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The Implications of Agency Theory on Mudarabah and Musharakah Agreements

A Comparison with Conventional Debt

Abstract

This is a theoretical study analysing the Islamic profit-sharing agreements *mudarabah* and *musharakah*. In the analysis *mudarabah* and *musharakah* agreements are compared to conventional debt agreements. By using a framework with verifiable payoff structure structural characteristics that have been omitted in previous research are addressed. It is found that, despite underreporting being stated as the main problem of these instruments, there are also other types of moral hazard problems inherent to the structure of *mudarabah* and *musharakah* contracts.

The analysis illustrates that debt serves as a better incentive device to induce high effort. It is found that under *mudarabah* and *musharakah,* capital structure problems can arise only when the entity does not have sufficient retained earnings, when covenants limit the entrepreneur's mandate to seek outside financing or if a bonus strategy gives incentive to take on risky projects. The presence of information asymmetries are more harmful to profit-sharing agreements compared to debt agreements, leading to higher risk of market-breakdown. It is concluded that in contrast to debt, profit-sharing agreements are unlikely to function in the absence of mechanisms sending signals regarding the type of the project.

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1 INTRODUCTION

Islamic finance is a fast growing industry that showed resilience during the recent financial crisis. Islamic financial assets are estimated to grow to around USD 1.6 trillion in year 2012 (Reuters, 2012), and Moody's investor service reports that some estimates suggest assets held by Islamic financial institutions may rise to more than USD 5 trillion[1] (Reuters, 2010).

Today, LIBOR linked financial contracts dominate the Islamic finance industry. However, Usmani (2003) describes profit-sharing agreements like *mudarabah* and *musharakah* financing as more preferable participatory modes of financing and notes that the LIBOR linked and leasing modes of financing often has the same net result as interest based borrowing. Khan & Mirakhor (1992) state that profit-sharing is regarded as the norm towards which practice of Islamic finance should gravitate and that profit-sharing agreements like *mudarabah* and *musharakah* constitute the core of Islamic finance since they are in tune with the Islamic injunctions against interest based financing.

Profit-sharing as a concept is not only addressed in Islamic finance literature. Proposals to reform the conventional western banking system into a banking system similar to a profit-sharing system have been made on several different occasions often corresponding with episodes of financial crisis. Simons (1948), Golembe and Mingo (1985), Kareken (1985), and Kindleberger (1985) all argued for such a transition.

Despite the dominant position of profit-sharing agreements and partnerships as modes of financing among Islamic scholars, the role of these instruments is very small in practice. The agency problem and the presence of asymmetric information have been stated as a major reason to why profit-sharing agreements like *mudarabah* and *musharakah* have not been a more preferred mode of financing (Zaher & Hassan, 2001). The State Bank of Pakistan commented on the subject in their report, Financial Stability Review for 2007 to 2008, addressing that the agency problems are a major factor for the reluctance on the part of banks to undertake profit-sharing modes of financing (Babar, Iqbal, Khan, & Afzal, 2007).

Several papers have addressed the problem of agency costs and asymmetric information. However, they have assumed that the outcome of the financed project is unverifiable by the financier. Khan (1989), Ahmed (2002) and Aggerwal and Yousef (2000) provide theoretical analyses of agency problems and asymmetric information, but focus on the entrepreneurs' incentive to

[1] For comparison, the total assets of the US banking system was approximately USD 12.6 trillion by December 2011 (Federal Deposit Insurance Corporation, 2012)

understate profits. Consequently, other forms of moral hazards and agency problems have not received attention in previous theoretical research.

1.1 PURPOSE AND CONTRIBUTION OF STUDY

In the study a thorough analysis of agency problems and asymmetric information concerning *mudarabah* and *musharakah* financing is conducted. The analysis of *mudarabah* and *musharakah* is put into perspective through a comparison to conventional debt contracts. To our knowledge there has been no theoretical analysis of risk taking and debt overhang for *mudarabah* and *musharakah* agreements.

Throughout the analysis the assumption of verifiable returns is made. Consequently the problem of underreporting is avoided. Avoiding the underreporting problem enables a broader analysis of effort, capital structure and asymmetric information for these instruments. As a result, attention can be put on capital structure and effort problems that have not been investigated in Islamic finance literature. For the analysis of asymmetric information, traditional models are further developed in order to capture the characteristics of profit-sharing agreements. By introducing an entrepreneur with a new type of project a new perspective on the effects of imperfect information is revealed.

The purpose of the study is to contribute to the understanding of the problems and opportunities connected to the use of profit-sharing agreements. By using a framework with verifiable payoff structure structural characteristics are addressed that to some extent have been omitted in previous research. The study is able to address problems beyond underreporting and cost allocation problems, thereby shedding new light and giving new insights on some issues and confirm others.

1.2 MAIN CONCLUSIONS

It is found that, despite underreporting being stated as the main problem of these instruments, there are also other types of moral hazard problems inherent to the structure of *mudarabah* and *musharakah* contracts.

When the instruments are analysed in a context where the entrepreneur receives private benefits if not exerting full effort, it is found that debt usually serves as a better incentive device. The analysis also concludes that giving bonuses is an effective way for inducing high effort. Another

effect of bonuses is that the payoff structure for the entrepreneur is converging towards that under debt as the bonus increases. This aspect of bonuses has not been addressed in previous research.

Mudarabah and *musharakah* display similar behaviour to equity contracts when analysed from the perspective of risk taking. As such, they are more effective in preventing excessive risk taking. However, when bonuses are introduced, there is a trade-off between giving effort incentives and preventing risk taking.

No definite conclusions regarding which form of financing is more effective in preventing debt overhang problems can be made. The conclusion depends on the availability of retained earnings, financing covenants, and the characteristics of the existing project and of the new investment opportunity.

Asymmetric information is concluded to be more harmful for *mudarabah* and *musharakah* than for conventional debt since the profit-sharing agreements attract negative net present-value projects that would not be financed under conventional debt. This increases the risk of market breakdown. As a result, the profit-sharing agreements market might not be able to function properly without mechanisms signaling the type of the project.

1.3 STRUCTURE OF PAPER

The paper is divided into nine sections including the present one. This section, the introduction, gives a short introduction to Islamic finance together with a motivation of the study. The main conclusions and contributions of the study are also presented in this section.

The introduction is followed by a brief presentation of Islamic finance. It contains the history and development of the industry as well as a presentation of the main ethical norms and regulations of Islamic finance that are different from conventional finance. This section also contains a thorough description of the instruments *mudarabah* and *musharakah* investigated in the study.

In the methodology the models used throughout the paper are described and motivated. In this section limitations and delimitations of the study are presented.

This is followed by a review of previous research related to the subject addressed in this study. Then, this study is described and put into the context of previous research.

Sections five to eight contain the analysis and constitute the main focus of the study. Each section of the analysis begins with a short introduction of the problem analysed followed by the results and intuitions from the analysis. This is followed by a formal analysis presenting a more detailed picture of the analysed problem. Every section is followed by concluding remarks. The

subjects analysed are agency costs and effort, risk taking, debt overhang, and information asymmetries.

In the final section the main conclusions are presented and put into relation to previous research.

2 BRIEF PRESENTATION OF ISLAMIC FINANCE

2.1 HISTORY OF ISLAMIC FINANCE

Islamic Banking is of quite recent origin. The earliest references on the subject of Islamic Banking address profit-sharing as an alternative to the conventional interest based banking model. This reorganisation of the banking system was discussed by Qureshi (1946), Siddiqi (1948) and Ahmad (1952). Mawdudi elaborated these ideas and theories in writings in the 1950s. In the following two decades interest-free banking attracted more attention because of increasing political interest in Pakistan together with the emergence of several Muslim economists (Gafoor, 1995).

The idea of Islamic Banking continued to develop on a theoretical level. As institutions and governments started to get more involved, the theory was applied in practice and resulted in the establishment of the first interest-free banks. A driving factor was the 1973 energy crisis, after which some of the oil-producing states in the Middle East and North Africa accumulated large amounts of capital (Bassens, Derudder, & Witlox, 2010). The capital was partly invested through conventional banks, but at the same time, it laid the basis for a number of new financial institutions within the region.

In year 1975, the Islamic Development Bank was founded as an international financial institution with the objective to foster economic progress, social progress, and cooperation among the member countries (Okumus, 2005). The same year the first private interest-free bank, the Dubai Islamic Bank, was founded (Zaher & Hassan, 2001). However, official support was needed with the governments of the United Arab Emirate and Kuwait contributing some of the capital (Iqbal & Molyneux, 2005). This was followed by several banks that started to offer services compliant to Islamic ethics (Gafoor, 1995).

The period between 1975 and 1990 was a very important period in the development of the Islamic financial industry. During this period, it matured into an alternative model of financial intermediation and gained credibility in terms of theoretical development as well as practical experiences (Iqbal & Molyneux, 2005). A number of countries started to transform their economic systems to accord more closely with the principles and conditions of Islam. The countries in the forefront of this development were Iran, Pakistan and Sudan, although the transformation could be observed in most Islamic countries (Khan, 1986). In Iran, Pakistan and Sudan all banks and financial institution have adopted Islamic Banking principles since the early 1980s. The Government of Pakistan eliminated interest-based transactions from its banking system on July first year 1985. The

transition was a gradual process brought to an end by a law requiring all transactions to be on an equity-participation basis (State Bank of Pakistan, 1984). A similar process was conducted in Iran. Other Muslim countries like Turkey, Jordan, Egypt, Indonesia, Malaysia and Bangladesh developed Islamic compliant institutions alongside conventional banks and several multinational financial institutions with a western origin started to offer Islamic compliant services through divisions called Islamic windows.

The size of Islamic financial assets has grown by 150% from 2006 to early 2012 (The Economist online, 2012). Islamic finance has also diversified away from the traditional geographical concentration in Middle East. Middle East accounted for more than 85% of total assets in early nineties, however by the end of 2010 Middle East's share of total assets has decreased to around 40% (Islamic Banks and Financial Institutions Information, 2012). United Kingdom, France, Germany, Japan, Singapore, Hong Kong and South Korea have passed laws in order to accommodate Shariah-compliant financial assets (Islamic Financial Services Board, 2010).

During the financial crisis Islamic banks showed greater resilience, on average, compared to conventional banks. The specifics of Islamic banks' business model enabled them to avoid some of the adverse effects of the crisis in 2008 (Hasan & Dridi, 2010). Islamic laws prohibited Islamic banks from dealing with interest-bearing mortgages, the assets that were the primary cause of the US financial crisis (Imam & Kpodar, 2010). However, weak risk management practices in place lead to a greater profitability decline in Islamic banks compared to conventional banks in 2009. (Hasan & Dridi, 2010). Since Islamic banks had not diversified away from their traditional markets – financing trade, real estate and infrastructure projects with the main focus being on real estate, the collapse of the property market affected Islamic banks (Imam & Kpodar, 2010). After the Dubai World crisis borrowers had to pay an extra premium in order to attract investors pushing global issuance of *sukuk*[2], Islamic bonds, down (Reuters, 2010).

In 2011 global Islamic finance assets had exceeded $1.3 trillion (Reuters, 2012). According to Zawya Sukuk Monitor, in 2010 the global market for *sukuk* had completely recovered from the decrease during the crisis (The Economist online, 2012). In 2011 global *sukuk* issuance reached a new record high. Global issuance of *sukuk* securities in first three months of 2012 was approximately half of total *sukuk* issuances in 2011 (Reuters, 2012).

[2] In contrast to a conventional bond which is a promise to repay a loan, *sukuk* constitutes partial ownership in a debt, asset, project, business, or investment (Obaidullah, 2005).

Globally, around 12% of Muslims use Islamic finance products. With other countries expressing their interest in the area, the market seems likely to grow (The Economist online, 2012). By some forecasts, the industry's assets are on track to double over the next five years (Economist Corporate Network, 2010). In 2007 there were over 300 Islamic financial institutions and almost 25 percent of them had operations in countries that do not have Muslim majorities. Conventional banks have opened up Islamic windows to attract Muslims living in Europe and North America. Another sign of the globalization of Islamic finance is the creation of the Dow Jones Islamic Market Index in 1999, and of the Dow Jones Citigroup *Sukuk* Index in Kuala Lumpur in 2003 (Pollard & Samers, 2007).

Hasan and Dridi (2010) noted some challenges that the financial crisis highlighted about Islamic finance: (i) Underdeveloped infrastructure and tools for managing liquidity risks. Some Islamic Banks tried to address this by having overly liquid balance sheet. This resulted in sacrifices in profitability, but mitigated risks during the crisis. The other challenges listed in the paper are (ii) incomplete and untested legal framework, (iii) lack of harmonization among contracts and (iv) insufficient expertise relative to industry growth. There has also been an increased pressure on Islamic finance to join accounting mainstream (Reuters, 2012).

2.2 WHAT MAKES ISLAMIC FINANCE DIFFERENT?

Islamic banks, like other banks, are profit-maximizing entities. However, Islamic banks operate under different constraints compared to conventional banks (Imam & Kpodar, 2010). Islamic contracts have to comply with Islamic law, Shariah (Hesse, Jobst, & Solé, 2008). Islamic law requires the parties to any financial transaction to have a direct participation in the performance of the underlying asset. Only interest-free forms of finance are allowed. Financing projects associated with forbidden activities, such as alcohol, pork, fire arms, adult entertainment or gambling, is not permissible according to Islamic law. However, Islamic law does not object to payment for the use of an asset as long as both the lender and the investor share the investment risk. Returns from the investment cannot be guaranteed *ex ante* and can only accrue if the investment itself is profitable (Hesse, Jobst, & Solé, 2008).

2.2.1 Riba

The prohibition of *riba* is the central element of Islamic ethics. All the financial contracts must not contain an element of *riba* (Obaidullah, 2005). The term *riba* literally can be "excess" or "increase",

and covers interest and usury (Hassan & Lewis, 2007). Obaidullah (2005) gives the following applications and explanations of *riba*:

Interest in debt. Interest is largely understood as *riba*. *Riba* is defined as an increase the lender receives for the time he grants his borrower to repay his debt. Interest in loans is a compensation for the re-payment period of the loan and therefore has been declared unlawful.

Risk and return. This is an important maxim that affects many contracts in Islamic finance. It implies that no positive returns should come with a condition of zero risk. However, Islamic financial contracting laws deal with risk-return relationship in a broad sense, and risk-return parity is not required. One implication of this requirement is that the investor is not permitted to require collateral from the borrower.

Exchange/transfer of debt. The concept of *riba* applies to debt exchange/transfer in the following way – (i) when a debt is exchanged for money, it should be at par. (ii) when a debt is exchanged for a debt, it should be at par.

The rationale behind the prohibition of collateral-based lending at a fixed predetermined interest is that it is considered to favour the rich, and those who are already in business, and is only marginally concerned with the success of the ventures it finances (Warde, 2000).

2.2.2 Gharar

The meaning of the word *gharar is* risk, uncertainty and hazard. Unlike *riba, gharar* is not a precisely defined concept. Prohibition of *riba* is absolute whereas some degree of uncertainty or *gharar* is acceptable by Islamic law. Only excessive degree of uncertainty is not permissible (Obaidullah, 2005). However, there is no definite agreement on what level of uncertainty is excessive. Decision-making under uncertainty from an Islamic perspective has not been much studied (Al-Suwailem, 2002). Al-Suwailem (2002) argues that the probability of success of the project should be reconciled with possible profits in order to determine if the uncertainty is excessive. Elgari however, disagrees with this view on comments to Al-Suwailem's paper.

2.3 MUDARABAH

Mudarabah is an ancient form of financing that has been practiced by Arabs since long before the advent of Islam. Gafoor (2004) gives an example of agreements between traders in ancient Arabia that have formed the basis of the modern *mudarabah*. When a trading caravan was organized, traders could either join with their own goods and money or could combine their money with that of other

traders. For people who decided to go with the second option, they would bear trading losses from their own capital; profits would be split with the manager of the capital.

Modern *mudarabah* has evolved to a mode of financing which constitutes an alternative to interest based financing. Within Islamic finance it has turned into a tripartite contract (*two-tier mudarabah*) where depositors enter a partnership based on profit-and-loss sharing with the bank, with the bank acting as the depositors' agent. The bank is then entering into *mudarabah* contracts with entrepreneurs, with the bank acting as the investor and the entrepreneur acting as the agent (Abdul-Rahman, 1999). *Mudarabah* agreements are thereby used on both sides of the banks' balance sheet. However, in this paper only the relationship between the bank and the entrepreneur is analysed.

Usmani (1998) defines *mudarabah* as an agreement where one or several parties provide the capital and another party invests it in and manages the business venture. The provider of the capital, the investor, is called the *"Rabb-ul-Maal"* while the recipient of the funds who has the exclusive responsibility in managing and working for the venture is referred to as the *"Mudarib"*.

There are two main types of *mudarabah*:

- Restricted *mudarabah* - The investor specifies the particular business, asset class or particular place for the entrepreneur to invest in.
- Unrestricted *mudarabah* – The entrepreneur is given full freedom to undertake whatever business the entrepreneur deem appropriate in order to maximize profits. However, the entrepreneur is not authorized to commit to any other *mudarabah* contracts or mix his own investment in that particular *mudarabah* without the consent of the investor (Usmani, 1998).

The *mudarabah* contract works as described in Figure 1. The investor provides all the capital needed to the entrepreneur under the *mudarabah* contract (1). The entrepreneur is then responsible for the management and for providing the necessary expertise and effort (2). If the venture is successful and generates profits the profits are shared according to a pre-determined ratio (3) (Obaidullah, 2005).

Figure 1. "The *mudarabah* contract".

In a *mudarabah* contract all parties must agree on a definite proportion of the actual profit each one is entitled to. The ratio can be determined freely by the investor and the entrepreneur. If a

mudarabah contract is initiated without any pre-determined ratio of how to divide the profits, the profits are distributed equally between the entrepreneur and the investor. The parties are not allowed to allocate a lump sum amount of profit for any party or determine the share of any party at a specific rate tied to the capital investment. The investor may give the entrepreneur bonuses in order to encourage certain behaviors. Bonus may be paid for achieving specified targets or meeting some other pre-determined performance criteria. If the venture is unsuccessful losses must be borne solely by the investor unless they were caused by negligence or gross violence of the terms of agreement (Obaidullah, 2005). In the case of negligence or misconduct the entrepreneur is liable to compensate the loss. The investor has limited liability under the *mudarabah* contract so the investor is not able to lose more than the initial investment. If the project or business has incurred losses in some transactions and profits in others the losses shall be offset before profits are shared (Warde, 2000).

In a *mudarabah* contract the investor is considered to be a silent or sleeping partner. The investor has the right to monitor and oversee the activities of the entrepreneur throughout the contract period. However, the investor is not allowed to work for the business without the entrepreneurs consent. The capital provided by the investor is not required to be in cash. However if the contribution of capital is not made in cash it has to be valued in order for the contract to be valid. If several investors are needed to finance a business under a single *mudarabah* contract, the profits will be shared according to their share of investment (Abdul-Rahman, 1999). Under a *mudarabah* contract only the investor is entitled to the gains from appreciation of capital.

A very important aspect of a *mudarabah* contract is that the entrepreneur is not allowed to claim any periodical salary, fee or remuneration for the work done under the *mudarabah* contract apart from the entrepreneur's share of the profits. However, if the *mudarabah* contract turns out to be void the entrepreneur is entitled to get compensated for the exerted efforts. Furthermore, the entrepreneur is not allowed to invest own capital in the project.

A time of termination of the *mudarabah* can be contracted but it can also be treated as a going concern. The *mudarabah* contract can still be terminated at any time by either of the two parties. Some difficulties arise when one or several of the investors desire to discontinue a contract of a going concern with several investors. The shares of the outgoing parties or party can be sold either to an outsider, given an approval by the remaining party or parties, or to the remaining party or parties. When the contract is terminated the entrepreneur is no longer allowed to make new purchases of goods or services for the *mudarabah*. However, the entrepreneur may sell the existing goods that were purchased before termination. If all assets of the *mudarabah* are in the form of cash

at the time of termination, and some profit has been earned, it shall be distributed between the parties according to the agreed ratio. If the assets of *mudarabah* are not in the form of cash, assets and/or goods are sold and liquidated so that the actual profit may be determined. If there is a profit, it will be distributed between the investor and the entrepreneur.

2.4 MUSHARAKAH

Musharakah is a relationship established by two or several parties through a mutual contract. In order to be a valid the contract has to fulfill some basic terms. For example, the parties should be capable of entering into a contract, and the contract must be entered into with free consent of the parties (Usmani, 2002).

In a *musharakah* contract two or more parties decide to enter into a *musharakah* partnership. The *musharakah* contract works as described in Figure 2. All parties agree to contribute a specified amount of investment (1). One or several of the partners acts as agents and managers of the venture. If the business is successful and generates profits, then these profits are to be shared at a pre-determined ratio between the partners (2) (Obaidullah, 2005). If the project is unsuccessful and generate losses the losses are shared strictly in proportion to the respective partners' capital contribution.

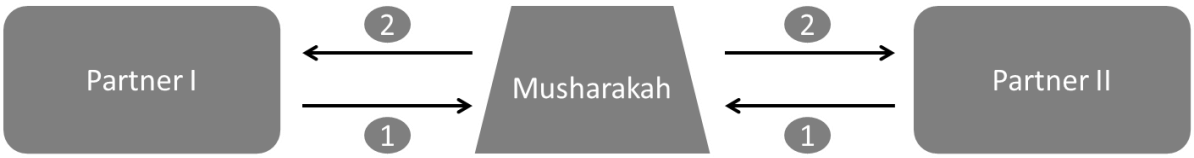

Figure 2. "The *musharakah* contract".

All partners are allowed to take part in the management of the business venture. However the partners may appoint one or several managing partners by mutual consent (Warde, 2000). The parties not taking part in the management are considered silent. Silent partners share of profits are not allowed to exceed their share of investment. If more than one of the partners agrees to work for the business, and take part in the management, each one of them is treated as the agent of the others in all matters of business. Any work done by one of the managing partners in the normal course of business is considered as approved by all partners (Rammal, 2004).

Prior to commencing the *musharakah* agreement all parties should agree on the exact profit-sharing ratio each one is entitled to (Rammal, 2004). The determined share must be based on future profits. It cannot be determined as a lump sum or a percentage of the capital investment. However, it is not necessary for the profit-sharing ratio to be proportionate to the actual capital investment.

The profit-sharing ratio can be amended at a later date given that all partners agree on the new terms. Partners are also allowed to surrender a part of their profit in favor of another partner (Obaidullah, 2005). The profit-sharing ratio can either be fixed or variable and capped at a certain amount of money and partners can decide to retain profits in the venture for further investment. The final allocation of profit should not be based on expected profit, but it is permissible to distribute a provisional profit, subject to final settlement. Consequently, the *musharakah* contract is flexible in terms of managing profits. In terms of losses the *musharakah* is less flexible. In terms of liability, the participants in a *musharakah* contract normally have unlimited liabilities.

2.4.1 Settlement

Each partner is entitled to terminate the partnership with prior notice or when set conditions have been met. The *musharakah* contract is terminated if (Usmani, 2002):

- the partnership was limited to a given time frame
- the purpose of the partnership has been achieved
- the continuity of the project is compromised by the withdrawal of one or several partners
- any of the partners die before the end of the agreement

In the case of premature termination, the business shall be liquidated and the settlement distributed pro-rata (Usmani D. M., Meezan Bank's Guide to, 2002). If the assets are not in the form of cash the partners can choose to distribute the assets of the partnership without liquidating them, given mutual consent. If one or several partners wishes to terminate the *musharakah* whilst the other partners intent to continue the business, it is possible to continue the business with the expressed agreement of all the parties involved. The partners who wish to continue the project are then required to purchase the share of the business of the leaving partner at a price that is determined by mutual consent. If there is a dispute of the valuation, the leaving partner has the choice to force a liquidation of the contract (Usmani D. M., Meezan Bank's Guide to Islamic Banking, 2002). When entering a *musharakah* contract it is possible to agree that a majority decision of the partners is needed in order to force liquidation on a business.

A partner cannot demand that another partner provides security in any form since they have the same rights and obligations towards each other and since they are acting as agents for each other. However, in case of a *musharakah* agreement between the bank and the bank's client, the bank can obtain adequate security from the partners against possible misconduct and negligence to ensure the safety of the capital invested.

2.4.2 Diminishing musharakah

One recent variation on *musharakah* contracts is the diminishing *musharakah*, where one or several of the partners' capital or share is progressively reimbursed by another partner. This setup enables entrepreneurs to progressively increase his/her share in the business or project (Warde, 2000). According to this concept, a financier and his client participate either in a joint ownership of a property, equipment, or in a business. The share of the financier is divided into a number of units. These units are purchased by the client over the contracted time period increasing the clients own share until all the units of the financier have been purchased by the client, making him/her the sole owner of the property, equipment or the business (Usmani, 2002).

2.5 MAIN DIFFERENCES BETWEEN MUDARABAH AND MUSHARAKAH

There are many similarities between *mudarabah* and *musharakah* contracts. However, the fundamental difference between the two in terms of investment is that all parties in a *musharakah* contracts provide funds for the needed investment whereas in a *mudarabah* contract the entrepreneur is not allowed to invest in the business. In terms of management all parties in a *musharakah* have the right to take part in the management of the business. In the *mudarabah,* the entrepreneur has full responsibility for the management as the investor lack the right to participate. In terms of liability the participants in a *musharakah* contract normally have unlimited liabilities. If the liabilities of a business exceed its assets and the business goes into liquidation the difference will be born pro-rata by the participants. In a *mudarabah* the investor's liabilities are limited to the investment in the business. The entrepreneur's liabilities are limited to the exerted effort put into the project. In a *musharakah* agreement capital appreciation benefits all partners compared to a *mudarabah* contract where only the investor is entitled to gains from the appreciation of capital.

2.6 MUDARABAH AND MUSHARAKAH COMPARED TO EQUITY

Mudarabah and *musharakah* contracts carry features that can resemble both equity and debt. Just like equity, *mudarabah* and *musharakah* represent a percentage claim on the company's future profits. However, unlike equity which is a perpetual claim, *mudarabah* and *musharakah* are often limited to a fixed period of time similarly to a debt contract. However, *mudarabah* and *musharakah* does not increase a firm's risk the way debt financing does through increased financial leverage.

Equity holders are allowed to sell their shares in a business. This is not possible under *mudarabah* and *musharakah* without the consent from the other partners of the agreement.

Consequently, *mudarabah* and *musharakah* are inherently illiquid compared to equity contracts. Another difference between equity and *mudarabah* and *musharakah* financing is the treatment of capital gains. Under equity finance the investor receives a part in profits including the appreciations of assets within the business. Under *mudarabah* and *musharakah* the appreciation of capital is only attributed to the investors.

Mudarabah and *musharakah* are generally used as modes of project financing. Owner of *mudarabah* and *musharakah* contracts therefore can have a claim in the profits of a particular project which might not be representative of the company's overall performance. Moreover, dividend payments are likely to have more priority in *mudarabah* and *musharakah* financing since the bank might be interested in recovering its investment in form of cash flow rather than capital appreciation.

3 METHODOLOGY

3.1 THEORETICAL MODELS

This section presents the methodology used for the theoretical analysis of the Islamic profit-sharing agreements *mudarabah* and *musharakah*. The models in this study are based on the model in Tirole and Holmström (1997) which was used to analyse the relationship between financial intermediaries and borrowers. Having one model as a basis ensures consistency among expressions in different sections. Since the *mudarabah* and *musharakah* contracts are alternatives to debt, the framework is suitable in order to make a valid comparison between the contracts. Furthermore the framework can be used to analyse several types of problems surrounding agency costs and information asymmetries with only small alterations to the basic model.

The models used in the paper are in discrete time with two time periods. There are two types of participants in the framework. The first type is the entrepreneur trying to finance a project and the second type is a bank providing finance. The project's outcome depends on the entrepreneur's actions, choice or type. Capital markets are considered competitive and both the investor and entrepreneur are considered risk neutral. In all projects the outcome is verifiable by all parties. For simplicity no discounting is assumed.

For the analysis of the level of effort exerted by the entrepreneur the model described in Tirole and Holmström (1997) is used. To analyse risk taking the extension of Tirole and Holmström (1997) by Biais and Casamatta (1999) is used. The altered model has three possible outcomes and addresses both the problem of effort level as well as risk taking.

The Tirole and Holmström (1997) model is then modified to be able to analyse debt overhang problems. The entrepreneur is now assumed to have a project in place and a new investment opportunity. The altered model has a framework similar to the models described by Hart and Moore (1995) and Bhattacharya and Faure-Grimaud (2001).

In the section addressing information asymmetries an altered version of Tirole (2006) framework is used. The original model has two types of entrepreneurs seeking finance. However, this study introduces a new type of entrepreneur not used in previous research. This enables a more thorough analysis of the characteristics of profit-sharing instruments like *mudarabah* and *musharakah*.

3.2 LIMITATIONS AND DELIMITATIONS

The models in the paper assume risk neutrality which may not be consistent with real-world risk profile of economic agents. If risk-aversion is introduced, the conclusions when comparing conventional debt, and *mudarabah* and *musharakah* can be affected. The framework assumes that cost allocation and underreporting problems are not present.

The theoretical framework has been developed in previous research for analysing problems of agency costs and asymmetric information for conventional debt contracts. This may not be an optimal framework for analysing profit-sharing agreements since several characteristics of *mudarabah* and *musharakah* are lost. The consequence is that the only difference between *mudarabah* and *musharakah* agreements in the models is the investment of own capital by the entrepreneur. Characteristics such as unlimited liability and differences in control rights have not been taken into account. In practice the participants in *musharakah* normally have unlimited liability. However, this is not a definite requirement under *musharakah*.

The paper also excludes methods of dealing with moral hazards such as posting collateral or pledging own wealth. Although some Islamic finance literature investigates these methods, posting collateral is not consistent with Islamic ethics. Therefore, these methods are not analysed in this study.

Since *mudarabah* and *musharakah* share some characteristics with equity, some conclusions this study makes regarding the profit-sharing instruments are equally applicable to equity. However, such situations arise when the analysis of *mudarabah* and *musharakah* is performed in a general context. When the model is further complicated, such as risk taking and bonus or debt overhang with no retained earnings, the mathematical implications are different between equity and the profit-sharing instruments. This paper however does not provide a formal comparison between *mudarabah* and *musharakah,* and equity.

The study is delimited to the relationship between a financier such as a bank and an entrepreneur. The relationship between the bank and its depositors are not considered. For simplicity it is assumed the entrepreneur himself is the only shareholder.

The analysis is only provided for the comparison of debt and profit-sharing instruments. This study does not consider combined use of debt, and *mudarabah* and/or *musharakah*.

4 PREVIOUS RESEARCH

In Islamic finance literature the advantages and disadvantages with financing methods in line with Islamic ethics, and how these compare to conventional forms of financing, are a common subject. In this debate financing modes like *mudarabah* and *musharakah* have a central role as they represent the core of Islamic finance (Khan & Mirakhor, 1992). Advocates of Islamic finance have argued that the profit-sharing properties of *mudarabah* and *musharakah* are superior to conventional debt for several reasons, including the risk-sharing properties (Ebrahim and Safadi 1995). In a theoretical exposition Khan (1989) concludes that variable return scheme like profit-sharing agreements are Pareto optimal contracts opposed to conventional fixed return agreements. However, Khan (1989) adds that the conclusion is very dependent on the availability of information in the economy and when including costs related to information asymmetries profit-sharing agreements may be Pareto inferior. Bacha (1997) provides an evaluation of *mudarabah* financing by using scenario analysis, assuming no information asymmetries, and finds that a borrower faced with the alternative of using *mudarabah*, debt or equity financing, *mudarabah* is preferred in a risk-return framework. For an investor faced with the same three alternatives, *mudarabah* financing would be the worst. Shaikh (2011) uses a different scenario analysis with similar results as Bacha (1997) and concludes that *mudarabah* financing is beneficial for the company seeking finance, but fruitless for the Islamic Financial Institution. In contrast to this, Humayon and Presley (2001) state that there are no theoretical reasons to believe that profit-sharing agreements is inherently inefficient.

Aggarwal and Yousef (2000) find that most of the Islamic banks they examined do not conform to the principle of profit-sharing. Instead, much of their financing activities are offered through debt-like instruments. The agency problem and the presence of asymmetric information have been stated as a major reason to why profit-sharing agreements like *mudarabah* and *musharakah* have not been a more preferred mode of financing (Zaher & Hassan, 2001). The problem of underreporting has been argued to be the main source of the structural problems with profit-sharing agreements (Babar, Iqbal, Khan, & Afzal, 2007). Consequently, other forms of moral hazard and agency problems have not received attention in the theoretical analysis.

Khan (1989) is addressing the underreporting problem. In Khan's (1989) model both the bank and the entrepreneur can verify the expected return of the projects. But, the actual outcome is unknown by the bank, which gives the entrepreneur incentives to divert cash from the project and thereby understate profits. However, In Khan's (1989) model all projects have a positive net present

value. As a result, problems such as cross-subsidisation and market-breakdown are not formally analysed. The focus is rather on finding the most effective way of monitoring to prevent the underreporting problem.

Aggerwal and Yousef (2000) present a theoretical model of investment and capital structure based on incomplete contracts. The model is built on a framework similar to Hart and Moore (1998) and Bolton and Scharfstein (1990) with the addition of allowing equity contracts in addition to debt contracts. Similarly to Khan (1989) projects are assumed to have positive net present value and the moral hazard present in the model is the underreporting of profits. However, Aggerwal and Yousef (2000) assume there are different types of entrepreneurs with different abilities to divert cash. Good entrepreneurs can divert less of a project's returns while bad entrepreneurs can divert more. By using a multi period model the aspect of entrepreneurs' reputation is incorporated in the model. Just like Khan (1989), Aggerwal and Yousef (2000) conclude that as the information asymmetries become more severe, debt will become the dominant instrument of finance.

Ahmed (2002) develops an incentive-compatible profit-sharing contract that reduces the moral hazard problem. He analyses the conditions under which an entrepreneur may under-report profits and the steps that banks can take to minimize the problem. However, there is no comparison with conventional debt. Similar to Aggerwal and Yousef (2000), Ahmed (2002) use a multi period model where the entrepreneur's track record is used as a signal of quality. An index is used to capture the magnitude of the information asymmetries.

Several researchers have focused on finding solutions on how to overcome the information asymmetries in profit-sharing agreements. Bacha (1997) proposed that the entrepreneur must reimburse the investor in the event of certain outcomes. Sarker (n.d) suggests positive incentives like providing stake in the ownership or granting bonus shares depending on performances as a way for decreasing moral hazard problems. However, the implications of such a bonus on other elements of the financing agreement such as profit-sharing ratio are not analysed. Karim (2000) proposes contribution of net worth or collateral from the entrepreneur as a way of solving moral hazard problem. However, he does not provide a formal argument of how this would mitigate the moral hazard problems. Khan (1989) focuses on finding the most effective way of monitoring to prevent the underreporting problem and concludes that a randomized monitoring technique is the most effective. Karim (2000) argues that *mudarabah* and *musharakah* are viable modes of financing and present four general guidelines for reducing adverse selection, agency costs and moral hazard problems. The general guidelines are; increase contribution of net worth and/or collateral from the

entrepreneur; decrease operational risk in the business; increase the fraction of observable cash flow; and lower the fraction of unobservable costs.

Returns are assumed to be verifiable in this study. Thereby, the well examined problem of underreporting is avoided. By using a different perspective, new structural characteristics can be addressed in terms of problems of effort level and asymmetric information. With regards to asymmetric information, the introduction of a new type of entrepreneur reveals fundamental problems that might lead to market breakdown. This study also provides a formal analysis of the problems of debt overhang and risk taking, which have not been addressed in previous research. The study therefore paints a broad picture of the problems and benefits surrounding profit-sharing agreements like *mudarabah* and *musharakah* that is not present in previous literature.

5 AGENCY COSTS AND EFFORT

The potential problems arising from agents controlling a firm on behalf of shareholders were mentioned in the literature as early as in the 18th century (Smith, 1776). Conflicts arise between the providers of financing (banks) and corporate insiders (the entrepreneur), since corporate insiders may not always act in the financiers' best interest. Sometimes the agents might have interests other than maximizing the total firm value which may cause the entrepreneur not putting his best effort in the undertaken project. This section analyses how the choice and the structure of financing agreements affect the level of effort the entrepreneur decides to exert on a given project. Traditional debt is compared to *mudarabah* and *musharakah* in order to determine which type of the contracts are a bigger subject to moral hazards.

The analysis starts with participation constraints for banks under conventional financing and under *mudarabah* and *musharakah* financing. The Modigliani-Miller proposition of irrelevance of financing choice holds with regards to *mudarabah* and *musharakah*. Intuitively, under conventional debt the bank takes all payoffs if the project fails, but has only a fixed claim in case of success. Under *mudarabah* and *musharakah* however, the bank can only take a portion of the payoff in case of failure and is therefore compensated by requiring a higher share if the project succeeds. These two effects cancel each other and the expected payoff to the entrepreneur is independent from financing method. Furthermore, if there is no payoff in case of failure – then, *mudarabah, musharakah* and conventional debt become equivalent in the framework used.

Debt generally serves as a better incentive device. The reason is that under *mudarabah* and *musharakah* financing the entrepreneur is rewarded even when the project fails. This property increases the entrepreneur's expected payoff from exerting low effort and decreases the net opportunity cost of pursuing private benefits. Debt financing, however, rewards the entrepreneur only when the project succeeds, and the expected payoff from low effort is less compared to *mudarabah* and *musharakah*. Paying bonuses can help to decrease the incentive problem arising from the profit-sharing nature of *mudarabah* and *musharakah*. It is shown that *mudarabah* and *musharakah* converge towards conventional debt as the size of the bonus increases. The reason is that a risk-neutral bank takes into account the possibility of paying bonus and increases the required profit-sharing ratio accordingly. Therefore, as the bonus increases, the entrepreneur's expected payoff in case of low effort is decreasing and the payoff in case of high effort is increasing. In an extreme case when the bonus is set at the maximum level possible under risk neutrality, the profit-sharing ratio is

equal to one and the entrepreneur is rewarded only if the project succeeds, which is a property of debt financing.

The size of the investment of the entrepreneur's own capital does not affect the entrepreneur's incentive-compatibility constraint. In that sense, *mudarabah* and *musharakah* do not behave differently with regards to incentive-compatibility. The intuitive explanation is that once the capital is invested, the investment becomes a sunk cost and the entrepreneur chooses the level of effort that maximizes the total payoff. The effect of capital investment by the entrepreneur is symmetric both for high and low effort, therefore having a zero net effect on the entrepreneur's effort choice. Although the capital investment by the entrepreneur does not have an effect on the incentive compatibility constraint, an investment by the entrepreneur increases the project's chances of getting financed. The reason is that the investment by the entrepreneur decreases the financing required from the bank, thereby decreasing the profit-sharing ratio required. Consequently, the incentive compatibility constraint becomes more likely to hold.

5.1 THE MODEL FOR EFFORT LEVEL

The model described in Tirole and Holmström (1997) is used as a basis of the theoretical analysis. The model contains an entrepreneur with an investment opportunity and a bank. The investment has a positive net present value. The project requires an initial investment of I. The entrepreneur may have some initial assets A to invest into the project, but must seek finance for the difference $I - A > 0$ in order to undertake the project. In this context *mudarabah* can be viewed as a special case of *musharakah*. Conditions for *mudarabah* can be obtained by setting $A = 0$ in the *musharakah* framework if not otherwise stated.

The model has two time periods ($t = \{1; 2\}$). The entrepreneur has the opportunity to invest in a project at $t = 1$ with assets in place generating profits in $t = 2$. If the project is undertaken and succeeds, it yields an income of $X_H > 0$. In contrast to Tirole and Holmström (1997) the project yields a certain income even when it fails. The income in case of failure is equal to $X_L$with X_L being $0 < X_L < I$. The information is symmetric throughout the model, but the project is subject to moral hazard since the entrepreneur can decide on exerting either high or low effort on the project. The entrepreneurs' decision on exerting effort is not verifiable. If the entrepreneur exerts high effort the probability of success is θ_H. If the entrepreneur exerts low effort he/she gets private benefits $B > 0$, but the probability of success of the project decreases to $\theta_L < \theta_H$. Once the project is undertaken both the financier and the entrepreneur can observe the final payoff.

Both the entrepreneur and the bank are risk-neutral. For notational simplicity, it is assumed there is no time preference, and the rate of return expected by the lenders is equal to zero. The entrepreneur is protected by limited liability. The capital markets are competitive and lenders make zero profit on their investment.

It is assumed that only exerting high effort is efficient. The project has a positive net present value if the entrepreneur exerts high effort ($\theta_H X_H + (1-\theta_H)X_L - I > 0$), but the net present value is negative if the entrepreneur exerts low effort ($\theta_L X_H + (1-\theta_L)X_L - I < 0$).

5.2 PARTICIPATION CONSTRAINTS

First, the condition necessary for a bank to provide financing is analysed. For a conventional bank the notion of interest is the face value of debt and for an Islamic bank it is the share in the project. In order to provide financing, the face value of the debt or the bank's share in the project should be set so that the bank can at least recover its initial investment on expected terms. The financing agreements are constructed on an implicit assumption that the entrepreneur will exert a high level of effort.

5.2.1 Conventional bank agreements

Under conventional debt agreements the bank has a fixed claim on the company's profit. The bank's claim is senior to that of any shareholder. Therefore, if the project succeeds, the bank takes only its fixed claim from the profits generated by the project. In case the project fails, the bank takes all the profits since $X_L < I$ according to the model's specification. Given these conditions, a risk neutral bank would agree to provide financing if the face value of debt meets the condition specified in equation (1.1).

$$R \geq \frac{I - A - (1-\theta_H)X_L}{\theta_H} \tag{1.1}$$

Equation (1.1) can be interpreted as the bank's participation constraint for conventional debt financing.

5.2.2 Musharakah agreement

Mudarabah and *musharakah* agreements are different from conventional debt in the sense that the bank does not have a fixed claim on the profit generated by the project. Instead of having a fixed claim, the bank has a fixed share in the final outcome of the project. The bank's share is independent from the outcome of the project. The bank takes an equal share of the project's payoff, in case of both success and failure.

A risk neutral bank agrees to finance the project if the profit-sharing ratio is set so that the bank expects at least to break even on the investment. The profit-sharing-ratio is denoted by *s* and is per definition $0 < s < 1$. Given these conditions, the bank will agree to finance the project if the profit-sharing ratio s meets the condition specified in equation (1.2) which can be viewed as the bank's participation constraint under *musharakah* financing.

$$s \geq \frac{The\ bank's\ investment}{Expected\ profits\ from\ the\ project} = \frac{I - A}{\theta_H X_H + (1 - \theta_H) X_L} \tag{1.2}$$

Since the entrepreneur has initial assets equal to A, the bank provides only the difference $I - A$. Equation (1.2) show that the minimum profit-sharing-ratio required by the bank increases with the amount of financing required from the bank, and decreases with the profitability of the project. When the entrepreneur is not contributing to the project with own wealth ($A = 0$) the *musharakah* contract is equivalent of *mudarabah* contract within this framework.

If the substance of the two agreements is analysed, it can be concluded that the difference between these agreements exists due to the presence of profits in case of failure. Mathematically, this is verifiable by setting X_L equal to zero in equations (1.1) and (1.2) and by dividing equation (1.1) by X_H. The intuition is that when $X_L > 0$ and the project fails, the bank takes the whole X_L under conventional debt financing, whereas the bank takes only sX_L in case of *musharakah,* which is the main difference between the agreements. In the absence of payoff in failure both banks construct the agreements taking into account only the payoff in success and end up having same profits in case of both success and failure.

5.3 IRRELEVANCE OF FINANCING CHOICE

This part examines how the choice of financing agreement affects the value of the project for the entrepreneur in the absence of private benefits. In particular, it is examined if the entrepreneur can expect a higher payoff when using either conventional debt or *musharakah*. The participation constraints specified in equations (1.1) and (1.2) become binding under competitive capital markets. The assumption that the financing is raised under competitive capital markets is applied.

5.3.1 Conventional bank agreements

Under conventional financing the entrepreneur receives payoff only in case of success since the bank takes all the profits if the project fails. Therefore, the entrepreneur's expected payoff function only considers the probability and outcome of success. The expected payoff attributed to the entrepreneur is shown in (1.3).

$$E(Profit) = \theta_H(X_H - R) = \theta_H\left(X_H - \frac{I - A - (1-\theta_H)X_L}{\theta_H}\right) - A = \theta_H(X_H - X_L) + X_L - I \quad (1.3)$$

5.3.2 Musharakah agreement

Under a *musharakah* agreement the share s of the project's final payoff accrues to the bank and the entrepreneur receives the remaining share $1 - s$. The bank's share s is identical in the case of success and failure. The entrepreneur's expected payoff under *musharakah* agreement is presented in (1.4).

$$E(Payoff) = \theta_H(1-s)X_H + (1-\theta_H)(1-s)X_L - A \quad (1.4)$$

The parameter s in equation (1.4) is replaced with the expression in (1.2) and equation (1.5) is obtained.

$$\begin{aligned} E(Payoff) &= \theta_H\left[\left(1 - \frac{I-A}{\theta_H X_H + (1-\theta_H)X_L}\right)X_H\right] + (1-\theta_H)\left[\left(1 - \frac{I-A}{\theta_H X_H + (1-\theta_H)X_L}\right)X_L\right] - A \\ &= \theta_H(X_H - X_L) + X_L - I \end{aligned} \quad (1.5)$$

The result obtained in (1.5) is identical with the result in (1.3). This shows that the entrepreneur has the same expected payoff from the project independent on the mode of financing agreement. Also note that the entrepreneur's net payoff does not depend on the initial investment he/she makes from own capital.

Intuitively, the banks construct the financing agreements so that they take portion *I* from the total expected profits. The remaining part of the expected payoffs is attributed to the entrepreneur. On expected terms the payoff to the entrepreneur is identical for the two modes of financing. Under conventional debt the bank receives a larger share of the profits in case of failure, whereas under a *musharakah* agreement it receives a larger share in case of success. From the entrepreneur's perspective these two effects offset each other and therefore he/she is indifferent between financing modes given the assumption of risk neutrality.

5.4 INCENTIVE COMPATIBILITY CONSTRAINTS

When introducing private benefits to the analysis, the entrepreneur's incentives are not necessarily aligned with the bank's interest. Since private benefits are a form of payoff, the entrepreneur needs to be compensated in order to refrain from pursuing them. In this part the effect of private benefits on the entrepreneur's incentives is analysed. The analysis is conducted for *musharakah*, *mudarabah* and conventional debt agreements. *Mudarabah* and *musharakah* are analysed separately in this part to investigate the effect of the entrepreneur investing own wealth. The results are then compared to conventional debt.

5.4.1 Conventional debt

For the entrepreneur to have an incentive to exert high effort, the payoff when exerting high effort should be higher than the payoff when exerting low effort plus private benefits. Therefore, in order for the entrepreneur to exert high effort the constraint (1.6) must hold. Otherwise, the entrepreneur will have a higher expected payoff when not working and will therefore not have incentive to exert high effort.

$$\theta_H(X_H - R) \geq \theta_L(X_L - R) + B \tag{1.6}$$

By solving equation (1.6) for R the constraint specified in (1.7) is obtained.

$$R \leq X_H - \frac{B}{\theta_H - \theta_L} \tag{1.7}$$

When the face value of debt R exceeds the level specified in equation (1.7) the entrepreneur will expect a higher payoff from not working. Equation (1.7) can therefore be viewed as an incentive compatibility constraint for the entrepreneur.

5.4.2 Mudarabah

The logic described for conventional debt applies to *mudarabah*. The entrepreneur's expected payoff from working should be sufficiently high in order to compensate for private benefits. The entrepreneur exerts high efforts if the expected payoff from exerting effort is higher than the expected payoff from exerting low effort plus private benefits. For simplicity, expected payoff from high effort is denoted by $E(P_H)$ and the expected payoff from low effort is denoted by $E(P_L)$. The entrepreneur's incentive compatibility constraint is then given by equation (1.8).

$$(1 - s) \times E(P_H) \geq (1 - s) \times E(P_L) + B \tag{1.8}$$

Equation (1.8) is solved for s to determine the maximum profit-sharing-ratio that gives the entrepreneur incentive to work.

$$s \leq 1 - \frac{B}{E(P_H) - E(P_L)} \tag{1.9}$$

Equation (1.9) shows that the maximum incentive-compatible level of *s* decreases with the level of private benefits and increases with the difference between expected profits in high and low effort level. The difference between expected payoff from working and the expected payoff from shirking is further examined in equation (1.10).

$$E(P_H) - E(P_L) = (\theta_H X_H + (1 - \theta_H)X_L) - (\theta_L X_H + (1 - \theta_L)X_L) = (\theta_H - \theta_L)(X_H - X_L) \tag{1.10}$$

Equation (1.10) concludes that the difference between the expected payoffs can be divided into two components. The first component is the difference between the probabilities of success when working and when shirking. The difference is increasing with θ_H and decreasing with θ_L.

Similarly, the second component is the difference between cash flows in success and failure. The results from equation (1.10) can be substituted into equation (1.9) obtaining equation (1.11).

$$s \leq 1 - \frac{B}{(\theta_H - \theta_L)(X_H - X_L)} \tag{1.11}$$

5.4.3 Musharakah

Musharakah can be viewed as an extension of *mudarabah* where the entrepreneur invests own wealth A into the project. The incentive compatibility constraint given that the entrepreneur invests own wealth is specified in equation (1.12):

$$\theta_H[X_H(1-s) - A] + (1-\theta_H)[X_L(1-s) - A] \geq \theta_L[X_H(1-s) - A] + (1-\theta_L)[X_L(1-s) - A] + B \tag{1.12}$$

Equation (1.12) can be simplified to equation (1.13). The A on the right hand side of the constraint cancel with the Aon the left hand side, making the entrepreneur's incentive compatibility constraint under *musharakah* identical to the constraint under *mudarabah*:

$$(1-s)(\theta_H X_H + (1-\theta_H)X_L) \geq (1-s)(\theta_L X_H + (1-\theta_L)X_L) + B \tag{1.13}$$

Solving (1.13) with respect to s results in the same equation as in (1.11). Hence, the solution to the constraint is:

$$s \leq 1 - \frac{B}{(\theta_H - \theta_L)(X_H - X_L)} \tag{1.14}$$

The capital investment by the entrepreneur does not have a direct effect on the level of effort he/she chooses to exert. Once A is invested into the project, it becomes a sunk cost for the entrepreneur. After starting the project, the entrepreneur will choose the level of effort that maximizes his/her expected payoff. Since expected payoff in low and high effort are not affected by the size of initial investment, A does not have an impact on the entrepreneur's decision making.

Note that the size of required A has an effect on the entrepreneur's decision on taking/not taking the project. The entrepreneur will invest A if it is either less than his payoff in case of high effort $(A < (1-s)(\theta_H \times X_H + (1-\theta_H) \times X_L)$ or in case of low effort $(A < (1-s)(\theta_L \times X_H + (1-\theta_L) \times X_L) + B)$. Moreover, for the entrepreneur willing to exert high effort, the size of A has no impact on the net expected payoff (1.5).

Classical corporate finance literature such as Besanko & Thakor (1987) discusses the method of pledging collateral or the entrepreneur's own wealth in order to increase incentives for high effort. This method is usually effective for conventional debt since the entrepreneur is punished in case of failure as the bank seizes pledged assets. However, the method of pledging collateral or wealth does not comply with Islamic ethics. Although investing own wealth has some resemblance to pledging wealth, it is not as effective in providing incentives for high effort.

5.5 COMPARISON OF AGENCY COSTS BETWEEN MUSHARAKAH AND CONVENTIONAL DEBT

In order for a bank to provide financing both the participation constraint and the incentive compatibility constraint should hold. By combining participation constraint $\frac{I-A-(1-\theta_H)X_L}{\theta_H} \leq R$ (1.1) and incentive compatibility constraint $R \leq \frac{X_H(\theta_H-\theta_L)-B}{(\theta_H-\theta_L)}$ (1.7), equation (1.15) is obtained.

$$\frac{I-A-(1-\theta_H)X_L}{\theta_H} \leq R \leq \frac{X_H(\theta_H-\theta_L)-B}{(\theta_H-\theta_L)} \tag{1.15}$$

The face value of debt has to be big enough for the bank to break even on expected terms. However, the face value of the debt cannot be higher than the maximum amount that the entrepreneur is willing to give up and still exert high effort.

The equivalent constraint to (1.15) for a *musharakah* agreement is given in (1.16). Equation (1.16) is a combination of the participation constraint $\frac{I-A}{\theta_H X_H+(1-\theta_H)X_L} \leq s$ (1.2) and incentive compatibility constraint $s \leq 1-\frac{B}{(\theta_H-\theta_L)(X_H-X_L)}$ (1.14).

$$\frac{I-A}{\theta_H X_H+(1-\theta_H)X_L} \leq s \leq 1-\frac{B}{(\theta_H-\theta_L)(X_H-X_L)} \tag{1.16}$$

The share s given to the financier has to be large enough so that the financier breaks even on expected terms. However, the share given to the financier cannot be larger than the share the entrepreneur is willing to give up and still have incentive to exert effort.

If neither equation (1.15) or equation (1.16) holds, there is a problem of agency costs. Projects that have positive net present values will not be financed since the entrepreneurs have higher incentive to exert low effort. Since the effort choice is not verifiable by the financier this induces agency costs.

Equation (1.16) can be rearranged into the form shown in equation (1.17)

$$\frac{I-A-(1-\theta_H)X_L}{\theta_H} \leq \frac{X_H(\theta_H-\theta_L)-B}{(\theta_H-\theta_L)} - \frac{BX_L}{\theta_H(\theta_H-\theta_L)(X_H-X_L)} \tag{1.17}$$

If equation (1.17) holds for *musharakah*, the entrepreneur's interests are aligned with the bank's interests. Consequently, the constraint (1.17) can also be viewed as a condition for financing to be possible. Writing equation (1.16) in this form makes it easier to compare the conditions for *mudarabah* and conventional debt. The only difference between equations (1.15) and (1.17) is the term $-\frac{BX_L}{\theta_H(\theta_H-\theta_L)(X_H-X_L)}$. The term is strictly negative since the factors B, X_L, θ_H, $(\theta_H-\theta_L)$ and (X_H-X_L) are all positive. Consequently, the right hand side of equation (1.17) is smaller than right hand side of equation (1.15) meaning that there is a bigger risk of agency problems under *musharakah* financing than under debt financing.

The intuitive reason for this finding is that under *musharakah,* the entrepreneur receives some payoff even if the project fails. This makes exerting low effort and receiving private benefits less costly compared to debt. Consequently, projects with no effort problem under conventional debt may have this problem under *musharakah* financing.

Also note that the difference exists only when the cash flow in case failure X_L is larger than zero. If X_L is equal to zero, then there is no difference between the financing methods from agency cost perspective. These conclusions are equally true for *mudarabah* as well as for *musharakah.*

5.6 PERFORMANCE BASED BONUSES

Classical incentive devices like pledging collateral and pledging the entrepreneur's own wealth is not an option in Islamic finance since it violates the ethical rules prohibiting risk free profits. Pledging collateral or wealth in a *mudarabah* or *musharakah* agreement is therefore not possible. However, it is possible for banks in *mudarabah* and *musharakah* agreements to give the entrepreneur positive incentive devices such as performance based bonuses. In this part the effect of performance based bonuses' on the agency costs of *mudarabah* and *musharakah* agreements is analysed.

5.6.1 Bonus as a lump sum

The lender may decide to pay a performance based bonus in the form of a lump sum. Then, a risk neutral bank would take into account the potential possibility of paying a bonus and adjust its profit share in the project accordingly. The bonus the bank pays as an incentive to exert high effort is denoted with c and the new profit-sharing-ratio a risk neutral bank would require is denoted with s_c. Given these conditions, the bank requires a profit-sharing ratio so that equation (1.18) holds.

$$s_c\theta_H X_H + s_c(1-\theta_H)X_L - \theta_H c \geq I - A \tag{1.18}$$

By solving equation (1.18) for s_c the participation constraint (1.19) is obtained.

$$s_c \geq \frac{I - A + \theta_H c}{\theta_H X_H + (1-\theta_H)X_L} \tag{1.19}$$

The bank is increasing its share in the project in accordance to the size of the bonus and the probability that the bank will be paying it. It should be noted that $s_c > s$ for any positive lump sum bonus.

As is shown in equation (1.20), the introduction of lump sum bonus does not change the entrepreneur's expected pay-off if the entrepreneur is exerting high effort. The result obtained in (1.20) is identical to the results obtained in (1.3) and (1.5). The intuition is that a risk neutral bank defines its share in expected profits so that it could recover I and this leaves the same expected

payoff for the entrepreneur independently from the financing mechanism. The possible bonus in case of success is compensated by decreasing share in future payoffs leaving the total expected payoff to the entrepreneur unchanged.

$$\begin{aligned}(1-s_c)(\theta_H X_H+(1-\theta_H)X_L)+\theta_H c-A\\ =\left(1-\frac{I-A+\theta_H c}{\theta_H X_H+(1-\theta_H)X_L}\right)(\theta_H X_H+(1-\theta_H)X_L)+\theta_H c-A\\ =\theta_H X_H+(1-\theta_H)X_L-I\end{aligned} \tag{1.20}$$

However, if the entrepreneur exerts low effort the expected payoff with bonus is smaller than what it otherwise would be. The entrepreneur's expected payoff with low effort $(1-s_c)(\theta_L X_H+(1-\theta_L)X_L)+\theta_H c+B$ can be rearranged into the form given in equation (1.21).

$$(1-s)(\theta_L X_H+(1-\theta_L)X_L)+B-c\frac{X_L(\theta_H-\theta_L)}{\theta_H\times X_H+(1-\theta_H)\times X_L} \tag{1.21}$$

Entrepreneur's payoff with low effort when no bonus is paid | Negative term arising due to bonus

The introduction of a bonus decreases the entrepreneur's payoff in case of low effort. The probability of success in case of low effort is smaller and therefore the entrepreneur looses more from the decreased share in the project than he/she gains from the expected bonus. The bonus leaves the entrepreneurs expected payoff unchanged in high effort and decreases the expected payoff in low effort. Therefore, introduction of bonus can serve as an effective incentive device. Note that in the absence of cash flows in case of failure, bonus would not be an effective device since the term $c\frac{X_L(\theta_H-\theta_L)}{\theta_H\times X_H+(1-\theta_H)\times X_L}$ becomes equal to zero. This is because the absence of profits in failure makes *musharakah* and debt identical to each other.

The entrepreneur's pay-off in the case of failure is linearly decreasing with c meaning a higher bonus has more chance of being incentive compatible. However, c cannot be larger than $(X_H-\frac{I-A-(1-\theta_H)X_L}{\theta_H})$ since s_c should always be less than one. In the extreme case, when the amount of bonus is chosen so that $s_c=1$ the entrepreneur's pay-off matrix is $\{X_H-\frac{I-A-(1-\theta_H)X_L}{\theta_H},0\}$ which is identical to the payoff matrix under conventional debt. Therefore, introduction of bonus can be viewed as a way of transforming *mudarabah* and *musharakah* contracts into conventional debt. This is consistent with the findings in the previous part where it was shown that debt is a better incentive device.

5.6.2 Bonus as an increase in share of profits

Now consider a different type of performance based bonus. Instead of giving a lump sum c, the entrepreneur is given a larger share in the profits (Δ_s) if the project is successful. The profit-sharing-

ratio required by a bank that gives this type of bonus is denoted by s_B. The bank's share s_B should be set so that equation (1.22) holds in order for the bank to break even in expected terms.

$$(s_B - \Delta_s)\theta_H X_H + s_B(1-\theta_H)X_L \geq I - A \tag{1.22}$$

By solving equation (1.22) for $s_B$the constraint in (1.23) is obtained.

$$s_B \geq \frac{I - A + \Delta_s \theta_H X_H}{\theta_H X_H + (1-\theta_H)X_L} \tag{1.23}$$

The bank is increasing its share in the project in accordance to the size of the bonus and the probability that it will be paid.

Similarly to the setup with a lump-sum bonus, the introduction of bonus as an increase in share of profits does not change the entrepreneur's expected payoff if he is exerting high effort (1.24). The intuition is similar to that in lump-sum bonus. The bank keeps its share in the expected profits constant in order to be able to break even, thereby leaving the same amount for the entrepreneur. The possible bonus in case of success is compensated by decreasing share in payoffs in the case of failure, leaving the expected payoff to the entrepreneur unchanged.

$$\begin{aligned}(1 - s_B + \Delta_s)\theta_H X_H + (1-s_B)(1-\theta_H)X_L \\ = \left(1 - \frac{I - A + \Delta_s \theta_H X_H}{\theta_H X_H + (1-\theta_H)X_L}\right)(\theta_H X_H + (1-\theta_H)X_L) + \Delta_s \theta_H X_H \\ = \theta_H X_H + (1-\theta_H)X_L - I\end{aligned} \tag{1.24}$$

However, if the entrepreneur exerts low effort, the expected payoff function is given in equation (1.25).

$$(1 - s + \Delta_s)\theta_L X_H + (1-s)(1-\theta_L)X_L + B \tag{1.25}$$

The expression in (1.25) can be rearranged into the expression (1.26).

$$\underbrace{(1-s)(\theta_L X_H + (1-\theta_L)X_L) + B}_{\text{Entrepreneur's payoff with low effort when no bonus is paid}} \underbrace{- \Delta_s X_H \frac{X_L(\theta_H - \theta_L)}{\theta_H \times X_H + (1-\theta_H) \times X_L}}_{\text{Negative term arising due to bonus}} \tag{1.26}$$

Similar to a lump sum bonus, the introduction of a share bonus decreases the entrepreneur's payoff in case of low effort. The probability of success in case of low effort is smaller and therefore the entrepreneur loses more from the decreased share in the project than gains from expected bonus. The bonus leaves the entrepreneurs expected payoff unchanged in high effort and decreases the expected payoff in low effort. Therefore, introduction of bonus can serve as an effective incentive device. Because of the symmetrical characteristics of the bonus structure between a lump sum bonus and bonus with a share increase, the earlier conclusion that, as bonus increases

musharakah and *mudarabah* converges to conventional debt still holds. It can be concluded that from an incentive perspective, under this setup the form of bonus is irrelevant.

5.7 CONCLUDING REMARKS

This section showed that the difference between *mudarabah, musharakah* and conventional debt is coming from the existence of cash flows in case of failure. If the project does not yield any income when failing, then the instruments are equivalent to each other within this framework. It was shown that Miller and Modigliani (1958) proposition 1 is applicable to *mudarabah* and *musharakah* agreements. A risk neutral entrepreneur is indifferent between the forms of financing, but debt generally has lower agency costs compared to *mudarabah* and *musharakah* financing. By investing own capital, the entrepreneur helps financing to become possible since the profit-sharing-ratio required by the bank decreases. However, this investment does not have a direct impact on the entrepreneur's effort decision. Bonuses are generally an effective incentive device decreasing the agency cost for *mudarabah* and *musharakah*. However, as bonus increases, *mudarabah* and *musharakah* contracts converge towards conventional debt.

6 RISK TAKING

Taking on leverage may adversely affect project choice. Leverage encourages risk-taking because the downside is limited while the upside is not. Thus risky projects with negative net present value may be undertaken instead of safer projects with positive net present value. In this section risk taking and effort choice is analysed in *mudarabah* and *musharakah* agreements. The results are compared to conventional debt agreements.

Risk shifting occurs when the entrepreneur is not affected by the downside. Under debt financing, the entrepreneur receives the entire excess payoff once the bank's claim is satisfied. Since the entrepreneur's payoff depends only on success, he might not consider what the project generates in other outcomes when undertaking the project. Therefore, the entrepreneur may have incentives to take riskier projects that generate larger payoff in the case of success. Taking risky projects may however have adverse impact on debtholders' expected payoff.

In contrast to conventional debt, under *mudarabah* and *musharakah* contracts the entrepreneur is affected by all states of the world. The entrepreneur's expected payoff function is symmetrical to the bank's expected payoff function and their interests are thereby aligned. Therefore, under *mudarabah* and *musharakah* the entrepreneur will take the risky project only if it is in the interest of the capital-provider as well. This property eliminates the risk-shifting problem from *mudarabah* and *musharakah* financing. However, *mudarabah* and *musharakah* agreements become a suspect of risk-taking when bonuses are paid. These problems arise because paying bonuses makes the payoff structure of *mudarabah* and *musharakah* converge towards conventional debt.

6.1 THE RISK TAKING AND EFFORT MODEL

The model described by Biais and Casamatta (1999) which is an extension of the model by Tirole and Holmström (1997) is used in analysis of risk taking. In the model the entrepreneur has an investment opportunity requiring an investment of I. The entrepreneur has own wealth $(A \geq 0)$. However, $A < I$, so there is a need for external financing for the new investment. All outcomes in the model are assumed to be verifiable by all parties and the entrepreneur is assumed to act in shareholders' interest. In contrast to the previous models, it is now assumed that there are three possible payoffs for the project; success (X_S), medium (X_M) and failure (X_F) with $X_S > X_M > X_F$.

There are two different ways for the entrepreneur to commit moral hazard. The first way is by risk taking and the second way is by not exerting sufficient effort. If the entrepreneur does not exert

high effort, he/she receives private benefits B. However, the choice of low effort is not efficient and the project then has a negative net present value as presented in (2.1).

$$\frac{1}{3}X_S + \frac{1}{3}X_M + \frac{1}{3}X_F + B < I \tag{2.1}$$

If exerting high effort, the entrepreneur receives no private benefits. However, exerting high effort increases the probability of success and decrease the probability of failure by $\theta > 0$. The net present value of the project is positive if the entrepreneur exerts high effort. The net present value in case of high effort is presented in equation (2.2).

$$\left(\frac{1}{3} + \theta\right)X_S + \frac{1}{3}X_M + \left(\frac{1}{3} - \theta\right)X_F > I \tag{2.2}$$

In addition to the choice of effort, the entrepreneur also decides between different risk levels of the project. The risk decision is independent from the effort decision. The entrepreneur may decide to gamble and increase the probability of success by α and increase the probability of failure by β. Risk taking reduces the net present value of the project as presented in (2.3).

$$\alpha(X_S - X_M) < \beta(X_M - X_F) \tag{2.3}$$

The face value of debt is such that the entrepreneur does not get any reward in the case of failure $X_S > X_M > R > X_F$. The entrepreneur is risk neutral and is protected by limited liability. Investors have no time preference and expect zero profit on their investments. In order to avoid repetition, the analysis in this section is presented only for *musharakah*. The results for *mudarabah* can be obtained by replacing $A = 0$.

6.2 CONVENTIONAL DEBT

The bank constructs the loan agreement in such a way that it breaks even in expected terms. The loan is constructed under the assumption that the entrepreneur will exert high effort and will not take risk. The bank receives all the payoff generated by the project in the case of failure and recovers its initial investment in cases of middle and successful outcome. The participation constraint for the bank is presented in (2.4).

$$R \geq \frac{I - A - (\frac{1}{3} - \theta)X_F}{\frac{2}{3} + \theta} \tag{2.4}$$

6.2.1 Effort level under conventional debt financing

For the entrepreneur to exert high effort, the incentive compatibility constraint presented in (2.5) must hold.

$$\left(\frac{1}{3}+\theta\right)(X_S-R)+\frac{1}{3}(X_M-R)\geq\frac{1}{3}(X_S-R)+\frac{1}{3}(X_M-R)+B \tag{2.5}$$

After some simplifications the constraint in (2.6) is obtained.

$$R\leq X_S-\frac{B}{\theta} \tag{2.6}$$

The equation in (2.6) can also be rearranged to $\theta(X_S-R)\geq B$. An intuitive explanation could be that the increase in expected payoff for the entrepreneur from exerting effort should be larger than the private benefits the entrepreneur would otherwise get. If the entrepreneur does not expect a large enough increase in payoff from exerting high effort, he/she would prefer to shirk and receive private benefits.

6.2.2 Risk taking under conventional debt financing

The risk decision is independent from the effort decision in the model. Assuming that the entrepreneur is exerting high effort, the constraint in (2.7) must hold in order for the entrepreneur not to take the risky project.

$$\left(\frac{1}{3}+\theta\right)(X_S-R)+\frac{1}{3}(X_M-R)\geq\left(\frac{1}{3}+\theta+\alpha\right)(X_S-R)+(\frac{1}{3}-\alpha-\beta)(X_M-R)+B \tag{2.7}$$

After some simplifications the constraint in (2.8) is obtained.

$$(\alpha+\beta)(X_M-R)\geq\alpha(X_S-R) \tag{2.8}$$

The intuitive explanation is that if the gain in expected payoff in the successful outcome is greater than the decrease in expected payoff in the medium outcome, the entrepreneur will have incentive to undertake the risky project. Since the entrepreneur is protected by limited liability, he/she is not affected by the downside in the outcome of failure. However, the entrepreneur receives the entire extra payoff in case the project succeeds. This leads to a risk shifting problem.

6.2.3 Combination of risk taking and effort level

In order for the entrepreneur not to take the risky project and exert high effort at the same time, the incentive compatibility constraint displayed in (2.9) should hold.

$$\left(\frac{1}{3}+\theta\right)(X_S-R)+\frac{1}{3}(X_M-R)\geq\left(\frac{1}{3}+\alpha\right)(X_S-R)+\left(\frac{1}{3}-\alpha-\beta\right)(X_M-R)+B \tag{2.9}$$

After some simplification equation (2.10) is obtained.

$$R \leq \frac{X_S(\theta - \alpha) + X_M(\alpha + \beta) + B}{\theta + \beta} \tag{2.10}$$

6.3 MUSHARAKAH FINANCING

The bank in a *musharakah* agreement chooses its profit-sharing-ratio so that it breaks even in expected terms. The participation constraint for the bank in a *musharakah* agreement is given in (2.11).

$$s \leq \frac{I - A}{\left(\frac{1}{3} + \theta\right) X_S + \frac{1}{3} X_M + \left(\frac{1}{3} - \theta\right) X_F} \tag{2.11}$$

6.3.1 Effort level under musharakah financing

In order for the entrepreneur to exert high effort, the entrepreneur's expected payoff in high effort has to be equal to or greater than the entrepreneur's expected payoff in low effort plus private benefits. The incentive compatibility constraint for effort is presented in (2.12).

$$\begin{gathered}(1 - s) \times E(P_H) \geq (1 - s) \times E(P_L) + B \\ s \leq 1 - \frac{B}{E(P_H) - E(P_L)}\end{gathered} \tag{2.12}$$

The result obtained in (2.12) is equivalent to the result presented in (1.9). Consequently, the introduction of a new possible state of the world does not affect the general structure of the entrepreneur's incentive compatibility constraint. When plugging in the expressions for $E(P_H)$ and $E(P_L)$ and simplifying the incentive compatibility constraint (2.13) is obtained.

$$s \leq 1 - \frac{B}{\theta(X_S - X_F)} \tag{2.13}$$

The level of s the entrepreneur is willing to give up and still exert high effort depends on the size of the benefits, the success probability and the difference in payoff between success and failure. The risk of low effort is increasing in the amount of private benefits the entrepreneur receives and decreases in the probability of success and the difference in payoff between success and failure.

6.3.2 Risk taking under musharakah financing

The next step is to analyse the problem of risk taking under *musharakah* agreements. In order for the entrepreneur not to take the risky project under *musharakah* financing, the incentive compatibility constraint in (2.14) must hold.

$$\left(\frac{1}{3}+\theta\right)(1-s)X_S+\frac{1}{3}(1-s)X_M+\left(\frac{1}{3}-\theta\right)(1-s)X_F \geq \left(\frac{1}{3}+\theta+\alpha\right)(1-s)X_S+(\frac{1}{3}-\alpha-\beta)(1-s)X_M+\left(\frac{1}{3}-\theta+\beta\right)(1-s)X_F \quad (2.14)$$

By dividing each side of equation (2.14) by $1-s$ $(0<s<1)$ the equation presented in (2.15) is obtained.

$$\left(\frac{1}{3}+\theta\right)X_S+\frac{1}{3}X_M+\left(\frac{1}{3}-\theta\right)X_F \geq \left(\frac{1}{3}+\theta+\alpha\right)X_S+(\frac{1}{3}-\alpha-\beta)X_M+\left(\frac{1}{3}-\theta+\beta\right)X_F \quad (2.15)$$

The result presented in (2.15) shows that whenever the net present value of the project without risk taking is higher than the net present value of the project with risk taking, the entrepreneur will not take risk. Considering that the model assumes that taking risk decreases the project's net present value, then under *musharakah* agreement the entrepreneur will never take risk under this framework. Consequently, there is no risk shifting problem in *musharakah* financing. This result is consistent with previous research in this area such as Hart (1986) where profit-sharing has been shown to be a remedy to risk-shifting problems. The entrepreneur will only have preference for the project with the highest net present value. An intuitive explanation is that unlike under conventional debt contracts, under *musharakah* the entrepreneur is affected by downside as well. More formally, the entrepreneur does not take the risky project if constraint (2.16) holds.

$$0 \geq \alpha X_S - X_M(\alpha+\beta)+\beta X_F \quad (2.16)$$

6.3.3 Combination of risk taking and effort level

Now the combination of risk shifting and effort under *musharakah* agreements is analysed. For the entrepreneur not to take risk and at the same time exert high effort, it should be that the entrepreneur's payoff from efficient behaviour is larger than the payoff from inefficient behaviour. The incentive compatibility constraint for the entrepreneur to exert high effort and not to take on risk at the same time is given in equation (2.17).

$$(1-s)\left[\left(\frac{1}{3}+\theta\right)X_S+\frac{1}{3}X_M+\left(\frac{1}{3}-\theta\right)X_F\right] \geq (1-s)\left[\left(\frac{1}{3}+\theta+\alpha\right)X_S+\left(\frac{1}{3}-\alpha-\beta\right)X_M+\left(\frac{1}{3}-\theta+\beta\right)X_F\right]+B \quad (2.17)$$

By solving the constraint in (2.17) for s constraint (2.18) is obtained.

$$s \leq 1-\frac{B}{\theta(X_S-X_F)-[\alpha X_S-(\alpha+\beta)X_M+\beta X_F]} \quad (2.18)$$

The equation given in (2.18) can be rewritten as in (2.19).

$$s \leq \frac{\theta(X_S-X_F)-B-[\alpha X_S-(\alpha+\beta)X_M+\beta X_F]}{\theta(X_S-X_F)-[\alpha X_S-(\alpha+\beta)X_M+\beta X_F]} \quad (2.19)$$

Effort part Risk-taking part

Equation (2.19) can be viewed as a combination of equation (2.13) and equation (2.16). Given that each of constraints for high effort (2.13) and for no risk taking (2.16) hold, then the constraint for no risk and high effort (2.19) will also hold.

6.4 COMPARISON BETWEEN MUSHARAKAH AND CONVENTIONAL DEBT

In the previous section it was shown that the entrepreneur will always prefer the project with the highest net present value under *musharakah* financing and therefore risk shifting does not occur under this mode of financing. Here, it is formally shown that the constraint is more likely to hold for *musharakah* than for conventional debt. The condition for the entrepreneur not to take on the risky project under conventional debt $(\alpha+\beta)(X_M-R)\geq\alpha(X_S-R)$ (2.8) is rearranged in (2.20).

$$0\geq\alpha X_S-X_M(\alpha+\beta)+\beta R \tag{2.20}$$

The equivalent constraint for *musharakah* is $0\geq\alpha X_S-X_M(\alpha+\beta)+\beta X_F$ (2.16). The only difference between the constraints (2.20) and (2.16) are the terms βR and βX_F. Since the debt is risky ($R>X_F$), it can be concluded that $\beta R>\beta X_F$ is also true. Consequently the likelihood of risk shifting is larger for conventional debt than for *musharakah* financing.

Effort is not compared between *musharakah* and conventional debt in this section since the issue has been addressed in the previous section.

6.5 BONUSES AND RISK SHIFTING

It has been shown that bonus under *musharakah* can work as an effective device for giving the entrepreneur incentives to work. However, introduction of bonuses may impose other types of moral hazard problems. For simplicity we assume a lump sum bonus c is paid to the entrepreneur if the project succeeds. Then, the entrepreneur's incentive compatibility constraint for not taking risk is given in equation (2.21).

$$\begin{aligned}\left(\frac{1}{3}+\theta\right)(1-s_c)X_S+\frac{1}{3}(1-s_c)X_M+\left(\frac{1}{3}-\theta\right)(1-s_c)X_F+\left(\frac{1}{3}+\theta\right)c\\ \geq\left(\frac{1}{3}+\theta+\alpha\right)(1-s_c)(X_S)+\left(\frac{1}{3}-\alpha-\beta\right)(1-s_c)X_M\\ +\left(\frac{1}{3}-\theta+\beta\right)(1-s_c)X_F\ +\left(\frac{1}{3}+\theta+\alpha\right)c\end{aligned} \tag{2.21}$$

The constraint in (2.21) is then solved for s obtaining the result in equation (2.22).

$$c\leq(1-s_c)\frac{(\alpha+\beta)X_M-\alpha X_S-\beta X_F}{\alpha} \tag{2.22}$$

Equation (2.22) displays that there is an upper limit to the maximum amount of risk-compatible bonus. If the bonus exceeds the amount specified in constraint (2.22), the problem of risk shifting occurs.

Equation (2.22) is more easily interpreted when rearranged to $\alpha c \leq (1 - s_c)(\alpha + \beta)X_M - \alpha X_S - \beta X_F$. If the entrepreneur chooses the risky project, the expected bonus will increase by αc. On the other hand, the risky project has a negative net present value and the entrepreneur's expected payoff will therefore decrease by $(1 - s_c)(\alpha + \beta)X_M - \alpha X_S - \beta X_F$. If the increase in expected bonus from taking the risky project is larger than the decrease in expected payoff, the entrepreneur will choose the risky project. Therefore, unlike the findings in the previous section, under risk-shifting framework a larger bonus is not necessarily a better incentive device.

It should be noted that increasing the bonus affects equation (2.22) from two sides – first it increases the left hand side via c, second, it decreases the right hand side since a higher bonus reduces $1 - s_c$ due to the assumption of risk neutrality. The bank's participation constraint in this setup is determined by the equation given in (2.23). The constraint (2.23) becomes binding under competitive capital markets.

$$s_c \geq \frac{I - A + \left(\frac{1}{3} + \theta\right) c}{\left(\frac{1}{3} + \theta\right) X_S + \frac{1}{3} X_M + \left(\frac{1}{3} - \theta\right) X_F} \tag{2.23}$$

By substituting the equation in (2.22) into equation (2.22) the expression in (2.24) is obtained.

$$c \leq (1 - s) \frac{(\alpha + \beta)X_M - \alpha X_S - \beta X_F}{\alpha} - c \frac{\left(\frac{1}{3} + \theta\right)}{\left(\frac{1}{3} + \theta\right) X_S + \frac{1}{3} X_M + \left(\frac{1}{3} - \theta\right) X_F} \times \frac{(\alpha + \beta)X_M - \alpha X_S - \beta X_F}{\alpha} \tag{2.24}$$

Expression (2.24) can be rearranged as in (2.25).

$$\underbrace{\alpha c}_{\text{Expected bonus}} \leq \underbrace{(1 - s)((\alpha + \beta)X_M - \alpha X_S - \beta X_F)}_{\text{Payoff change from taking risk when no bonus is paid}} - \underbrace{c \left(\frac{1}{3} + \theta\right) \frac{(\alpha + \beta)X_M - \alpha X_S - \beta X_F}{\left(\frac{1}{3} + \theta\right) X_S + \frac{1}{3} X_M + \left(\frac{1}{3} - \theta\right) X_F}}_{\text{Decrease due to bonus: expected bonus multiplied by the ratio of payoffs}} \tag{2.25}$$

The right hand side of inequality (2.25) can be divided into two parts. The first part represents the change in entrepreneur's payoff when taking the risky project in the absence of the bonus payments. The second part shows the effect of introducing a bonus. When introducing a bonus the entrepreneur is less affected by the downside of the risky project. The reason for this is that as the bonus increases the *musharakah* is converging towards a conventional debt contract.

By solving the expression in (2.24) for c the constraint in equation (2.26) is obtained.

$$c \leq \left[\left(\frac{1}{3}+\theta\right)X_S + \frac{1}{3}X_M + \left(\frac{1}{3}-\theta\right)X_F - I + A\right] \times \frac{(\alpha+\beta)X_M - \alpha X_S - \beta X_F}{\left(\frac{1}{3}+\theta\right)X_S + \frac{1}{3}X_M + \left(\frac{1}{3}-\theta\right)X_F + \left(\frac{1}{3}+\theta\right)((\alpha+\beta)X_M - \alpha X_S - \beta X_F)} \quad (2.26)$$

If the constraint in equation (2.26) holds there is no risk shifting problem caused by the introduction of a bonus. The first part of the right hand side of the constraint $\left[\left(\frac{1}{3}+\theta\right)X_S + \frac{1}{3}X_M + \left(\frac{1}{3}-\theta\right)X_F - I + A\right]$ represents the maximum amount of bonus possible under the risk neutrality assumption. A bonus larger than this amount would require that $s_c > 1$. The first part is multiplied by the expression $\frac{(\alpha+\beta)X_M-\alpha X_S-\beta X_F}{\left(\frac{1}{3}+\theta\right)X_S+\frac{1}{3}X_M+\left(\frac{1}{3}-\theta\right)X_F+\left(\frac{1}{3}+\theta\right)((\alpha+\beta)X_M-\alpha X_S-\beta X_F)}$. If this expression is larger than one there is no risk shifting problem within this framework, because the amount of c that would lead to risk a shifting problem is larger than the maximum amount of bonus possible under the assumption of risk neutrality. However, if $\frac{(\alpha+\beta)X_M-\alpha X_S-\beta X_F}{\left(\frac{1}{3}+\theta\right)X_S+\frac{1}{3}X_M+\left(\frac{1}{3}-\theta\right)X_F+\left(\frac{1}{3}+\theta\right)((\alpha+\beta)X_M-\alpha X_S-\beta X_F)} < 1$, then there is a possibility of risk shifting.

Then, it can be concluded that the existence of a maximum risk-compatible bonus depends on whether the constraint (2.27) holds.

$$\left(\frac{1}{3}+\theta\right)X_S + \frac{1}{3}X_M + \left(\frac{1}{3}-\theta\right)X_F + \left(\frac{1}{3}+\theta\right)((\alpha+\beta)X_M - \alpha X_S - \beta X_F) \leq (\alpha+\beta)X_M - \alpha X_S - \beta X_F \quad (2.27)$$

The constraint (2.27) can be modified into the form presented in constraint (2.28).

$$\left(\frac{1}{3}+\theta\right)X_S + \frac{1}{3}X_M + \left(\frac{1}{3}-\theta\right)X_F \leq (\frac{2}{3}-\theta)[(\alpha+\beta)X_M - \alpha X_S - \beta X_F] \quad (2.28)$$

Equality (2.28) shows that the upper limit on a risk-compatible bonus depends on the difference between the net present value of the projects and the change in expected payoff from risk taking.

6.6 CONCLUDING REMARKS

Under *musharakah* financing there is no problem of risk shifting in contrast to conventional debt. However, when introducing a performance based bonus risk shifting may become a problem since the *musharakah* agreement converges towards conventional debt as the bonus increases. The upper limit of a risk-compatible bonus depends on the net present value of the existing project and the change in payoff from risk taking.

7 DEBT OVERHANG

Debt overhang is a conflict between shareholders and debtholders first discussed by Myers (1977). Generally it is described as a situation where an entrepreneur with an ongoing project, financed to some part with risky debt, has a new investment opportunity with a positive net present value, but is unable to find financing because renegotiation with debtholders is not possible. The current risky debt used to finance the ongoing project will tax the new investment as the returns from the new investment will be used to meet debt repayment obligations to the current debtholders. In the following section debt overhang problems for *mudarabah* and *musharakah* financing is analysed and compared to conventional debt financing. The profit-sharing agreements have been analysed under two circumstances. First, when retained earnings generated by the project are sufficient to finance the project. In this case *mudarabah* and *musharakah* display equity characteristics and a debt overhang problem is not present. Second, when retained earnings are not sufficient to finance the new project. In this case debt overhang can prevent a positive net present value project from being undertaken.

The debt overhang problem is discussed from two perspectives. First, the entrepreneur has an opportunity to invest into a project that improves the probability of success of the ongoing project. A real world example of such an investment could be a marketing effort. From this perspective debt overhang is more likely to be a problem under *mudarabah* and *musharakah* than under conventional debt. This result is attributed to the design of the instruments. The first section of the analysis has described that under *mudarabah* and *musharakah* the bank's actual payoff in case of success is larger than that under conventional debt. Since the new project increases the probability of success, the holder of *mudarabah* or *musharakah* contracts benefits more than the holder of conventional debt. On the other hand, the entrepreneur would benefit more from the increased probability if the financing in place was debt rather than *mudarabah* or *musharakah*. Consequently, a debt overhang problem is less likely to occur if the existing agreement is conventional debt.

The second perspective of analysing debt overhang includes a different type of project. The new project is safe and increases the profits of the existing project irrespective of outcome. A real world example of such an investment could be a cost cutting investment or an investment increasing the volume of production. Given this type of project there are no definite conclusions regarding which form of financing imply a bigger debt overhang problem. Which mode of financing being preferable depends on the probability of success, the payoff generated by the existing project and the size of the initial investment made by the bank.

Similarly to the previous section, the analysis is presented only for *musharakah* in order to avoid repetition.

7.1 PROJECT IMPROVING THE PROBABILITY OF SUCCESS

7.1.1 Debt overhang model I

The model described in the first section is modified to be able to analyse debt overhang problems. The modified model used in this section has a framework similar to the models described by Hart and Moore (1995) and Bhattacharya and Faure-Grimaud (2001). In this setup, in $t = 1$ the entrepreneur already has a project in place that will generate profits in $t = 2$. The ongoing project is financed to some extent via debt with a face value R. In $t = 2$ the ongoing project will have a payoff $X = \{X_H; X_L\}$. The payoff of the project is equal to X_H if the project succeeds and X_L if the project fails with $X_H > R > X_L > 0$. The probability of project being successful is equal to θ, and there is no discounting.

At $t = 1$ the entrepreneur encounters a new investment opportunity requiring an investment of I which will increase the success probability of the project from θ to $\theta + \Delta_\theta$ with $\Delta_\theta > 0$. The new project has a positive net present value ($\Delta_\theta(X_H - X_L) - I \geq 0$). The entrepreneur decides whether to take this new investment opportunity and is assumed to act in the interest of shareholders. The new project cannot be financed as an independent entity, so project financing is not an option. Similarly to the other sections, outcome is assumed to be verifiable. In this model the entrepreneur's decision on exerting effort or not is excluded, and there are no private benefits.

In this framework there is no difference between *musharakah* and *mudarabah* agreement since the profit-sharing-ratio is not decomposed.

7.1.2 Conventional debt

The entrepreneur already has a project in place financed with risky debt. The debt has face value R with $X_L < R < X_H$. The bank's expected payoff is thereby equal to $\theta R + (1 - \theta)X_L$ when the entrepreneur does not decide to undertake the additional project. If the project is undertaken, the probability of success of the project increases by Δ_θ. An increase of Δ_θ in probability of success increases the bank's expected payoff by $\Delta_\theta(R - X_L)$. Therefore, it is in the bank's interest that the entrepreneur undertakes the new project.

In the absence of risky debt, the entrepreneur's expected payoff would increase by $\Delta_\theta(X_H - X_L) - I$ if undertaking the project. However, in the presence of risky debt the entrepreneur also has to take into account the part of the payoff from the project that will accrue to the existing

debtholder. Therefore, the entrepreneur invests only if the net present value of the project is larger than the portion of the payoff accruing to the bank (3.1).

$$\Delta_\theta(X_H - X_L) - I \geq \Delta_\theta(R - X_L) \tag{3.1}$$

The equation (3.1) can be rearranged into the form shown in (3.2).

$$\Delta_\theta(X_H - R) - I \geq 0 \tag{3.2}$$

If the project is undertaken and fails, the entrepreneur will not receive any additional income. Therefore, the only factors affecting the entrepreneur's decision on the new project are the payoff in case of success X_H and the increase in probability of success Δ_θ (3.2). If the constraint in (3.2) does not hold, the entrepreneur will refrain from investing in the new project even if it has a positive net present value. The increase in expected payoff from the new project is shared between the old debtholder and the entrepreneur, making the old risky debt work as a tax on new investments, thereby creating a debt overhang problem.

7.1.3 Musharakah with retained earnings

The project started under *musharakah* agreement may have generated certain profits by $t = 1$. In this part, it is assumed that these profits are sufficient to finance the new investment opportunity ($A \geq I$). The entrepreneur can be viewed as an agent of the bank and he is able to invest the retained earnings into the project. In this case, the requirement for the entrepreneur to undertake the project is that the expected payoff from the new investment opportunity is larger than what he would otherwise receive by sharing the retained earnings with the bank (3.3).

$$(1 - s)\Delta_\theta(X_H - X_L) \geq (1 - s)I \tag{3.3}$$

Equation (3.3) always holds when the project has a positive net present value $\Delta_\theta(X_H - X_L) \geq I$. Whenever it is in the interest of the entrepreneur to undertake the project, it is also in the interest of the bank that the entrepreneur undertakes the project. Therefore, the bank's and the entrepreneur's interests are always aligned given there are no private benefits connected to the investment. Equation (3.4) shows that if the project has a positive net present value, it is also in the bank's interest that the entrepreneur undertakes it.

$$s\Delta_\theta(X_H - X_L) \geq sI \tag{3.4}$$

Therefore, if the project undertaken under *musharakah* agreement has already generated profits $A \geq I$ there will not be a debt overhang problem within this framework.

7.1.4 Musharakah with no retained earnings

Now, it is assumed the retained earnings at $t = 1$ are not sufficient to finance the new investment opportunity. Moreover, there are covenants in place prohibiting any changes to the profit-sharing-

ratio. However, the entrepreneur either has his own funds to finance the new project or can seek outside financing. Since the new project is an integrated part of the project already undertaken under the *musharakah* agreement, profits generated by the new investment cannot be separated. Therefore, the bank will receive the share s of any increase in the payoff of the project even if the bank has made no contribution to the new investment.

In a *musharakah* agreement the project's payoff is shared both in success and failure compared to conventional debt which represents a fixed claim. If the entrepreneur does not invest into the project, the bank's expected payoff from the project is $s\theta X_H + s(1-\theta)X_L$. If the entrepreneur invests into the project, the bank's expected payoff is given by expression (3.5).

$$s(\theta + \Delta_\theta)X_H + s(1 - \theta - \Delta_\theta)X_L \tag{3.5}$$

Expression (3.5) can be rewritten into the form shown in (3.6).

$$\underbrace{s\theta X_H + s(1-\theta)X_L}_{\text{Payoff with no investment}} + \underbrace{\Delta_\theta s(X_H - X_L)}_{\text{plus the extra payoff due to the investment}} \tag{3.6}$$

So, if the project is undertaken the bank providing the financing in the initial *musharakah* agreement will get an extra payoff in both the good and the bad state. It is therefore in the bank's interests that the entrepreneur undertakes the new project. The entrepreneur's expected payoff from the existing project is equal to $\theta_H(1-s)X_H + (1-\theta_H)(1-s)X_L$ if the new opportunity is not undertaken. If the entrepreneur invests into the new project, the expected payoff is given by (3.7).

$$(1-s)(\theta + \Delta_\theta)X_H + (1-s)(1-\theta-\Delta_\theta)X_L - I \tag{3.7}$$

Expression (3.7) can be rewritten into the form written in (3.8).

$$\underbrace{(1-s)\theta X_H + (1-s)(1-\theta)X_L}_{\text{Payoff with no investment}} + \underbrace{(1-s)\Delta_\theta(X_H - X_L)}_{\text{increased expected payoff}} - \underbrace{I}_{\substack{\text{minus cost} \\ \text{of investment}}} \tag{3.8}$$

From equation (3.8) it can be inferred that the entrepreneur will only invest if the entrepreneur's share in the increased expected payoff is larger than the cost of investment. This conclusion is rewritten in equation (3.9):

$$(1-s)\Delta_\theta(X_H - X_L) \geq I \tag{3.9}$$

The expression in (3.9) can be rewritten into (3.10) in order to obtain a construction similar to the one given in (3.1).

$$\Delta_\theta(X_H - X_L) - I \geq \Delta_\theta s(X_H - X_L) \tag{3.10}$$

In order for the entrepreneur to undertake the project, the net present value of the project should be larger than the increase in the payoff to the bank. If this condition is not met, then a

project with a positive net present value will not be undertaken. This situation arises because the financier does not share the cost of the additional investment, but receives a share of the expected payoff because of the increased profitability of the initial project.

7.1.5 Comparison between musharakah and conventional debt

In competitive capital markets, a bank lending I should expect the same return on an investment irrespective of the form of financing agreement. Under this assumption *mudarabah* and *musharakah* agreements have the same expected payoff as conventional debt. Therefore, equation (3.11) should hold.

$$\theta X_H s + (1-\theta)X_L s = \theta R + (1-\theta)X_L \tag{3.11}$$

The expression in (3.6) can be rearranged in order to obtain the face value of debt (3.12).

$$R = \frac{\theta X_H s + (1-\theta)X_L s - (1-\theta)X_L}{\theta} \tag{3.12}$$

If the entrepreneur undertakes the project, the bank's expected income for the initial lending increases by $\Delta_\theta(R - X_L)$. Then, R obtained in equation (3.12) can be substituted into increase in payoff function $\Delta_\theta(R - X_L)$. The result is displayed in equation (3.13).

$$\Delta_\theta(R - X_L) = \Delta_\theta\left(\frac{\theta X_H s + (1-\theta)X_L s - (1-\theta)X_L}{\theta} - X_L\right) = \Delta_\theta s(X_H - X_L) - \frac{X_L}{\theta}(1-s) \tag{3.13}$$

The result obtained in (3.13) can be substituted into the constraint $\Delta_\theta(X_H - X_L) - I \geq \Delta_\theta(R - X_L)$ displayed in (3.1) which shows the condition required for conventional debt not to have debt overhang. The resulting constraint is displayed in equation (3.14).

$$\Delta_\theta(X_H - X_L) - I \geq \Delta_\theta s(X_H - X_L) - \frac{X_L}{\theta}(1-s) \tag{3.14}$$

The constraint for conventional debt shown in (3.14) is easily compared to the similar constraint for *musharakah* (3.10) $\Delta_\theta(X_H - X_L) - I \geq \Delta_\theta s(X_H - X_L)$. The only difference between the two constraints is the term $-\frac{X_L}{\theta}(1-s)$ in the constraint for conventional debt. The term $-\frac{X_L}{\theta}(1-s)$ is always negative since X_L, θ, and $(1-s)$ are all positive. Since the term is negative, the constraint for conventional debt is more likely to hold than the constraint for *musharakah*. Consequently, the debt overhang problem is more likely in the case of *musharakah* and *mudarabah* given this framework.

Note that the difference between *musharakah* and conventional debt exists due to the presence of the cash flow in case of failure. Since the debtholder can take all cash flow in case of failure compared only a portion accruing to a *musharakah* financer, the *musharakah* financer is compensated by requiring a higher payoff in case of success. Moreover, despite receiving some payoff in case of

failure, the entrepreneur is not able to completely recover its investment if the project fails. Therefore, the entrepreneur receives a positive net payoff only if the project succeeds and the entrepreneur's net payoff in success is smaller for *musharakah* than for conventional debt. This leads to conventional debt being a more preferable mode of financing in this context.

If the increase in total payoff ($\Delta_\theta s(X_H - X_L)$) from the new investment is within the range displayed in (3.15), then the initial financing being a *musharakah* agreement leads to debt overhang problem, whereas conventional debt agreement does not.

$$\frac{\Delta_\theta(X_H - X_L) - I}{s} < \Delta_\theta(X_H - X_L) \leq \frac{\Delta_\theta(X_H - X_L) - I + \frac{X_L}{\theta}(1-s)}{s} \tag{3.15}$$

7.2 PROJECT INCREASING THE PAYOFF

7.2.1 Debt overhang model II

A few alterations are now made to the debt overhang model discussed in the first part of this section. In this setup the new project does not change the probability of success of the project. Instead, undertaking the new project changes the actual payoffs of the ongoing project. The new project generates additional payoff of $\Delta_X > 0$ in $t = 2$, both in case of success and failure. The project requires an initial investment of I and has a positive net present value $\Delta_X \geq I$. For notational simplicity it is assumed that $X_L + \Delta_X < R$. Except for these changes the previous model is unchanged.

7.2.2 Conventional debt

If the new project is undertaken and the initial project succeeds, the bank's payoff is not affected. The reason is that the bank's claim on the profits is limited to the face value of debt. However, if the initial project fails, the bank's payoff is increasing by Δ_X if the opportunity is taken. The increase in the bank's expected payoff if the new investment is undertaken is given in expression (3.16).

$$(1-\theta)\Delta_X \tag{3.16}$$

The entrepreneur's perspective is the opposite of the bank's perspective. The entrepreneur receives the whole additional payoff if the project succeeds, but receives nothing if the initial project fails. The entrepreneur will invest if the expected payoff from the project to the entrepreneur is larger than the initial investment give in (3.17):

$$\theta\Delta_X \geq I \tag{3.17}$$

When the constraint (3.17) does not hold, the entrepreneur will not invest even if the project has a positive net present value.

7.2.3 Musharakah with retained earnings

Given that the existing financing is a *musharakah* agreement and there are retained earnings available to invest into the new project, there is no debt overhang problem within this setup. This is consistent with the corresponding analysis in the first part and is a result of the equity characteristics of *musharakah*. The bank's payoff if the project is financed through retained earnings is equal to $s(\Delta_X - I)$ and the entrepreneur's payoff is equal to $(1-s)(\Delta_X - I)$. Then, it will be in both party's interest to invest whenever the project has a positive net present value ($\Delta_X - I \geq 0$). Similarly to the earlier case, the debt overhang problem does not occur as long as the entrepreneur has been given the right to reinvest the earnings under the *musharakah* agreement.

7.2.4 Musharakah with no retained earnings

The situation is more problematic when the project cannot be financed through retained earnings. Here it is assumed that it is not possible to renegotiate the profit-sharing-ratio. If the entrepreneur decides to invest into the new investment opportunity, the bank's expected payoff increases by $s\Delta_X$ since the bank gets a share both in case of success and failure of the project. Similarly, the increase in the entrepreneur' expected payoff from undertaking the project is equal to $(1-s)\Delta_X$, but the entrepreneur also covers the whole cost of the investment. Therefore, the entrepreneur will only invest if the increase in his expected payoff is larger than the cost of investment (3.18).

$$(1-s)\Delta_X - I \geq 0 \tag{3.18}$$

Projects with positive net present value that do not satisfy the constraint specified in (3.18) will not be undertaken. Thus there is a problem of debt overhang in this setup.

7.2.5 Comparison between musharakah and conventional debt

The face value of the existing debt is given by equation (1.1) $\left(R = \frac{I_{itl} - A - (1-\theta_H)X_L}{\theta_H}\right)$. This can be rearranged in order to obtain an expression of the bank's investment into the project. The term I_{itl} denotes the total investment required for the initial project.

$$I_{itl} - A = \theta R + (1-\theta)X_L \tag{3.19}$$

When *musharakah* financing is undertaken, the bank determines the profit-sharing-ratio by dividing its investment with the expected profits. Consequently, equation (3.19) can be plugged into the bank's participation constraint. Expression (3.20) shows the profit-sharing ratio of the existing *musharakah* agreement.

$$s = \frac{I_{itl} - A}{\theta X_H + (1-\theta)X_L} = \frac{\theta R + (1-\theta)X_L}{\theta X_H + (1-\theta)X_L} \tag{3.20}$$

The constraint for conventional debt (3.17) can be rewritten as $\Delta_X \geq \frac{I}{\theta}$ and the constraint for a *musharakah* agreement with no retained earnings (3.18) can be rewritten as $\Delta_X \geq \frac{I}{1-s}$. By replacing s in the right hand side of equation $\Delta_X \geq \frac{I}{1-s}$ with the expression given in (3.20) equation (3.21) is obtained.

$$\Delta_X \geq \frac{I}{1-s} = \frac{I}{\theta} \times \frac{\theta X_H + (1-\theta)X_L}{X_H - R} \tag{3.21}$$

The constraint can be rewritten by replacing the face value of debt R in equation (3.21) with equation (1.1).

$$\Delta_X \geq \frac{I}{\theta} \times \theta \frac{\theta X_H + (1-\theta)X_L}{\theta X_H + (1-\theta)X_L - I_{itl} + A} \tag{3.22}$$

If the debt overhang problem for *musharakah* agreements is greater or smaller compared to conventional debt depends on whether the term $\theta \frac{\theta X_H + (1-\theta)X_L}{\theta X_H + (1-\theta)X_L - I_{itl} + A}$ is greater or less than one. When $\theta \frac{\theta X_H + (1-\theta)X_L}{\theta X_H + (1-\theta)X_L - I_{itl} + A} < 1$, the debt overhang problem is greater for conventional debt compared to financing under a *musharakah* agreement. When $\theta \frac{\theta X_H + (1-\theta)X_L}{\theta X_H + (1-\theta)X_L - I_{itl} + A} > 1$ the debt overhang problem is greater for *musharakah* financing compared to conventional debt. In the special case where $\theta \frac{\theta X_H + (1-\theta)X_L}{\theta X_H + (1-\theta)X_L - I_{itl} + A} = 1$ the debt overhang problem in conventional debt agreements are equal to the debt overhang problem in *musharakah* agreement.

The result in equation (3.22) shows that the difference in magnitude of debt overhang problem between conventional debt and *musharakah* agreement depends on the probability of success and the initial investment by the bank. A greater probability of success or a bigger size of initial investment makes debt preferable to *musharakah* in terms of avoiding debt overhang problems. On the other hand, a smaller probability of success makes *musharakah* a more preferable form of financing.

The intuitive reason is that if the success probability is small, the new project's effect on the entrepreneur's expected payoff ($\theta \Delta_X$) is also small if the financing in place is debt. The entrepreneur benefits from the new cash flow only if the project succeeds and small probability of success makes the investment less attractive. Under *mudarabah* or *musharakah* however the entrepreneur receives a share from the project irrespective of the outcome of the initial investment. Consequently, when the probability of the success is small, the entrepreneur's payoff from investing into the project is larger under *musharakah* than under conventional debt. A reverse logic can be applied to explain why conventional debt is more preferable when the probability of success is high. The likelihood of the

entrepreneur investing also depends on the terms of initial financing. This is reflected by $I_{itl} + A$ in equation (3.22).

7.3 CONCLUDING REMARKS

When analysing debt overhang the results vary depending on the underlying assumptions of the model. First, the setting where the success probability is affected by the new investment opportunity is considered. In this setup there are two different scenarios. In the first scenario there are retained earnings available to finance the new project. In this setting there is no debt overhang problem under *musharakah* financing in contrast to conventional debt. The reason for the absence of debt overhang under *musharakah* the cost of investment is shared at the same ratio as the profit-sharing-ratio. The second scenario is when there are no retained earnings available to finance the new project. In this setting the debt overhang problem is more likely for *musharakah* compared to conventional debt.

In the second setting the new project is assumed to affect the payoff of the initial project rather than the probability of success. In this setting there are two different scenarios. Similar to the first setting there are retained earnings available for the new investment opportunity. In line with previous conclusion there is no debt overhang problem under *musharakah* financing in this setting. In the second scenario with no retained earnings neither form of financing dominates the other.

8 INFORMATION ASYMMETRIES

This section deals with the part of contract theory where one party has more information than the other. The difference in available information is considered in a setting where an entrepreneur wants to raise funds for an investment opportunity. The entrepreneur is assumed to have superior information about the investment opportunity. This can be harmful since the entrepreneur is unable to commit not to exploit the information advantage. Consequently, banks are concerned that the lending conditions do not reflect the project's real characteristics. This results in asymmetric information problems and may lead to market breakdown.

A change has been made to the conventional information asymmetry model and a new type of entrepreneur is introduced in order to analyse the effect of information asymmetries on *mudarabah* and *musharakah* contracts. The new entrepreneur has a project with earnings lower than the fixed claim and therefore has no incentive to borrow under the terms of conventional debt. However, this type of entrepreneur has incentive to obtain *mudarabah* and *musharakah* financing under market terms as long as the profit-sharing ratio is less than one. Consequently, information asymmetries are more damaging to *mudarabah* and *musharakah* markets compared to conventional debt markets.

Even in the absence of the third type of entrepreneur, an entrepreneur with a positive net present value project has a higher expected payoff under conventional debt if information asymmetries are present. This can be explained by a larger cross-subsidisation under *mudarabah* and *musharakah* than under conventional debt. As a result of a larger cross-subsidisation, the entrepreneur is willing to pay more for monitoring in order to signal his/her type in *mudarabah* and *musharakah* markets. Signalling mechanisms such as co-funding and underpricing are more likely to lead to a separating equilibrium under conventional debt.

8.1 THE INFORMATION ASYMMETRIES MODEL

A modified version of the model described in Tirole (2006) is used with an addition of a new type of entrepreneur. The model has two time periods $t = \{1; 2\}$. All three types of entrepreneurs have a project that requires an initial investment of I in $t = 1$. The payoff from the project is realised in $t = 2$. The first type of entrepreneur has a positive net present value project that yields X_H in the case of success and X_L in the case of failure. The probability of success is θ_G and $\theta_G X_H + (1 - \theta_G)X_L > I$. The second type of entrepreneur has a project that also yields X_H in the case of success and X_L in the case of failure. However, the probability of success is equal to $\theta_B < \theta_G$and the net present value of the project is negative ($\theta_B X_H + (1 - \theta_B)X_L < I$). The third type of entrepreneur has a project that

yields $X_L < I$ in case of success and zero in case of failure. The probability of success of the project is equal to $\theta_T > 0$.

The type of the entrepreneur is not verifiable by the bank, so only the entrepreneur knows his/her type. The market rates the probability of a borrower being of the first type by α, of the second type by $1 - \alpha - \beta$, and of the third type by β. Moral hazard in the form of private benefits is assumed not to exist under this setup.

In contrast to the previous section, analysis is started from the perspective of *mudarabah* financing and *musharakah* financing is later discussed as a special case of *mudarabah*.

8.2 INFORMATION ASYMMETRIES AND MARKET BREAKDOWN

8.2.1 Conventional debt

If the bank sets the face value of debt equal to $R = \frac{I-(1-\theta_G)X_L}{\theta_G}$, the first entrepreneur will always have an incentive to borrow since $\theta_G(X_H - R) > 0$. However, the second type of entrepreneur with a negative net present value project can profit from claiming to be an entrepreneur of the first type in order to receive an expected payoff of $\theta_B(X_H - R) > 0$. The entrepreneur of the second type with a negative net present value project will thereby try to mimic the first type in order to raise financing. A risk neutral bank therefore has to take into consideration the probability of the entrepreneur being of the second type.

Since the bank does not know the type of the borrower, it chooses the face value of debt so that it can break-even in total lending. The success probability used by the bank is given in (4.1).

$$\hat{\theta} = \alpha\theta_G + (1 - \alpha)\theta_B \tag{4.1}$$

The bank sets a uniform face value of debt for all borrowers given in equation (4.2).

$$\hat{R} = \frac{I - (1 - \hat{\theta})X_L}{\hat{\theta}} \tag{4.2}$$

If the resulting face value of debt is too high $\hat{R} > X_H$, it will lead to market breakdown since neither of the borrowers will find the financing condition attractive. Then the gains from trade will not be realised and the first type of entrepreneur with a positive net present value project will not be able to receive financing since $\theta_G(X_H - R_{AI}) < 0$. If $\hat{R} < X_H$, then this results in cross-subsidisation since the good type of entrepreneur is paying more and the bad type of entrepreneur is paying less than what they would be paying under perfect information.

It should be noted that the presence of the third borrower does not have any effect on the equilibrium. Even if the repayment required by the bank was set at $R = \frac{I-(1-\theta_G)X_L}{\theta_G}$, which is the lowest

possible within this framework, the third type of entrepreneur would have no incentive to try to mimic good entrepreneurs since $X_L < R$.

8.2.2 Mudarabah comparison with two types of entrepreneurs

If the first entrepreneur was the only borrower in the market, there would be no information asymmetry problems and the market would function properly. The bank would require profit participation as specified in equation (1.2) $\left(s = \frac{I}{\theta_G X_H + (1-\theta_G)X_L}\right)$ and the good project would get financed. However, the second type of borrower then would have an incentive to claim to have a good project since $(1-s)[\theta_B X_H + (1-\theta_B)X_L] > 0$. The bank would therefore change the profit-sharing ratio in order to break even on expected terms. With two types of entrepreneurs, the profit-sharing ratio required by the bank would be set as in equation (4.3).

$$\hat{s} = \frac{I}{\alpha[\theta_G X_H + (1-\theta_G)X_L] + (1-\alpha)[\theta_B X_H + (1-\theta_B)X_L]} = \frac{I}{\hat{\theta} X_H + (1-\hat{\theta})X_L} \tag{4.3}$$

If $\hat{s} > 1$ then the market breaks down since the profit-sharing-ratio is limited to the interval of $0 < s < 1$. On the other hand, $\hat{s} < 1$ leads to cross-subsidisation. The comparison between mudarabah and conventional debt below assumes that $\hat{s} < 1$ since projects wouldn't be financed if the market does not function.

The entrepreneur's payoff function under information asymmetries and *mudarabah* financing given in the formula (4.3) is as stated in (4.4).

$$(1-\hat{s})(\theta_G X_H + (1-\theta_G)X_L) = \frac{(\hat{\theta} X_H + (1-\hat{\theta})X_L - I)(\theta_G X_H + (1-\theta_G)X_L)}{\hat{\theta} X_H + (1-\hat{\theta})X_L} \tag{4.4}$$

Similarly, the entrepreneur's payoff under information asymmetries and conventional debt is given in (4.5).

$$\theta_G(X_H - \hat{R}) = \frac{\theta_G(\hat{\theta} X_H + (1-\hat{\theta})X_L - I)}{\hat{\theta}} \tag{4.5}$$

By taking the difference between expression (4.4) and (4.5) the expression stated in (4.6) is obtained.

$$\begin{aligned} &\frac{\theta_G(\hat{\theta} X_H + (1-\hat{\theta})X_L - I)}{\hat{\theta}} - \frac{(\hat{\theta} X_H + (1-\hat{\theta})X_L - I)(\theta_G X_H + (1-\theta_G)X_L)}{\hat{\theta} X_H + (1-\hat{\theta})X_L} \\ &= \frac{\hat{\theta} X_H + (1-\hat{\theta})X_L - I}{\hat{\theta}(\hat{\theta} X_H + (1-\hat{\theta})X_L)} X_L(\theta_G - \hat{\theta}) \end{aligned} \tag{4.6}$$

The difference in (4.6) is always positive under the assumption that there is no market breakdown $(\hat{\theta} X_H + (1-\hat{\theta})X_L - I \geq 0)$. Therefore, the entrepreneur's payoff under conventional debt is always larger than the payoff under *mudarabah*. Taking into account the symmetry of the

calculation, the difference in the payoffs to the bad entrepreneur would be $\frac{\hat{\theta}X_H+(1-\hat{\theta})X_L-I}{\hat{\theta}(\hat{\theta}X_H+(1-\hat{\theta})X_L)}X_L(\theta_B-\hat{\theta})$, which is always negative. This implies that the payoff is larger for the bad entrepreneur under *mudarabah*. As a result, it can be concluded that the entrepreneur of good type subsidises the entrepreneur of bad type more under *mudarabah* financing than under conventional debt. Consequently, in case of a pooling equilibrium, it is more profitable to use conventional debt for a good type of entrepreneur. Note that in the absence of payoff in case of failure the difference is equal to zero.

8.2.3 Mudarabah comparison with three types of entrepreneurs

This part of the analysis is the continuation of the previous part. The presence of the third type of the entrepreneur is now taken into consideration. It has already been discussed that the third type of entrepreneur has no impact on the debt market. However, in the case of *mudarabah* financing, the third entrepreneur may have a positive expected payoff if he/she borrows under the terms given in equation (4.3). The payoff for the third type of entrepreneur is equal to $(1-\hat{s})\theta_T X_L$ which is greater than zero as long as $\hat{s}<1$. The bank would therefore have to take into account the possibility of the entrepreneur being of the third type when deciding on the required profit-sharing-ratio. Assuming that the bank rates the probability of the entrepreneur being of the first type at α and the probability of the entrepreneur being of the third type at β, the new profit-sharing ratio would be as specified in equation (4.7):

$$\tilde{s}=\frac{I}{\alpha[\theta_G X_H+(1-\theta_G)X_L]+(1-\alpha-\beta)[\theta_B X_H+(1-\theta_B)X_L]+\beta\theta_T X_L} \tag{4.7}$$

Note that the denominator of equation (4.7) is smaller than the denominator of equation (4.3) meaning that the bank requires a greater profit-sharing ratio in the presence of the third project. One then could imagine that an economy contains more than one negative net present value project similar to the project the third type of entrepreneur has $(X<I)$. The entrepreneurs with these projects would not try to get financed with conventional debt agreements since the payoff generated by this type of projects does not exceed the face value of debt in any state of the world. However, under *mudarabah* financing these entrepreneurs receive a positive payoff as long as the profit-sharing ratio is less than one. Consequently, the flow of bad projects will push the profit-sharing-ratio towards one after which no financing is possible for any entrepreneur.

8.3 MONITORING/PRELIMINARY AUDIT

One possible way of solving the information asymmetry problems described above is by requiring a preliminary audit of the entrepreneur's project by a third party. The third party would analyse the project on behalf of the entrepreneur and issue an opinion revealing the type of the entrepreneur to the bank. The analysis starts with the assumption that only the first and second types of entrepreneurs are present and no market breakdown is assumed. Later the assumption of no market breakdown is relaxed.

In case of conventional debt, the first type entrepreneur is willing pay as much as $\frac{(I-X_L)(\theta_G-\hat{\theta})}{\hat{\theta}}$ for monitoring in order to reveal his/her type. This is presented in equation (4.8).

$$\theta_G\left(X_H-\frac{I-(1-\theta_G)X_L}{\theta_G}\right)-\theta_G\left(X_H-\frac{I-(1-\hat{\theta})X_L}{\hat{\theta}}\right)=\frac{(I-X_L)(\theta_G-\hat{\theta})}{\hat{\theta}} \tag{4.8}$$

In case of *mudarabah*, the maximum amount the first type of entrepreneur is willing to pay is equal to $\frac{I(X_H-X_L)(\theta_H-\hat{\theta})}{\hat{\theta}X_H+(1-\hat{\theta})X_L}$ presented in equation (4.9).

$$(1-s_G)(\theta_G X_H+(1-\theta_G)X_L)-(1-\hat{s})(\theta_G X_H+(1-\theta_G)X_L)=\frac{I(X_H-X_L)(\theta_H-\hat{\theta})}{\hat{\theta}X_H+(1-\hat{\theta})X_L} \tag{4.9}$$

In order to compare the entrepreneurs' willingness to pay for the different modes of financing the difference between equations (4.8) and (4.9) is calculated. If the difference is positive, entrepreneurs using *mudarabah* financing are willing to pay more than entrepreneurs using debt financing. The difference is calculated in equation (4.10).

$$\frac{I(X_H-X_L)(\theta_H-\hat{\theta})}{\hat{\theta}X_H+(1-\hat{\theta})X_L}-\frac{(I-X_L)(\theta_G-\hat{\theta})}{\hat{\theta}}=\frac{(\theta_G-\hat{\theta})X_L(\hat{\theta}X_H+(1-\hat{\theta})X_L-I)}{\hat{\theta}(\hat{\theta}X_H+(1-\hat{\theta})X_L)} \tag{4.10}$$

The right hand side of equation (4.10) is always positive assuming no market breakdown $(\hat{\theta}X_H+(1-\hat{\theta})X_L-I\geq 0)$. A positive difference indicates that an entrepreneur under *mudarabah* financing is willing to pay more for monitoring compared to an entrepreneur under conventional debt financing. Note that there is no difference between conventional financing and *mudarabah* if there is no payoff in case of failure.

The calculations above assume there is no market breakdown. If there is a market breakdown, the terms $\theta_G\left(X_H-\frac{I-(1-\hat{\theta})X_L}{\hat{\theta}}\right)$ in equation (4.8) and $(1-\hat{s})(\theta_G X_H+(1-\theta_G)X_L)$ in equation (4.9) should be substituted with zero. Then, the entrepreneur would be willing to pay as much as his/her entire payoff for monitoring. In the first section it was discussed that $\theta_G\left(X_H-\frac{I-(1-\theta_G)X_L}{\theta_G}\right)$ and $(1-s_G)(\theta_G X_H+(1-\theta_G)X_L)$ are equivalent in competitive capital markets. Therefore, the entrepreneur's

willingness to pay for monitoring is equal under conventional debt and *mudarabah* if the market breaks down.

8.4 CO-FUNDING

Co-funding can also be used by entrepreneurs with positive net present value projects to separate themselves from entrepreneurs with projects with negative net present value. Investing own wealth in a project signals the quality of the project and can be a way to create a separating equilibrium.

8.4.1 Conventional debt

An alternative way for the first type of entrepreneur with an investment opportunity with positive net present value to separate from the other types of the entrepreneurs is to finance some portion of the required investment through own funds. If the investment is large enough so that the constraint in (4.11) holds, the other types of entrepreneurs will no longer have incentives to finance their projects.

$$\theta_B\left(X_H - \frac{I - A - (1-\theta_G)X_L}{\theta_G}\right) - A < 0 \tag{4.11}$$

If the inequality (4.11) holds then the second type of entrepreneur is better off consuming own assets than claiming to have a good project. The third type of entrepreneur does not have any impact on the separating equilibrium since he/she would not be willing to borrow via conventional debt in any case. By solving equation (4.11) for A, (4.12) is obtained.

$$\frac{\theta_B(\theta_G X_H + (1-\theta_H)X_L - I)}{\theta_G - \theta_B} < A \tag{4.12}$$

8.4.2 Musharakah

The investment of own wealth can also be used in *musharakah* financing to create a separating equilibrium. The constraint in (4.13) must hold in order to make the second type of entrepreneur refrain from claiming to have a good project.

$$\left(1 - \frac{I - A}{\theta_G X_H + (1-\theta_G)X_L}\right)(\theta_B X_H + (1-\theta_B)X_L) - A < 0 \tag{4.13}$$

The equation in (4.13) is solved for A in (4.14) revealing the minimum required investment for the separating equilibrium under *musharakah* financing.

$$\frac{(\theta_B X_H + (1-\theta_B)X_L)(\theta_G X_H + (1-\theta_G)X_L - I)}{(X_H - X_L)(\theta_G - \theta_B)} < A \tag{4.14}$$

It should be noted that if constraint (4.14) holds, the third type of entrepreneur will also refrain from claiming to be a different type of entrepreneur. The reason is that the third type of entrepreneur has a project with a smaller net present value.

8.4.3 Comparison between musharakah and conventional debt

Equation (4.14) and equation (4.12) are compared to find which instrument requires a smaller amount of investment by the entrepreneur in order to create a separating equilibrium. Both equations have the term $\frac{(\theta_G X_H+(1-\theta_H)X_L-I)}{\theta_G-\theta_B}$ in common. The comparison between the two instruments therefore depends on which of θ_B or $\frac{(\theta_B X_H+(1-\theta_B)X_L)}{X_H-X_L}$ being larger. The term $\frac{(\theta_B X_H+(1-\theta_B)X_L)}{X_H-X_L}$ is rearranged in equation (4.15).

$$\frac{(\theta_B X_H + (1-\theta_B)X_L)}{X_H - X_L} = \theta_B + \frac{X_L}{X_H - X_L} \tag{4.15}$$

The comparison between the constraints for *musharakah* and conventional debt is given in (4.16). The left hand side displays the minimum level of A required for *musharakah* financing and the right hand side displays the minimum level of A required for conventional debt.

$$\left(\theta_B + \frac{X_L}{X_H - X_L}\right)\frac{(\theta_G X_H + (1-\theta_G)X_L - I)}{\theta_G - \theta_B} > \theta_B \frac{(\theta_G X_H + (1-\theta_H)X_L - I)}{\theta_G - \theta_B} \tag{4.16}$$

Expression (4.16) shows that the minimum level of A required to create a separating equilibrium is lower for conventional debt than for *musharakah* financing. Note that the difference between the two instruments exists only if payoffs in the case of failure are different from zero.

8.5 UNDERPRICING

If the assets in place A are not sufficient for the entrepreneur to create a separating equilibrium, the first type of entrepreneur can agree to a more expensive financing in order to create a separating equilibrium. A more expensive financing choice will make the expected payoff for the other types of entrepreneurs equal to zero or negative, therefore making them unwilling to mimic the first type of entrepreneur's behaviour.

8.5.1 Conventional debt

The first type of entrepreneur may agree to a larger face value of debt compared to the face value of debt under pooling equilibrium. By giving up a portion of its payoff to the bank, the entrepreneur ensures that other types of entrepreneurs with bad projects are better off by consuming their

existing assets rather than investing. For a given level of initial assets A, the entrepreneur may choose the face value of debt so that the constraint given in (4.17) holds.

$$\theta_B(X_H - R) < A \leq \theta_G(X_H - R) \tag{4.17}$$

As before, the presence of the third type of entrepreneur has no impact on conventional debt market.

Compared to co-funding, underpricing is a more expensive way of obtaining a separating equilibrium since now the bank makes profit on their investments. Solving the constraint in equation (4.17) for R the range of the face value of debt creating a separating equilibrium is obtained (4.18).

$$-\frac{A}{\theta_B} + X_H < R \leq -\frac{A}{\theta_G} + X_H \tag{4.18}$$

8.5.2 Musharakah

The idea of underpricing in *musharakah* is the same as underpricing in conventional debt. The first type of entrepreneur agrees to such a profit-sharing ratio that the other types of entrepreneurs expect a negative payoff from their investment. In equation (4.19) the break off point for a separating equilibrium is displayed.

$$(1-s)(\theta_B X_H + (1-\theta_B)X_L) < A \leq (1-s)(\theta_G X_H + (1-\theta_G)X_L) \tag{4.19}$$

The intuition for equation (4.19) is that the profit-sharing ratio increases to such an extent that the other entrepreneurs find it unprofitable to invest their own capital into the project. Solving the inequality (4.19) for s the following expression in (4.20) is obtained.

$$1 - \frac{A}{\theta_B X_H + (1-\theta_B)X_L} < s \leq 1 - \frac{A}{\theta_G X_H + (1-\theta_G)X_L} \tag{4.20}$$

Note that if equation (4.20) holds, the presence of the third type of entrepreneur does not have an impact on the level of A required for a separating equilibrium. The reason for this is that the net present value of the third type's project is smaller than the net present value of the second type's project. Consequently if $(1-s)(\theta_B X_H + (1-\theta_B)X_L) < A$ is true, then $(1-s)\theta_T X_L < A$ also holds.

8.5.3 Comparison between musharakah and conventional debt

Parameter s in constraint (4.20) is omitted making the constraint for a separating equilibrium $1 - \frac{A}{\theta_B X_H + (1-\theta_B)X_L} < 1 - \frac{A}{\theta_G X_H + (1-\theta_G)X_L}$. This constraint is then rearranged into the form shown in (4.21).

$$X_H - \frac{A}{\theta_B} < X_H - \frac{A}{\theta_B}\left(\frac{\theta_B X_H + (1-\theta_B)X_L}{\theta_G X_H + (1-\theta_G)X_L}\right) \tag{4.21}$$

The left hand side of the constraint given in (4.18) $\left(X_H - \frac{A}{\theta_B} < X_H - \frac{A}{\theta_G}\right)$, is identical to the left hand side in (4.21). The difference between the constraints depends on the difference between the terms $\frac{A}{\theta_B}\left(\frac{\theta_B X_H + (1-\theta_B)X_L}{\theta_G X_H + (1-\theta_G)X_L}\right)$ and $\frac{A}{\theta_G}$. With some manipulations, the comparison between these two terms can be transformed into the expression in (4.22):

$$\frac{\theta_B X_L + \theta_G \theta_B (X_H - X_L)}{\theta_G[\theta_G X_H + (1-\theta_G)X_L]} < \frac{\theta_G X_L + \theta_G \theta_B (X_H - X_L)}{\theta_G[\theta_G X_H + (1-\theta_G)X_L]} \tag{4.22}$$

In expression (4.22) the term $\frac{\theta_B X_L + \theta_G \theta_B (X_H - X_L)}{\theta_G[\theta_G X_H + (1-\theta_G)X_L]}$ is a rearranged form of $\frac{A}{\theta_G}$ and the term $\frac{\theta_G X_L + \theta_G \theta_B (X_H - X_L)}{\theta_G[\theta_G X_H + (1-\theta_G)X_L]}$ is a rearranged form of $\frac{A}{\theta_B}\left(\frac{\theta_B X_H + (1-\theta_B)X_L}{\theta_G X_H + (1-\theta_G)X_L}\right)$. By replacing them in respective equations, it can be concluded that underpricing is likely to be effective for a larger number of projects under conventional debt. The intuitive explanation is that the entrepreneur's expected profit is larger under conventional debt, therefore the entrepreneur is willing to sacrifice more of a profit under conventional debt. Note that if the cash flow in case of failure is equal to zero, then there is no difference between the two instruments with respect to underpricing.

8.6 CONCLUDING REMARKS

Information asymmetries harm *musharakah* market more than conventional debt. The profit-sharing nature of *musharakah* makes this form of financing attractive for entrepreneurs that would not be considering undertaking the project under debt financing. This makes the likelihood of market breakdown under *mudarabah* larger than under conventional debt. The problem of information asymmetry can be mitigated by monitoring, co-funding or underpricing. A *musharakah* borrower is willing to pay more for monitoring than a conventional debt borrower is willing to pay. However, co-funding and underpricing are less costly for entrepreneurs under conventional debt than under *musharakah*.

9 CONCLUSIONS

The paper examines agency problems and contract theory in *mudarabah* and *musharakah* agreements. This contributes to existing literature since previous research has mainly focused on misreporting and has not considered other forms of moral hazards. It is found that, despite underreporting being stated as the main problem concerning these instruments, there are also other types of moral hazard problems inherent to the structure of *mudarabah* and *musharakah* agreements.

Within the used framework the difference between *mudarabah* and *musharakah,* and conventional debt is only present when there are payoffs even when projects fail. For the major part of the problems analysed within this study, *musharakah, mudarabah* and conventional debt converge as the payoff in case of failure decreases. It was also found that the results of Modigliani and Miller (1958) hold for *musharakah* and *mudarabah*, and that a risk neutral entrepreneur is indifferent between these forms of financing given no information asymmetries.

In the presence of private benefits when the entrepreneur does not fully commit on the project, debt generally serves as a better incentive device. The reason is that under *musharakah* and *mudarabah,* the entrepreneur is not punished and receives some payoff even when the project fails. However, introducing performance based bonuses can help to solve this problem. In particular, it was found that as the size of the bonus increases, the profit-sharing-instruments discussed in the paper converge towards debt. This is an aspect not addressed by Sarker (n.d) when he suggest bonus as a way of decreasing moral hazard problems.

An investment of own capital by the entrepreneur may help getting a project financed. Karim (2000) also suggested this method for decreasing agency costs. In contrast to Karim (2000), we find that the investment has no direct effect on the entrepreneur's decision on effort. The decrease in agency costs is rather attributed to the change in the profit-sharing ratio required by the bank.

Aggerwald and Yousef (2000) conclude that as the agency problems become more severe, debt becomes the dominant instrument of financing. The findings in our research indicate that this might not be true in all cases. When introducing problems arising from the choice of capital structure, conventional debt becomes less preferable to *mudarabah* and *musharakah*. Debt overhang can become a problem under *mudarabah* and *musharakah* only if the project does not generate sufficient profits to finance the new investment opportunity or in the presence of covenants prohibiting other forms of financing. The profit-sharing nature of *mudarabah* and *musharakah* contracts also helps to prevent risk-shifting problems. This finding is consistent with previous

discussion on risk-shifting in the financial literature such as Hart (1986). The introduction of performance bonuses can help to find a middle ground in these situations, ensuring the presence of effort incentives of debt and maintaining the no risk-shifting incentives of *mudarabah* and *musharakah*. This is in line with findings of Stiglitz (1974), Jensen and Meckling (1976), and Grossman and Hart (1982) who conclude that there is an optimal debt-to-equity ratio that induces effort without imposing risk taking.

Mudarabah and *musharakah* markets are subjected to additional problems from information asymmetries compared to conventional debt markets. The intuitive reason for this is that the bank does not have a priority claim for recovering its investment. This will attract entrepreneurs with negative net present value projects that would not seek finance under conventional debt. This can be argued to increase the risk of market breakdown. The methods suggested by Khan (1989) and Aggerwall and Yousef (2000) of randomized monitoring in order to prevent agency costs would not be effective in this context. Methods such as preliminary audit, underpricing, and co-funding can help in preventing the adverse effects of information asymmetries.

Overall, this paper contributes to Islamic finance literature by addressing aspects of effort, risk taking, debt overhang and information asymmetry problems that have not been previously formally discussed.

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