A STOCHASTIC MODEL FOR DIMINISHING MUSHARAKAH FINANCE IN SAUDI BANKS

By
Majdi Alsolami

Submitted in Partial Fulfillment
Of the Requirements for the

Master of Science
Specialization in Industrial Mathematics

New Mexico Institute of Mining and Technology
Department of Mathematics

Socorro, New Mexico
(May, 2015)
ABSTRACT

This thesis contains models of the Islamic financial system as a stochastic process and considers the future value to the bank. Consider the following three scenarios: when the business is losing money, profitable or stagnant. In each case, the distribution of the future value to the bank is estimated using Monte Carlo simulations. The business profit or loss is predicted using a random inverse normal distribution function $N (\mu, \sigma^2)$ which has two variables: mean and standard deviation. This model will make iterations for the bank's future value, sort the iterations, find the probability distribution, and plot the iterations for the bank's future value as a surface and show comparisons against the Western system.

Keywords: Corporate finance, partnership, Musharakah, diminishing Musharakah.
I would like to express my gratitude to my advisor, Prof. Bill Stone, for his guidance, enthusiasm and patience; without his encouragement, this study would not have been finished.

My special thanks goes to my committee members, Prof. Anwar Hossain and Dr. Rakhim Aitbayev for countless hours of their time that I used to grow as a student.

Finally, I am grateful to the whole Mathematics Department of New Mexico Tech for providing me with an excellent environment to study.

This thesis was typeset with LaTeX\textsuperscript{1}.

\textsuperscript{1} LaTeX\textsuperscript{1} document preparation system was developed by Leslie Lamport as a special version of Donald Knuth's TEX program for computer typesetting. TEX is a trademark of the American Mathematical Society. The LaTeX macro package for the New Mexico Institute of Mining and Technology thesis format was written for the Tech Computer Center by John W. Shipman.
# Table of Contents

**TABLE OF CONTENT** ........................................................................................................ IV

**CHAPTER ONE: INTRODUCTORY CHAPTER**

1.1 INTRODUCTION ............................................................................................................ 1
1.2 LITERATURE REVIEW .................................................................................................. 2

**CHAPTER TWO: OVERVIEW OF MUSHARAKAH FINANCING**

2.1 INTRODUCTION ............................................................................................................ 3
2.2 SAUDI BANKS FINANCE BACKGROUND ................................................................... 4
2.3 CONCEPT OF MUSHARAKAH ..................................................................................... 7
2.4 TYPES OF MUSHARAKAH ......................................................................................... 9
2.5 APPLICATION OF MUSHARAKAH ............................................................................. 11
2.6 RULES OF MUSHARAKAH FINANCING ................................................................. 13

**CHAPTER THREE: A MATHEMATICAL MODEL FOR MUSHARAKAH FINANCE**

3.1 INTRODUCTION ............................................................................................................ 17
3.2 CORPORATE FINANCE IN SAUDI BANKS .............................................................. 18
3.3 DIMINISHING MUSHARAKAH MODELING ............................................................. 19
3.4 PERMENANT MUSHARAKAH MODELING ............................................................... 21
3.5 TEMPORARY MUSHARAKAH MODELING ............................................................... 23
3.6 ...................................................................................................................................... 25
3.7 RESULTS ...................................................................................................................... 30

**CHAPTER FOUR: A MATHEMATICAL MODEL FOR CONVENTIONAL BANKS**

4.1 INTRODUCTION ............................................................................................................ 33
4.2 CORPORATE FINANCE IN CONVENTIONAL BANKS ........................................... 36
4.3 FINANCING MODEL OF CONVENTIONAL BANKS ................................................... 38
4.4 ...................................................................................................................................... 42
4.5 RESULTS ...................................................................................................................... 44

**CHAPTER FIVE: CONCLUSIONS**

5.1 DISCUSSION ................................................................................................................. 46
1.1 Introduction

In 2006, Professor Muhammad Yunus and the Grameen bank received the Nobel Peace Prize for their work in microfinance to help the poor people in Bangladesh and other countries. Most people do not know what kind of finance they used. They used Musharakah financing in their program [4]. Musharakah finance is the widespread financing system in Saudi banks. Saudi banks use this kind of finance to provide capital to individuals and corporations.

Saudi banks do not charge interest. Moreover, Saudi banks cannot invest in debt because they consider investment in debt as the most risky financial instrument in the global economy. Hence, most people do not understand how these banks function and how these banks make their profits and grow. Nevertheless, the banks that use this kind of finance or system are increasing rapidly in many countries in the world [15, 18]. For instance, there are more than twenty financial institutions in the U.S., and many more in Europe, using this kind of finance [8, 9].

Studies about the Saudi banking system are rare, and most of them are only concerned with the periodic financial statement analysis and overall performance of these banks. Thus, it is important to know more about Musharakah finance, using studies that examine Islamic finance since the Saudi banks have been using it successfully. From these studies we can see that most of the researchers who work in this field come from financial sciences backgrounds and they concentrate solely on how this kind of finance works. They do not try to build a mathematical model. For instance, Hussain G. Rammal [10] just explained financing through Musharakah without constructing a mathematical model. Instead, he used observational studies.

Musharakah finance is based on sharing between a bank and its client. Hence, building a mathematical model for Musharakah finance that includes risk will help us know more about this kind of finance. Moreover, comparing between Saudi banks and conventional banks in financing is very important to know the differences between these systems.
1.2 Literature Review

More than five decades ago, Islamic finance was introduced around the world in banks and financial institutions. Al Rajhi Bank, based in Saudi Arabia, and founded in 1957, is one of the largest Islamic banks in Saudi Arabia with total assets of SR 288 billion (US$ 76.8 billion) [5]. However, this bank has much smaller assets than JP Morgan Chase Bank National Association which is the biggest bank in the United States and has assets of US$ 2.57 trillion [16]. Following the example of Al Rajhi Bank, many other financial institutions in Saudi Arabia also introduced Islamic Finance. Since the 1970's, financial institutions worldwide operating on Islamic principles have grown and become quite sophisticated. For instance, British Prime Minister David Cameron announced further plans for Islamic Finance during a keynote speech at the ninth World Islamic Economic Forum, which was held in London in October 2013, the first time the event has ever been held outside the Muslim world. He said: "Already London is the biggest center for Islamic finance outside the Islamic world and today the ambition is to go further still. Because I don't just want London to be a great capital of Islamic finance in the Western world, I want London to stand alongside Dubai and Kuala Lumpur as one of the great capitals of Islamic finance anywhere in the world" [17].

Since the 1970's, banks and financial institutions in Saudi Arabia have tried to improve the performance of financial tools that conform to their internal systems. Also, they try to invent new ways of financing that are compatible with Islamic economic systems. These financial methods are designed to be applied in the real world and not conflict with the global economic system. The Saudi economy is directly linked to the global economy. Thus, innovative financing methods in Saudi banks are considered a catalyst for the growth and stability of the global economy because this kind of finance helps developing countries to grow and encourage the community to work. Hence, many researchers interested in such successful economic experiments began to try to understand them by using modern financial instruments [5, 7].

Those interested in this kind of financing are not only from Saudi Arabia but from all over the Islamic world because this economic system is based on principles from Islamic law. Therefore, Saudi banks benefit from the experiences of researchers around the world as well as from other Islamic banks, such as Malaysian banks. Saudi banks have applied a lot of financing programs taken from other Islamic banks scattered across the world [5, 7].
In the beginning, Sharia scholars explained the principles that must be followed to the bankers. The financial institutions in Saudi Arabia were able to build the rules for their partnerships according to these principles. The first international conference on Islamic banking, held in Dubai in 1979 discussed how Islamic banks apply the Musharakah finance system (Diminishing Musharakah) in real life. The first application for this kind of finance was in home financing. Therefore, most of studies about this kind of finance focused on home financing specifically. After applying this finance or system in realty, they got great results by increasing the number of Islamic financial institutions and customers [18, 19]. Moreover, Islamic banking is growing faster than its conventional counterpart but is focused in a few core markets and risks missing an opportunity to build a global footprint [20]. So, the financial institutions started to apply this financing within corporate environment.

Bendjilali, Boualem and Khan, Tariqullah [1] created a mathematical model to describe the Diminishing Musharakah system. They showed if acquisition of ownership offers a motivation and incentive for undertaking economics activity, then the diminishing Musharakah will improve the efficiency of the firm. On the other hand, they did not use financial tools to compute the risk in this process, but they discussed how to transfer or reduce the risk from financers.

Risk management is the process of identifying, evaluating, measuring, and controlling the risks. Transferring of risk to others and avoiding or reducing the negative effects are some strategies that can be used to lower the risks faced by the company or organization [21]. “Risk arises when there is a possibility of more than one outcome and the ultimate outcome is unknown. Though all businesses face uncertainty, financial institutions face some special kind of risks given the nature of their activities [21].”

Uncertainties of business outcomes is one of the risks that can be faced by the Islamic risk management. These types of risk are market and financial risk. The market risk is affected by several factors: price, regulations, operations, human resources, legal, and product risks. The financial risk is affected by the following: credit, liquidity, currency, settlement, and basis risk. Hence, the financial risk can be controlled, but the market risk cannot be controlled. Moreover, all these factors of risks are unsystematic risks [21].
Khalil Elian Abdelrahim [5] studied the effectiveness of credit risk management of Saudi banks. He showed that one of the findings on the determinants of effectiveness of credit risk management of Saudi banks is that liquidity has a significant strong positive impact on effectiveness of credit risk management. The study’s findings on developing effectiveness of credit risk management in Saudi banks, in order of importance, are: having an overall strategy for credit risk management; adopting mitigating methods for alleviating credit default risk; adopting Basel Committee principles; conducting training of credit officers; exchange of information with other banks on risky customers; submitting periodic reports to the board of directors and granting incentives for the best credit risk managers [5]. “The Basel Committee on Banking Supervision provides a forum for regular cooperation on banking supervision matters. Its objective is to enhance understanding of key supervisory issues and improve the quality of banking supervision worldwide [34].” Abdelrahim [11] studied the risks in general, but he did not mention the risks in the financing methods like Musharakah finance which is the common kind of finance in Saudi banks.

Saudi Arabia is one of the world's fastest growing banking markets. Based on ranking reports, banks with higher total assets do not always show higher profitability. Almazari and Almumani [13] concluded that there exist a significant impact of operational efficiency, asset management, and total assets on profitability efficiency represented by return of assets. They did not discuss the impact of the Musharakah finance in raising the size of assets, though they mentioned other effects such as operational efficiency.


Hence, building a mathematical model for Musharakah finance that includes risk will help us know more about this kind of finance. Musharakah finance is based on sharing between bank and client. So, we want to see the effect of this kind of finance on the size of assets in Saudi banks. Finally, comparing Saudi banks and conventional banks is very important to know the differences in funding between these systems.
CHAPTER TWO

OVERVIEW OF MUSHARAKAH FINANCING

2.1 Introduction

Musharakah finance is a method to provide what the corporations need to increase growth and remain economically stable. So, there are many motivations that encourage individuals and corporations to use this kind of finance. This method does not charge interest and works with the client as a partner. Moreover, in this method the relationship between banks and customers is like an investor and trader, buyer and seller because the transactions between the bank and the client are based on tangible things which are also dependent on production. This system allows the bank to partner with the customer. Hence, the bank’s partnership gives any project a positive momentum because of the strength of the bank’s financial budget.

A partnership between a customer and a bank means the bank shares with the customers in profit, loss and risk. A risk is a potential for a loss. The loss is the realization of that negative potential. Most studies on this issue have only examined the profit and loss between bank and customers. Therefore, their model ignored the scenario of loss in the business. In addition, when they created a model for Musharakah finance (MF), they created it without including the potential for loss in the model. For example, Meera and Abdul Razak [23] created a mathematical model for Musharakah finance without considering the economic hazards in this model. Furthermore, Ahamed Kameel Mydin Meera and Dzuljastri Abdul Razak [6] created this model without considering the chances for potential loss. However, creating a mathematical model for Musharakah finance that includes the risk is very important to observe the effect of risk in this model.

As we know, no financial institution likes financial transactions that have high risk and sharing with customers’ profit and loss. However, sharing between the bank and the client could potentially increase the chance for the risk if a business fails or when a bank does not fully evaluate a client’s financial history. Hence, the present thesis tries to create a mathematical model for diminishing Musharakah finance that includes the risk in the model and tries to find the differences between Musharakah finance model in Saudi banks and the methods of finance in conventional
banks. Murabaha, Istisna’a and Musharakah are three different methods of finance that the banks use to provide capital to the corporations. To be more specific, this paper tries to study the Musharakah finance of corporations only.

2.2 Saudi Banks Finance Background

Banking systems that are based on the standard of Islamic law and guided by Islamic economics are the most common banks in Saudi Arabia. Two basic principles behind Saudi banks are the sharing of profit or loss and, specifically, the prohibition of the collection and payment of interest. Collecting interest is not permitted under Saudi banking law. Saudi banks do not invest in illegal companies associated with activities such as alcohol, drugs, prostitution or gambling. Saudi banks build their money many ways including banking operations, installment sales, investments in real companies and factories in partnership with customers and the stock market. With regard to the stock market, Saudi banks work only with companies that have the same rule or systems. In summary, Saudi banks invest in real and tangible products and goods. [28]. Increasing the amount of money in circulation, increasing the price you pay for commodity, and decreasing the purchasing power of your money referred to inflation. However, most economists today use the term inflation to mean a rise in the price of basic items. Hence, banks will increase the interest rate to cover the inflation. However, Islamic banks do not have interest and do not have an overexpansion of the money supply because they use the goods in finance [33]. So, goods will not rise with the level of prices and the purchasing power will remain the same level. After all these interactions between the banks and customers, still the banks achieve high profit as well as fulfil their social responsibility [29, 33]. To understand the bank system, we should know the Islamic economic system. Saudi banks offer a full suite of corporate banking solutions in the following areas: corporate finance, global trade finance, and cash management.

2.2.1 Kinds of Business Financing
Saudi banks provide many different models of business financing that comply with the provisions of Islamic law and the common business financing. The models provided are the following:

1- **Murabaha Finance**

   The client requests from the bank a certain commodity at a specified price with a promise to buy the commodity from the bank at an agreed markup. In exchange, the bank promises to sell the commodity to the client on the terms mutually agreed upon. After the commodity is bought and owned by the bank, the bank sells it to the client at a deferred price basis payable as cash or by installments, while the client has the right to either accept or decline to purchase the commodity. Usually, clients finance personal items with this method, such as cars, mortgages, and personal goods.

2- **Istisna’a Finance**

   The literal meaning of the word Istisna’a is “manufacturing”. This kind of finance usually sells a commodity that does not exist at the time of contracting. Istisna’a Finance focuses on larger infrastructure projects, such as manufacturing aircrafts, and construction of power stations. The client tells the bank its intention to buy a commodity that has to be made, built, or assembled with certain specifications at a specified price. After that the client and bank enter into an Istisna’a contract, which allows the bank to make a contract with third party to manufacture the commodity that they agreed on and deliver this commodity to the client at certain time and specified price. The client can pay to the bank on the spot or in several installments.

3- **Musharakah Finance**

   The meaning of the word Musharakah is sharing. Musharakah finance is one of the funding programs that is compatible with the provisions of Islamic finance which Saudi banks use. The bank provides the funding to the customer which qualifies it to be a partner. Thus, the bank shares the profit, loss and risk with customers. The profit is shared according to a specific ratio, while the loss is shared according to the ratio of the contribution. Usually, clients use this sort of finance for big projects such as factories, service companies and productivity corporations. However, clients can also use it for personal finance.

2.3 **Concept of Musharakah**
Musharakah is derived from the Arabic word ‘Shirkah’ meaning partnership. It means a joint enterprise or project formed under contract by mutual consent of the parties for conducting some business. All parties share profit according to a pre-agreed ratio while loss is shared in accordance to the ratio of their capital contribution.

All the necessary elements required for a valid contract must be present: capital contribution should be clear and known by all partners, assets will be owned in proportion to the capital of each partner. It is an alternative for interest-based financing with far reaching effects on both production and distribution.

Capital investment in Musharakah can be either in liquid- (money) or commodities-form depending on the school of thought in Islam; the tenure of Musharakah can be either for a short or long time.

Every partner can either get involved in the management of the business or the partners may employ a particular individual to manage the business. The partner who manages the business gets paid a management fee plus the profit proportional to his share, while in case of loss he is still entitled to his management fee as an employee. For silent working partners, the ratio of their profit should not exceed the ratio of their capital investment.

A joint enterprise, or partnership structure with profit or loss sharing implications, is used in Saudi bank finance instead of interest-bearing loans. Musharakah allows each party involved in a business to share in the profits and risks. Instead of charging interest as a creditor, the financier will receive a return in the form of a portion of the actual profits earned, according to a predetermined ratio. However, unlike a traditional creditor, the financier will also share in any losses. In all kinds of Islamic finance, there is no guarantee for the capital and/or profit from any partner because it is based on the business’ success or failure. In some projects, the bank does not share the profit with the client, but the bank leases (Ijara) its assets to be used by the client. This can be considered as the profit for the bank. Sharing between the client and the bank takes several forms including: partnership by joint ownership and partnership by contract. The next section will clarify these types.
2.4 Types of Musharakah

There are a number of Musharakah financing techniques, such as:

- **Permanent Musharakah**

  In this kind of Musharakah, the bank shares the profit and loss with the client for an extended period of time, and the bank still continues to receive their profit as long as the partnership exists. Usually, the client uses this kind of finance when they want the bank as a permanent partner and the client wants to avoid the bank’s rental payment. Therefore, the client shares with the bank’s profit and loss without a rental rate payment to the bank.

- **Temporary Musharakah**

  Usually, banks and corporations use this kind of finance with working capital. Temporary Musharakah is a partnership for a specified period between the bank and customers who need to import certain goods and equipment but the customers do not have sufficient money. In this type of finance, the customer provides a portion of the funds and the bank provides the remaining funds. The bank then issues letters of credit to import the goods. When the goods arrive, there are three options available. Firstly, the bank sells its share in Musharakah to the customer in return for a cash payment or on a deferred basis at an agreed profit margin. Secondly, the customer sells his share to the bank in return for a cash payment or deferred basis. Finally, both parties sell their shares in the market together.

- **Diminishing Musharakah**

  In a diminishing Musharakah, the bank's interest share decreases by the payments received from the client, and the bank's share of the profit is calculated on the basis of the outstanding interest share. The client enters into an agreement with the bank for joint ownership of property in a known investment share of each partner. Afterward, the client pays the rent to the bank for using its share. The bank can only rent this property according to the level of its investment share. The bank cannot obligate the client to purchase its share. The bank’s shares will be divided into a certain number of units, and the client will purchase these units from time to time at an agreed
period. The customer purchases these units and the client increases his investment shares and reduces the amount of rent gradually until the client becomes the sole owner of the property.

2.5 Application of Musharakah

Trade is one of the essential sectors spearheading community economic development. Saudi Arabia is currently witnessing significant economic growth driven by high oil prices, which has resulted in launching several large-scale development projects especially infrastructure initiatives, such as electricity, communication, sanitation, etc. Executing these projects would require a strong contracting sector capable of meeting the needs of development. Hence, the need arises for banks and financing institutions to provide the liquidity required by these development projects in order to help the contracting sector implement these projects. So, business deals that use Musharakah finance are a common form of Islamic finance in Saudi banks. Musharakah financing is one solution that the Saudi banks use to finance anyone who agrees with Islamic finance law and meets the needs of many commercial companies. This kind of finance is used on a large scale to finance individuals and corporations. Musharakah finance is used to finance massive infrastructure projects that need high liquidity. Banks can use this kind of finance to finance corporate, global trade and e-trade.

Musharakah finance can also be used for financing poor people to give them microfinance to start their own businesses. For example, professor Muhammad Yunus and the Grameen Bank received the Nobel Peace Prize for their work in microfinance and they used Musharakah financing in this program in Bangladesh. Moreover, in Islamic Investment banks, Musharakah financing can be used in the following situations:

“Creation of Islamic equity securities (sukuk) through direct structuring or through the process of asset securitization. Here the Musharakah sukuk issued with the aim of using mobilized funds for launching new business, developing an existing project or financing business activities on the basis of any partnership contracts. The issued certificate represents the projects or activities managed on the basis of Musharakah. These certificates indicate the subscriber’s ownership of asset in that business according to his proportion. When the project is launched, these certificates can be treated as negotiable instruments and be sold and bought in the secondary markets [14].”
“Musharakah can also be used for financing agriculture as a participatory mode of financing, here the Islamic investment bank provide certain amount of funds to finance some activities as agreed by the client, the amount issued by the bank is considered as its investment share in the business. The profit and loss is shared as par the rules of Musharakah. In general, Musharakah finance is used to meet most of the needs of individuals and corporations [14].”

2.6 Evaluating Risk in Islamic banks

To make a decision to enter as a partner with any company or client, Islamic banks in Saudi Arabia have two items to evaluate:

1. Evaluating credit risk for the company
   As we know banks conduct a credit risk assessment on a corporation. The main goal for this step is that the bank wants to know if the potential partner has ability to meet its obligation to redeem its ownership \( R \) in accordance with the contract. The credit assessment procedures for companies are completely identical to what is recognized internationally. There are three most important elements that the banks consider. Firstly, character of the partner’s reputation, measured by their credit rating and credit history. Secondly, capacity of the partner’s ability to redeem its ownership, measured by comparing income against debts. Thirdly, capital which is the percentage of capital put towards the potential investment, measured by down payment (contribution made by the business owner \( B (0) \)). Some Islamic banks add one more condition which they cannot enter as a partner with a company or client who have big loans from the conventional banks. It is against the rules of the bank. If the bank assessment of this company or client is positive, this means the bank is able to ensure the redemption of capital.

2. Evaluate the project
   The main goal for this step is knowing the project profitability and the capability of sharing. Therefore, all the Islamic banks have experts to evaluate any project and they request from the potential client a study of the feasibility of being certified from specialized offices. After this step, the bank makes a decision whether to enter in this project as a partner.
2.7 Rules of Musharakah Financing

The following rules were obtained from [5, 7]:

• The equity contribution must be ‘paid in cash. Equity may not be accepted unless liquidated and converted into cash.

• The equity contribution need not necessarily be readily available at the time of signing the contract; it must be readily available when implementation of Musharakah commences.

• Investments come from all partners/shareholders hereinafter referred to as partners.

• Management could be undertaken by one or more of the parties in return for a percentage of the profits.

• Partners in Musharakah shall not guarantee the capital and/or profit.

• Any loss or damage sustained by the Musharakah-based project, except as a result of gross negligence or transgression, shall be shared by the parties proportionately.

• Profits shall be distributed as agreed by the partners provided that the share is predefined and known to them as a percentage, such as one quarter or one third or otherwise.

• A partner's interest share of the capital must be converted into a commodity should it wish to sell it to another partner. A partner may sell its interest share at any profit margin at its discretion.

• A share interest may not be sold before having been legally and duly possessed and owned.

• The ratio of profit for each partner must be determined in proportion to the actual profit accrued to the business and not in proportion to the capital invested. It is not allowed to fix a lump sum amount for any one of the partners, or any rate of profit tied up with his investment.

2.7.1 Features of Musharakah

The following features were obtained from [5, 7]:

• The customer may act as the bank's agent in performing the Musharakah process thereby allowing the customer, by virtue of its experience and expertise, sufficient flexibility to complete the formalities and custom duty requirements.
• This type of finance is suitable for customers who wish to receive the commodity documents in their names whether to serve their relationship with their suppliers or because they have certain concessions (custom exemptions for example).

• The bank's entry with customer as a financier partner to the purchase transaction, “commodity purchase,” is an evidence of seriousness and commitment to the partnership.

• Musharakah financing is one of the most flexible and comprehensive forms of Islamic finance in that it meets all finance requirements of various economic activities.

• Musharakah is a suitable instrument to finance fixed assets purchases, commensurate with the bank's credit policy, which is based on customer participation in the financing of such assets.

• The bank may discontinue the partnership in one stroke. Thereafter, the transaction becomes wholly owned by the customer.

• The bank may sell its share interest to a third party should the customer withdraw and decides not to purchase the subject commodity.

• Pre-maturity partnership termination option mitigates the risk related to investment term.
CHAPTER THREE

A STOCHASTIC MODEL FOR DIMINISHING MUSHRAKAH FINANCE

3.1 Problem Description:

Finance by Musharakah (Sharing) is an Islamic finance method under which the bank provides the required funds and becomes a financial partner in the business. The bank shares the actual profits pursuant to agreed terms and rules of distribution, and each partner assumes any losses on pro rata basis. There are a number of Musharakah financing techniques, such as:

(A) Permanent Musharakah: In this type of finance, the bank’s ownership share remains unchanged and the bank continues to receive its proportional dividends so long as the partnership exists.

(B) Temporary Musharakah: This form of financing is designed to finance working capital under which the bank enters as a partner for a specified period and receives its share of dividends and its principal equity contribution at the end of the contract. However, a temporary Musharakah contract may be renewed by a mutual agreement of the two parties.

(C) Diminishing Musharakah: In a diminishing Musharakah, the bank’s ownership decreases by the payments received from the customer, and the bank’s share of the profit is calculated on the basis of the bank's ownership ratio. This thesis concentrates on modeling the diminishing Musharakah.

3.2 Diminishing Musharakah Modeling

Let

\[ P(0) = \text{principal investment amount} \]
\[ B(0) = \text{contribution made by the bank} \]
\[ C(0) = \text{contribution made by the business owner (client)} \]

We have now the following relation between \( P(0), B(0) \) and \( C(0) \)

\[ P(0) = B(0) + C(0) \] (1)

Here \( B(0) \) and \( C(0) \) represents the initial value of \( B \) and \( C \). Likewise \( B(t) \) and \( C(t) \) will represent the ownership share at time \( t \).

\[ B(t) = \text{bank ownership at time } t \]
\[ C(t) = \text{client ownership at time } t \]
Let
\[ M = \text{total amount that the business owner pays to the bank every month} \]

This \( M \) will have two components as follows:

\[ BPLS = \text{bank profit or loss share (Based on the business)} \]
\[ R = \text{additional periodic amount that the business owner pays to the bank in order to redeem the ownership} \]

This amount \( R \) is decided at the beginning of sharing between the client and the bank to redeem the client’s ownership.

\( T = \text{agreed upon length of time for the sharing (in months)} \)

The relation between \( M, R \) and \( BPLS \) is as follows

\[ M(t) = R + BPLS(t) \]  

(2)

where \( BPLS \) is bank profit or loss share and \( R \) is the additional periodic amount and is defined by the equation:

\[ R = B(0)/T \]  

(3)

The additional periodic rate \( r \) is defined as:

\[ r = R/P \]  

(4)

where \( R \) is the additional periodic amount and \( P \) is the principal investment amount. Now, the development of the model can begin. Let

\[ BOR (t) = \text{bank ownership ratio} \]
\[ COR (t) = \text{client ownership ratio} \]
\[ BOI (t) = \text{bank outstanding investment} \]

The bank’s outstanding investment \( BOI \) decreases every month by receiving the additional periodic amount \( R \). Therefore, the \( BOI (0) = B(0) \) and \( BOI (t) \) is defined as:

\[ BOI (t) = BOI (t-1) - R (t) \]  

(5)

The bank ownership ratio is \( BOR (0) = B(0)/P(0) \) and is written as

\[ BOR (t) = BOI (t)/P (0) \]  

(6)

for all values of \( t \). Figures 3.1 shows that the bank ownership ratio decreases every month by receiving the additional periodic amount \( R \).

The client ownership ratio is \( COR (0) = C(0)/P(0) \) and more generally define by

\[ COR (t) = 1 - BOI (t) \]  

(7)
Also, Figures 3.1 shows that the client ownership ratio increases every month by redeeming its ownership from the bank.

![Client and Bank ownership ratio graph](image)

**Figure 3.1: Client and bank ownership ratio seen over time.**

Let

\[ BPL (t) = \text{business profit or loss} \]
\[ CPLS (t) = \text{client profit or loss share} \]
\[ BPLS (t) = \text{bank profit or loss share} \]

One of the most important parts in this model is predicting the business performance or business profit or loss \( BPL (t) \). Therefore, the business profit or loss is modeled stochastically, assuming a normal distribution. In this work a random inverse normal distribution function \( N(\mu, \sigma^2) \) was used to stochastically model the business profit or loss from original data. This function has two variables: mean and standard deviation.

Now, one can see clearly how the business profit or loss \( BPL (t) \) is found. Hence, the bank profit or loss share \( BPLS (t) \), which is the second component in equation (2), is written as

\[ BPLS (t) = BPL (t) \cdot BOR (t-1) \quad (8) \]

So, the total profit or loss made by the bank is

\[ \sum_{t=1}^{T} BPLS(t) \quad (9) \]

Equation (9) can be used to find the total profit or loss rate made by the bank as the follows

\[ \sum_{t=1}^{T} (BPLS(t) / BPL (t)) \quad (10) \]
It can be concluded from equations (2) and (9) that the total amount made to the bank is

$$M = \sum_{t=1}^{T} (R + BPLS(t))$$  \hspace{1cm} (11)

Also, the client profit or loss share is defined as

$$CPLS(t) = BPL(t) - BPLS(t)$$  \hspace{1cm} (12)

So, the total profit or loss made to the client is

$$\sum_{t=1}^{T} CPLS(t)$$  \hspace{1cm} (13)

Also, equation (13) can be used to find the total profit or loss rate made to the client as the follows

$$\sum_{t=1}^{T} (CPLS(t) / BPL(t))$$  \hspace{1cm} (14)

### 3.2.1 Time Value of Money in Islamic Finance

An important concept in financial management is the time value of money. This concept looks for the money today and in the future with the expectation that the value of money will increase in the future more than today based on the potential interest. For instance, if you have today $100 and the interest rate is 6%, after one year the value of $100 will be $106. Therefore, the investors use this concept to avoid having their money inactive and trying to create a positive value to the money.

“The Shari`ah [Islamic law] has the genuine provision of converting money into assets on the basis of which one can measure its utility. While it admits the concept of money’s time value to the extent of pricing in a credit sale, it does not endorse placing “rent” on money advances, as interest does in the case of credit and advances. As per the Islamic banks rules, the aspect that matters is the conversion of, for example, $1,000 into an asset, in which case that $1,000 asset may be worth more or less in the future, a condition that will lead to a profit or a loss. This conversion into assets is subject to well-articulated rules governing profit/loss sharing, trading, and leasing [30].”

The time value of money in diminishing Musharakah is similar to those of conventional banks but interest rates are replaced with the additional periodic rate or rental rate [23].

### 3.2.2 Future Value

Future value is an important concept in finance because it will help investors to know the value of money or assets in the future at any specified time. If the value in the future is worth more than now, it means the investment is useful and growing. So, the future value to the bank is
\[ FV = \sum_{t=1}^{T} M_t (1 + r)^{T-t} \]  

where \( M \) is the amount that the business owner pays to the bank every month, and \( r \) is the additional periodic rate or rental rate.

### 3.3 Implementation

The above steps consider the methodology used in diminishing Musharakah. Here we show the steps used in this model.

1. Data was collected from Saudi banks. The principle investment is $45,000, with the bank contributing $36,000 and the client $9,000. The period of time for which the sharing exists is 36 months. From these basic pieces of information, one can build the whole stochastic model.

2. The business profit or loss is modeled stochastically assuming a normal distribution. As mentioned above the most suitable function in this model is the random inverse normal distribution function \( N(\mu, \sigma^2) \) and this function has two variables: mean and standard deviation. Consider the following three scenarios:
   - First, when the business is losing money;
   - Second, when the business is profitable;
   - Third, when the business is stagnant.

In each case, the distribution of the future value to the bank is estimated using Monte Carlo simulations. In each of the above scenarios, we run the simulation for the bank's future value, sort the iterations, find the probability distribution, and plot the parameters for the bank's future value as a surface. Iteration is a repetition of a mathematical or computational procedure applied to the result and continues until an acceptably accurate value for the future value is found.

3. Business scenarios:
   1. When the business is losing money

      A losing business means that expenses are higher than revenues or operations do not cover the cost of production. Losing business is one of the possible scenarios for any business. Hence, banks consider loss in business one of the risks that they may face in the partnership between clients and banks. The net income for the losing business is negative on average. Hence, the mean for this business will be negative. Also, the standard deviation is used to quantify the amount of variation or dispersion of a set of data values in the business. Therefore, if there are extremist points in the result of income, the standard deviation value will be high.
In Figure 3.2, we sorted the data from the smallest to largest, and one can see what the data looks like. Figure 3.2 shows the future value of the bank with several changes in the mean and standard deviation values. Also, one can find maximum value, minimum value, and the range for the bank income or the future value of the bank. Moreover, when the standard deviation is low, the range of data will be low. One can also see the ranges are different from cases to cases based on difference of the mean and standard deviation. In this scenario, the ranges are $6500, $10500, $700 and $30000 respectively.

Since this scenario involves a business losing money for most of the period in this scenario, the loss is shared between the client and bank according to the ratio of the contribution. Also, if this business is losing money at the beginning of the sharing period, the bank will face the majority share of the total loss. Similarly, if this business is losing money at the end of the sharing period, the client will be faced with the majority share of the total loss because the client’s share of the business is increasing and bank’s share of the business is decreasing. Note that a lower standard deviation means the risk is lower.

Figure 3.2: Future values of the bank sorted from smallest to largest for the losing business scenario.
After sorting the data of the future value, the probability distribution is found. From Figure 3.3, one can see the probability distribution is normal and can predict the mean for this scenario. In addition, for all cases with different values for the mean and standard deviation, the distributions are normal. Figure 3.3 shows the probability density function, cumulative distribution function, and the P-plot and all of them have a normal distribution.
Figure 3.3: (a) probability density function, (b) cumulative probability distribution, and (c) p-plot for losing business made to the future value of the bank
(for business $\mu = -800, \sigma = 200$, for the bank $\mu = 35911.0, \sigma = 964.03$)

Figure 3.2 presents the future values of the bank as a curve. So, the best way to show the future value of the bank with the mean and standard deviation is plotting it as a surface, as seen in Figure 3.4. On the other hand, in Figure 3.2, the number of iterations are enough to plot the future value, but to plot the future value as smooth surface, we need to increase the number of iterations. From this surface, one can find the minimum, maximum, and range value with mean and standard deviation for the future values of the bank. In general in this scenario, whenever the mean approaches from the zero, the losses will be low.
ii. When the business is profitable

Profitable business means the business’s revenues exceed its expenses. So, the net income for the business is positive. Hence, the mean for this business will be positive. Profitable business is one of the scenarios for any business. Hence, banks consider this is the best scenario that can be expected. So, when the bank evaluates the financial statements for any company or project they try to choose the projects which have the highest chances to be profitable before entering as a partner. Similarly, in this scenario the bank shares the profit with the client based on the ratio of ownership. If the business has a high profit at the beginning of sharing (i.e. within the first ten months), the bank will redeem its principle amount. Moreover, in most of the profitable scenarios that were calculated, the bank redeems its principal amount before the middle of sharing. It means the risk in this scenario is very low.

In Figure 3.5, the data is sorted after using the Monte Carlo simulation from the smallest to largest. Figure 3.5 shows the future value for the bank with several changes in the mean and standard deviation values. Also, one can see the maximum value and minimum value for the bank income and find the range for future value of the bank. One can see clearly that the maximum
value and minimum value are higher than in the previous scenario. Moreover, when the standard deviation is high, the range of the data will be high. The range of data are different from case to case based on difference of the mean and standard deviation. In this scenario, the ranges are $20000, $5000, $70000 and $3000 respectively.

Figure 3.5: Future values of the bank sorted from smallest to largest for the profitable business scenario.

Similarly to the previous scenario, the data of the future value of the bank’s income are sorted and the distribution is calculated. Figure 3.6 demonstrates that the probability distribution is normal and the mean for this scenario can be determined. In addition, the distributions are normal.
for all the cases where the mean and standard deviation values were changed. Figure 3.6 shows the probability density function, cumulative distribution function, and the P-plot and all of them have normal distributions.
Figure 3.3: (a) probability density function, (b) cumulative probability distribution, and (c) p-plot for profitable business made to the future value of the bank

(for business \( \mu = 1200, \sigma = 600 \), for the bank \( \mu = 84852.0, \sigma = 3117.7 \))

In this scenario and previous scenarios, the volatility of the bank income is very high. Volatility is the relative rate at which the value of a future value moves up and down. The more the value moves up and down, the more volatility it is considered to have. So, in these scenarios we need to increase the iteration to let the surface to be smooth. Figure 3.7 shows the future value of the bank income with the mean and standard deviation as surface.
iii. When the business is stagnant

Stagnant business means production exceeds consumption, which leads to recession and lower prices of goods and in turn is difficult for producers selling stock. Therefore, the rate of production is in decline, and the profit of business will be very low. On the other hand, the mean of profit and range will not be high. Thus, there are not extremist points in the result of income in this scenario because the standard deviation will not be high.

Stagnant business is one of the scenarios that occur when the global or local economy is stagnant. Usually, it occurs after economic crises. Islamic banks consider this scenario is better than the losing business because they will recover the principle amount. From Figure 3.8, one can see the gap between the minimum value and maximum value is not very high because volatility of the values are not as high compared to the previous scenarios because this business is stagnant. In Figure 3.8, the data is sorted after using the Monte Carlo simulation from the smallest to largest. From Figure 3.8, the ranges are $2000, $3000, $1000 and $9000 respectively.
Similarly as in the previous scenario, the future values of the bank income are sorted and the distribution is calculated. From Figure 3.9, one can see clearly that the probability distribution is normal and the mean for this scenario can be determined. In addition, the distributions are normal for several cases where the mean and standard deviation values were varied. Figure 3.9 shows the probability density function, cumulative distribution function, and the P-plot and all of them have
normal distributions. When the business is stagnant, usually the profits or losses incurred are small and could be towards either the client or the bank. If the profits or losses occur in the beginning of sharing, the bank will get the majority of profits or losses because the ratio of ownership for the bank in the beginning of sharing is high and vice versa.
As in the previous scenarios, the future value of the bank income was plotted as a surface. So, Figure 3.10 shows the future value of the bank income with the mean and standard deviation. From this surface, one can see the minimum value, maximum value, and the range value with the mean and standard deviation. In this scenario, the volatility of the bank income is not very high because the business is stagnant. Therefore, the number of iterations is not as high to get the smooth surface as the previous scenarios.
Figure 3.10: Future value of the bank income with mean and standard deviation for the stagnant business scenario.
CHAPTER FOUR
CORPORATE FINANCE IN CONVENTIONAL BANKS

4.1 Relationship between Banks and Corporate in American (Western) Banks

Banks and corporations have a creditor-borrower relationship. This is also commonly referred to as a borrower-lender relationship. This relationship obligates the borrowing company to repay the borrowed funds at some future date and to pay periodic interest payments as a return on the borrowed funds. It is important to note that creditors do not have equity (ownership) within the firm but rather a contractual claim against the firm’s assets.

Loans are often considered less risky than equity within a company, as creditors have superior claim in bankruptcy over equity investors. That is, if the company were to become insolvent, a bank would be paid on their loan prior to equity investors receiving anything. However, with less risk comes less reward. Creditors do not share in the same upside potential as equity investors. If the company were to make more-than-ordinary profits, creditors will still only receive the scheduled cash payment. No more, no less. Equity investors, however, could receive the higher-than-normal profits in the form of dividends.

4.2 Evaluating Credit Risk in Western Banks

Before making a loan, a bank conducts a credit risk assessment on the corporation. Credit risk, in its most basic definition, is defined as the potential that the borrower will fail to meet its obligation to repay the principal and interest in accordance with the loan contract. To determine credit risk, American banks look at a multitude of factors. First, the character of the borrower’s reputation, measured by their credit rating and credit history. Second, capacity of the borrower’s ability to repay, measured by comparing income against debts. Third, capital, which is the percentage of capital put towards the potential investment, measured by down payment. Fourth, collateral, if the loan is secured, measured by the value of the collateral. Finally, several conditions including interest rate, timing of payments, etc. These five characteristics are known as the five “C’s” of credit [25, 26]. So, banks change the interest rate from company to company to cover the default risk based on the financial evaluation of the company [27].
4.3 Loan Amortization and Time Value of Money

In this model, loans are amortized over the term of the loan. Amortization is defined as the process of paying off the debt in regular installments over a period of time and consists of two things: principle payments and interest payments. An amortization schedule, in its most basic definition, is a chart showing the breakdown of loan payments (between principle and interest). Below is a description of each column and a general analysis of the amortization table for the relationship between corporate and bank in this loan [27].

4.3.1 Payment Number and Date

The loan period $N$ decides at the beginning of the loan contract by years or months. The total number of payments $n$ is due at the beginning of each month.

4.3.2 Beginning Balance

The beginning balance is equal to the ending balance from the previous month. The beginning balance is zero and ending balance is $P$ which is the actual loan amount.

4.3.3 Payment

The periodic payment amount is a fixed number calculated by finding the payment for a loan that has constant payments and constant interest. The formula for calculating periodic payment amount is as following:

$$PMT = \frac{i \cdot P \cdot (1 + i)^n}{(1 + i)^n - 1}$$

where $PMT$ is the monthly periodic payment amount, $P$ is the loan’s initial amount, $i$ is the monthly interest rate, and $n$ is the total number of payments. It is important to note that in this model the payment amount will stay constant through the term of the loan. This payment is derived from how much you have to pay each month so that the loan is paid off in $n$ months of equal payments.

4.3.4 Time Value of Money

The important parts in this concept are as follows:

1- The present value is

$$PV = PMT \left( \frac{1 - (1 + i)^{-n}}{i} \right)$$

where $PMT$ is the periodic payment amount, $i$ is the monthly interest rate, and $n$ is the total number of payments.

2- The future value is
\[ FV = PMT \left( \frac{(1+i)^n - 1}{i} \right) \]

4.4 Implementation

The corporate finance process is as follows:

1. Companies have two sources of funds: equity and debt. Equity financing takes the form of money obtained from investors in exchange for an ownership share in the business. The main advantage of equity financing is that the business is not obligated to repay the money. Instead, the investors hope to reclaim their investment out of future profits [32]. Debt financing means borrowing money from an outside source with the promise of paying back the borrowed amount plus the agreed-upon interest at a later date. Traditional secured loans, like those offered by banks, are one form of debt financing. Such loans are typically paid back in monthly installments and require a personal guaranty on the part of the borrower. Inventory, accounts receivable, equipment, real estate, and insurance policies can all be used as security on a bank loan. If the borrower can't pay back the loan, this collateral can be used to satisfy payment [32]. In our example we assume that the company will ask the bank for a loan of $36,000 with a term of three years.

2. The bank will assess credit risk of the company based on a multitude of different factors including: character, capacity, capital, collateral, and conditions. They will use ratio analysis on the income and balance sheets to determine the appropriate interest rate for the loan. Ratio analysis is the quantitative analysis of information contained in a company’s financial statements. Also, ratio analysis is based on line items in financial statements such as the balance sheet, income statement, and cash flow statement. Ratio analysis is used to evaluate different aspects of a company’s operating and financial performance like its efficiency, liquidity, profitability, and solvency. The trend of these ratios over time is studied to check whether they are improving or deteriorating [31]. Hence, banks use this method to determine the possibility of giving this company a loan. This method helps the banks estimate the company's ability to repay loans and its financial efficiency. In our model, only one interest rate was selected (6%), the one that Bank of America uses with most companies. Most other Western banks have interest rates around this value, either above or below. The interest rate that the banks take from the company is based on the ratio analysis and financial efficiency of the company and was calculated from collected data.
3. In this model, the loan has two components, the principle repayment and interest charges. The loan has a fixed monthly cash payment, which is determined at the beginning of the loan by modifying the present value formula. The principle payment is equal to the fixed cash payment minus the interest payment. The interest payment is equal to the monthly interest rate multiplied by the carrying value (ending balance) of the loan from the prior period. The ending balance is determined by taking the beginning balance (the ending balance from the previous period) and subtracting the principle repayment. These formulas and concepts are summarized in an amortization table.

\[
PM_T = \frac{i P (1 + i)^n}{(1 + i)^n - 1}
\]

\[
PM_T = \frac{\left(\frac{6}{12}\right)36000 \left(1 + \frac{6}{12}\right)^{36}}{\left(1 + \frac{6}{12}\right)^{36} - 1}
\]

\[
PM_T = $1,095.19
\]

4. The accounting impacts follow the amortization schedule table. On the first of each month (when payment is due), the company recognizes interest expense and a reduction in the loan liability. Consequently, Bank of America recognizes interest revenue and a reduction in the loans receivable. The interest revenue is also the total profit that Bank of America recognizes on the loan. In this example, over the three year term, the company recognized $3,426.83 in interest expense and Bank of America recognized the same amount in interest revenue.

5. In this model, the important thing to note is the future value for the bank income can be compared with the future value in Saudi banks under the same principle amounts and period of time. Therefore, the future value for the bank income is

\[
FV = \sum_{n=1}^{N} CF_n (1 + i_n)^{N-n}
\]
\[ FV = \sum_{n=1}^{36} 1,095.19 \left(1 + \frac{6\%}{12}\right)^{36-n} \]

\[ FV = $43,080.51 \]  

(16)

CHAPTER FIVE

COMPARISON AND CONCLUSIONS

5.1 Introduction
A general comparison between the western banking system and the Islamic banking system will be made in this chapter, comparing the future values for the both systems. This comparison will help explain the differences between these systems.

5.1.1 Comparison in General between the Two Systems

Islamic banks differentiate between profit and interest. In Islamic banks, the factors of production as capital and contractor are related. For instance, in some projects, the bank's share is money, but the client's share is labor. Hence, money and labor cannot be separate. It means the bank and the contractor bear the risk together and share profits. Anyone who made capital contributions in the form of money to a business project assumes the risk of loss and, therefore, deserves a proportional share in the actual profit of this project. However, Western banks deal with the capital and contractor as separate factors of production because the bank will get the fixed interest rate while the contractor will bear the risk of losing money. Therefore, the interest rate is a fixed return of money to the banks while the profit is from the distributions that return from the productions, rent and wages, etc. [10].

Creation of debt through direct lending and borrowing of money or other financial assets is not accepted in Islamic banks. However, they are allowed to create debt through the sale or rental of real assets. These assets must be tangible such as real estate, factories, etc. Moreover, banks cannot sell or transfer the debt. Hence, the Islamic financial system is in many ways different from the Western financial systems.

Table 5.1 below shows some main differences between the Islamic banking system and the Western banking system [35].

<table>
<thead>
<tr>
<th>Islamic banks</th>
<th>Conventional Banks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Islamic banks share with the client in the business rather than taking the fixed interest rate.</td>
<td>The financier charges a fixed interest rate rather than sharing with the client in the business.</td>
</tr>
<tr>
<td>Islamic banks cannot take extra money because of defaults on payments as a penalty. However, banks will ask the defaulters to pay some money to charities.</td>
<td>Most Western banks take extra money or compound interest from defaulters.</td>
</tr>
<tr>
<td>Islamic banks are not allowed to invest in debt.</td>
<td>Conventional banks are able to invest in debt.</td>
</tr>
</tbody>
</table>
Table 5.1: Comparison between Islamic banks system and western banks system.

5.1.2 Comparison between the Futures Values in the Both Models

From Figures 3.3, 3.6, and 3.9, one can see clearly that the future value in all scenarios in the Islamic finance model are normal probability distributions while from equation 16 the future value in Western finance model is a fixed number represented by a vertical line.

As seen in chapter three, the business in diminishing Musharakah finance has three scenarios. In a losing business, Figure 5.1 demonstrates the future values in both models. Hence, one can see that the future value (the red vertical line) for a Western bank is moderately above the mean of the future value in an Islamic bank.

![Figure 5.1: Comparison of future values in losing business scenario of Islamic vs. Western banks.](image)

In profitable business, Figure 5.2 presents the future values in both models. Hence, one can see that the future value (the red vertical line) for a Western bank is significantly below the mean of the future value in an Islamic bank.
Figure 5.2: Comparison of future values in profitable business scenario of Islamic vs. Western banks.
In stagnant business, Figure 5.3 displays the future values in both models. Hence, one can see that the future value (the red vertical line) for a Western bank is less than the mean of the future value in an Islamic bank.

![Figure 5.3: Comparison of future values in stagnant business scenario of Islamic vs. Western banks.](image)

5.2 Conclusions

As we have seen, the future value in diminishing Musharakah finance is a probability distribution and this distribution is normal while the future value in Western finance is a fixed number represented by a vertical line. Therefore, in the losing business scenario, the mean value of distribution is around the vertical line, either above or below. This depends on the interest rates for the Western system because the interest rate in Western banks vary from time to time. Moreover, as mentioned in chapter four, the banks change the interest rate from company to company based on the financial evaluation. However, in the profitable business scenario, the mean value is significantly above the vertical line in western banks. Otherwise, in the stagnant business scenario, the mean value of the distribution is appreciably above the vertical line. Therefore, in summary, in Islamic banks the rate of return to the banks in losing and stagnant business are not much different from the rate of return in Western banks, but in profitable business the rate of return in Islamic banks is largely different from the rate of return in Western banks.
References


[34] http://www.bis.org/bcbs/.