	E	53.58	4.6
FA	18	1.5	OL	50	4.3
TA	1175.14	100	TL	1175.14	100

The other results generated through this point are given in the Table below:

Table 9.22 Values of other variables obtained by the MOOM model for KFH.

item	NP	MF	LF	LID	UID	D	SR	GR
mKD	44.9	512.5	419.4	610.4	267.9	1071.6	21.9	5.7

4. **The results of the efficient extreme point number 4.**

Table 9.23 Values of the objective functions

Item	TP	VLR
Value(mKD)	20.7	130.3

Table 9.24 The Balance Sheet of KFH generated by the MOOM model at the end of 1989 extreme point 4.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	152.8	15	CD	40.7	4.1
IF	276.9	27.1	DFI	651.4	63.9
CW	561.3	55.1	ID	230.7	22.6
OA	10	1.0	E	46.2	4.5
FA	18	1.8	OL	50	4.9
TA	1019	100	TL	1019	100

The other results generated through this point are given in the Table below:

Table 9.25 Values of other variables obtained by the MOOM model for KFH.

item	NP	MF	LF	UID	D	SR	GR
mKD	7.7	152.3	124.6	230.7	922.9	18.2	1.97

5. **The results of the efficient extreme point number 5.**

Table 9.26 Values of the objective functions

Item	TP	VLR
Value	57.9	43.1

Table 9.27 The Balance Sheet of KFH generated by the MOOM model at the end of 1989 extreme point 5.

Assets	mKD	% of TA	Liabilities	mKD	% of TL
CLA	176.27	15	CD	155	13.2
IF	931.91	79.3	DFI	38.23	3.2
CW	38.96	3.3	ID	878.33	74.7
OA	10	0.9	E	53.58	4.6
FA	18	1.5	OL	50	4.3
TA	1175.14	100	TL	1175.14	100

The other results generated through this point are given in the Table below:

Table 9.28 Values of other variables obtained by the MOOM model for KFH.

item	NP	MF	LF	SD	LID	UID	D	SR	GR
mKD	44.9	512.5	419.4	535.8	74.7	267.7	1071.6	21.9	5.7

Chapter 10

Conclusions and Suggestions for Future Work

In this research we have dealt with the asset and liability management (ALM) problem of an Interest-free Islamic Bank (IB) and then we constructed mathematical models of the linear versions of single-and multi-objective forms to solve this problem. This effort was preceded by a thorough and detailed discussion of the nature and magnitude of the operations carried out by an IB and the implications of these operations on the ALM problem of these intermediaries. The main findings of this study are summarized as follows:

1. Financial intermediaries are very important vehicles for the process of pooling and transmitting funds as well as providing other services in modern economies. They carry out this function through the use of financial instruments. In this process two arrangements are provided; one for surplus economic units (i.e. secondary securities) and the other for deficit economic units (i.e. primary securities). Most of these arrangements are based upon interest rate mechanism; that is holders of these securities are promised at a future date the payment of their capital sums and a pre-determined positive rate of interest.

2. Interest-free IBs are those financial intermediaries that provide financial services to their customers on the basis of the principles laid down by Islamic Law (*Shari'ah*). Prohibition of *Riba* (interest is one form of it) in all transaction dealings is one important element of these principles that must be adhered to. This study has demonstrated that working within the framework of these principles has made some of the operations of IBs different from those carried out by their interest-based (IBBs) counterparts. This difference has been noticed qualitatively as well as quantitatively. Although on the qualitative level both intermediaries (i.e. IBs and IBBs) are similar in purpose; that is the provision of financial services, they have major contrasts on the intermediation function. These contrasts are summarized in the following Table.

Table 10.1 Major contrasts between IBs and IBBs

Islamic Banks (IBs)	Interest-based banks (IBBs)
Accept investment funds on the basis of PLS principle. Thus investment account holders are not guarantied the nominal values of their funds. Paying back these funds depends entirely upon the outcome of the operations financed by the bank.	Accept investment funds on the basis of interest mechanism. Thus depositors at the very least are guarantied the values of their capital sums. These funds and any interest are paid regardless the outcome of the operations of the bank.
Funds are passed on the same basis. That is PLS mechanism and therefore the results of the bank depend on the success/failure of the financed projects.	Funds are passed on to borrowers on the same basis. That is interest and the borrowed funds are paid regardless the outcome of the financed projects.
In addition to the supervision of the central bank the operations of most of these banks are inspected by religious supervisory committees to ensure the conformity of these operations to the principles of Islamic Law	The main regulatory body is the central bank.

On the quantitative level, it seems that IBs tend not to add to the available liquidity created elsewhere, whereas their interest-based counterparts tend to add to the liquidity of the rest of the economy.

3. The ALM problem of IBs is of special nature. This special nature is derived from the instruments applied by these intermediaries to pool and transmit funds as well as the environment through which they operate. The instruments used by IBs are not pure financial assets as applied so far, and hence these instruments cannot be traded in organized financial markets. The environment through which IBs operate affects the ALM problem because of the dominant role of interest based dealings in many countries. As a result major opportunities cannot be exploited (e.g. trading in money and capital markets).

4. Islam is a complete way of life as such the financial system constitutes one part only of this code of life. The major implication is that taking a single part in isolation from other parts may not produce the desired results. For instance, the whole code of this system is based on the belief of *Allah* (i.e. God) and the day of judgement. If the people who are supposed to be Muslims are not aware that they will to account for what they have done, this may affect their financial practices by underreporting the results of their projects. Therefore, those who are involved in the 'Islamization' process should be aware of this fact and hence they should provide a comprehensive educational program as an essential part of completing the task of 'Islamizing' the financial system. This by no means should be interpreted as abandoning the process of establishing financial institutions on the basis of Islam, but it should be taken in the context of emphasizing the comprehensiveness of Islamic way of life and the pitfalls or difficulties that might be faced if one part of this system is implemented in an environment that is not fully guided by the Islamic code.

5. As for the application of linear programs, it is difficult to draw any definite conclusions from the data we have presented. Nonetheless, it is clear that the specific models (i.e. SOOM and MOOM) do offer considerable insight into the way some policies are adopted by the management of IBs. This is apparent in the case of funds utilization and liquidity requirements ratios. However, the treatment of risk in the case of the MOOM model has affected the results by making them much closer to those actually achieved than under the case of the SOOM model. Therefore, with considerable caution we might say that linear optimization programs do offer some hope as means to help the management of IBs in determining the 'optimal' structure of the balance sheet of their banks.

6. It is evident that managerial implications of the results generated through these models offer very valuable information. Optimization techniques should be presented, therefore, as managerial tools rather than as mechanical approaches of deriving optimal solutions only.

7. The major difficulty faced, in generating the 'optimal' solutions through the application of these linear optimization techniques, was obtaining the appropriate data. The data used in thsi study was extracted from annual reports alone. This is a serious limitation, but unvoidable weakness of the present study. The ideal way of deriving conclusions from the use of these models requires at least virtual data to that used by the decision maker.

8. Not much cost is expected to be incurred if the management of IBs decides to adopt optimization techniques of the sort of the models we have developed in this study in their planning and managerial activities. Basically three elements are essential in these process: the analyst (model builder or management scientist), the model itself and the decision maker. It might be possible that at early stages of adopting this process that much time needs to be spent in establishing a very effective communication system and bridging the gap between the

understanding of the analyst and that of the decision maker, and hence reorganization of the data bases that provide the model builder with the necessary and appropriate data. Once this essential and initial stage is completed on a sound ground I do not think that the years to come will require as much time as that spent at the initial stage. As for the likely benefits that might be achieved, these are listed as follows:

- Reorganization of the information data in such a detailed and appropriate way that will be very useful for planning and decision making activities.
- Implementation of these models allows decision makers to evaluate different courses and hence have an overview about the policy to be selected under specific circumstances.
- Formulating real world activities may help us in increasing our understanding to these real phenomena, especially if we recognize the fact that mathematical optimization models consider simultaneously all aspects of the problem analysed.

However, the above listed benefits should not be considered in isolation from the limitations that optimization techniques have. The greatest, among others, is the fact that these models are merely abstract approximation of the real world phenomena. As such the developed models must necessarily be incomplete or inaccurate in some aspects. This is so because the real world is too complex to manipulate or understand without the help of an intellectual simplifications that models present. Therefore, rather being seen as a rigid guide to action, the solution provided by these models should be viewed as strategic plan to which tactical modifications, based on nonquantifiable subjective factors; may be necessary. Thus the use of these models should not be considered as a replacement to management judgement, but should serve as a basis for communication, coordination,etc. In short, benefiting from implementing these models requires an

interaction between the model builder, the decision maker and the model itself through computer programs. Cohen (1969) states "when management-oriented scientists work jointly with senior executives to develop the economic substance and banking meaning of the management science models, the results are usually very relevant to the executives' problems".

Suggestions for Future Work

The subject of Islamic banking is still a very fertile and new area as such many avenues yet to be explored. Here I point out a few avenues with respect to current research of the ALM problem and the area of Islamic banking in general. As far as the current research is concerned, there are several ways in which this study could be extended. One way is to consider the multiperiodicity of the ALM problem of IBs. Thus monthly or quarterly programs could be developed so as intertemporal links can be developed and more detailed constraints and variables can be included. Another venue is to enlarge the sample size by including other banks working under different economic conditions or just to cover as many banks as possible so that it would be possible to derive conclusions that can be generalized. Actual implementation of these models is a third possible way. Finally, managerial implications of these models could be extended to include more constraints, objective function parameters and structural coefficients in the case of the SOOM model and critical evaluation of the different non-dominated efficient solutions in the case of the MOOM model.

In the area of Islamic banking the following general topics are briefly listed:

- Firstly, the implications of establishing commercial banks on a pure equity basis for monetary policies as well as for the management of these institutions. In particular stability of this system, bank runs and failures, liquidity distribution and creation,etc.

- Secondly, critical evaluation on macro-level of the 'Islamization' process of the financial system in countries such as Sudan and Pakistan so as to determine the positive steps, and enforce them, and identify the weaknesses so as to avoid them, as well as such study will be fruitful for other experiments.

- Thirdly, accounting and financial reporting needs particular attention, so that standard accounting practices can be developed and implemented by operating Islamic banks.

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