Master's Thesis

Islamic Finance: Asymmetric Information in Profit-and Loss-Sharing Contracts

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1 Introduction

The history of modern Islamic finance began as the colonization ended. For most parts of the Muslim world this was in the early twentieth century. Through colonization, most Muslims lost their main values and traditions valued by their religion and culture. These values and traditions were regained as colonization ended, this was especially noticeable in the field of economics. Scholars began writings about interest, which stands in contflict with the general values of Islam. At that time, the Islamic financial system was shaped by the conventional system. Around 1950, Islamic scholars and economist conducted enough research to design a theoretical model for financial intermediation on a non-interest base (Iqbal and Mirakhor (2011)).

To circumvent the interest based approach of the conventional economic system, Islamic scholars designed different contracts which are based on an equity partnership. These contracts are more often refered to as profit- and loss-sharing contracts (PLS contracts) and are designed to comply with the principles of Islam and therefore with the *Sharia* (Islamic law). As the research work was complete, the first Islamic financial institutions came into existence. The first modern Islamic bank was the *Mit Ghamr* Local Savings Bank which was established in 1963 in Egypt. The main purpose of this institution was not banking, but instead operating as a social welfare institution. Nevertheless, it is generally seen as the first modern Islamic bank. Other banks followed, Dubai Islamic Bank opend it's doors in 1974 and is considered as the first commercial Islamic bank. The Islamic Development Bank came into being in 1975, it was not only a bank, but had also done a great deal of research, which in turn led to the development of the famous *murabaha* contract (trust finance) (Iqbal and Mirakhor (2011)).

In the 1980s, several countries decided to make their whole financial system *Sharia*-compliant (Iran, Pakistan and Sudan), while others decided to include the Islamic financial system beside their existing one (Malaysia and Bhrain) (Iqbal and Mirakhor (2011)). The reason behind these decisions were, that the Islamic financial system tends to grow rapidly.

The growth has also been recognized by conventional banks, which first acted as financial intermediaries for Islamic financial institutions to supply them with good quality investments, which were rare at that time. Later, they also established so called "Islamic windows" which are special divisions of conventional banks offering *Sharia*-compliant contracts to their clients. One Example of an "Islamic window" is UBS, which is seen as "the leading provider of *Sharia*-compliant wealth management services" (Iqbal and Mirakhor (2011)).

In 2009, there was a total of 1.57 billion Muslims living all over the world, which accounts for 23% of the total world population. Approximatly 60% of the Muslim population live in Asian regions, followed by the Middle East and North Africa (MENA) with about 20%. But, the concentration of Muslims in the MENA region is much higher than it is in Asia. The countries with the largest number of Muslims are Indonesia with about 203 million, Pakistan with 174 million and India with 161 million, these three countires alone represent more than one third of the total Muslim population (Lugo (2009)).

According to the research report of TheCityUK (2013)[1] the total Islamic financial assets world wide are estimated to be $1.45 trillion in 2012, which is twice as high as during the financial crises. These financial assets exhibited growth rates between 10 and 15 percent during 2010 (Abedifar et al. (2013)). Other sources represent similar figures, Iqbal and Mirakhor (2011) report total asset under management to be $820 billion in 2010. The tremendous growth rates of Islamic assets can also be found in Table (1), additionally the table displays growth rates of customer deposits between 2006 and 2008.

The Islamic financial system is based on the teachings of the *Quran* and heavily depends on the *Sharia*, which is derived from the *Quran*. The word *Sharia* can be translated into law and it's etymological meaning is "the road". The *Sharia* is not only the law but can also be described as a set of rules of behavior or a general guideline a person has to live by, in order to become a Muslim. These guidelines not only impose restrictions on private and social life of all Muslims, but also impose special princi-

[1]Source: http://www.thecityuk.com

ples on the whole economy (Iqbal and Mirakhor (2011)).
The first, and most well known of these principles is the prohibition of interest or *riba*. *Riba* means "an excess" and it is involved in any transaction where the return is positve, fixed and predetermined without any participation in the risks of the investment. Because of this prohibition, pure debt contracts become inapplicable in such a system. The favored method of financing in Islamic finance is the risk sharing one, whereby the financier acctualy participates in the investment and he therefore becomes an investor. The third principle is, that investments are always asset based, which is a direct implication of the risk sharing principle. The compensation of any investment is based on the performance of the asset instead of a predetermined interest rate. Another principle is that money is only seen as "potential" capital, which means that it is only able to produce goods if it is combined with other factors. The time value of money is only recongnized for capital, but not for "potential" capital. Fifth, the Islamic financial system prohibits any kind of speculative behavior, an example of speculative behavior would be gambling. The last principle emphasises the adherence of property rights and condemns any violation of these rights (see Iqbal and Mirakhor (2011) for these principles).
The purpose of this work is to analyze asymmetric information problems in such an environment. Special emphasis lies in the fact that the Islamic finacial system highlights the use of profit-and loss-sharing contracts. These profit-and loss-sharing contracts are supposed to be vulunerable to any kind of asymmetric information problems, because the financier faces stronger incentives to closely monitor his clients than he would face in a debt like contract. If we assume, that monitoring comes at non-negligible costs, these costs should be weighted against any benefits implied by the prohibition of debt.
The following work is structured as follows, in Section 2 the basic financial contracts in Islamic finance are highlighted and a small summary of prohibited elements is given. Section 3 represents a model which compares two of the mentioned contracts in Section 2 regarding their efficiency in an asymmtric information environment. In Section 4 the asymmet-

Country	Banks in Sample Sample	Assets		Deposits	
		Growth Rate (%)		Growth Rate (%)	
		2006-07	2007-08	2006-07	2007-08
Bahrain	12	48.54	39.00	58.33	32.07
Egypt	2	21.27	10.53	22.89	9.54
Jordan	2	(9.30)	25.86	(8.59)	16.34
Kuwait	2	47.04	19.33	51.05	24.94
Lebanon	1	362.09	145.54	(3.02)	21.43
Qatar	2	34.64	47.94	26.63	31.98
Saudi Arabia	3	23.16	27.94	28.65	22.32
UAE	5	40.28	17.07	46.16	19.56
Yemen	1	7.29	20.08	6.13	18.73
MENA Region	30	34.50	24.50	37.47	22.28

Table 1: Growth rates of assets and customer deposits, in accordance with Iqbal and Mirakhor (2011).

ric information problem between a debt like contract and an equity like contract becomes compared with a linear model. Section 5 illustrates literature regarding the asymmetric information problem in Islamic finance, it further acts as approval of the two previous chapters. Section 6 concludes the work.

2 Financial Contracts

The Islamic financial system is based on contracts between two parties, whereby one of them is the provider of funds and the other is the user of funds. In general there are three different mods of financing which are regarded as *Sharia*-compliant. The first one is the *mudaraba* principle which is also known as profit-sharing principle. The second mode is the *musharaka* principle, where two parties share in the profits of a given project but also in the losses. The last one is the *murabaha* contract or cost plus or mark-up contract where a good is bought and resold with a mark-up.

We will follow a slightly different classification, where we put together the first two principles (*mudaraba* and *musharaka*) discussed above, we will call them the primary modes. All other contracts, including the *murabaha* contract, will be pooled together as secondary modes. This classification is in common with Chapra (1998) and fits the following sections best. Other contracts which can be found in the secondary modes section are the *ijara* contracts, which are lease arrangements between two parties. Another contract which can be found in this section is the *sukuk*, which is often translated as an Islamic bond.
But before turning to the financial contracts themselves, we need an understanding of prohibited elements in the Islamic world.

2.1 Prohibited elements in Islamic financial contracts

The contracts were developed with these prohibitions in mind, with the overall goal to limit any source of unjustified enrichment. Islam in general tries to promote justice and condemns every kind of exploitation, this is taken particularly seriously when it comes to developing business contracts. There are basically three forbidden elements which should help make business contracts more just: *Riba*, *gharar* and *maysir*. Contracts are only regarded as valid, if they are free of all of these elements.

Riba

The word *riba* can't be easily translated into english, because there isn't a single word which would reflect the entire meaning of it. In most cases it referes to excess, addition or surplus. To make things easier, we will use the term *riba* as a synonym for interest, which is also often found in the literature. The prohibition comes form a divine order in the *Quran* and is the most popular forbidden element in Islamic finance. It is completely forbidden becuase it is seen as unjust and exploitative. Therefore, the prohibition of *riba* is seen as a good method to establish justice between borrower and lender.

Islamic scholars have basically two problems with interest or *riba*. The first one is that the interest payments are guaranteed regardless of the outcome of a project. In such a contract, the financier faces no risks associated with the project financed with his funds. The whole business risk is therefore transfered to the borrower, who has to make intererst payments regardless of the outcome of the project. This is seen as unjust and unfair, because both parties contribute capital (money and knowledge) but don't share in the risks associated with the project. The second problem is, that the interest payments in a conventional debt contract are positive and fixed *ex ante*. This is again seen as *haram* (forbidden by Allah, sinful), because we can't be sure about the outcome of the project *ex ante*. It is therefore seen as exploitative. Another problem of interest is, that it depends on the amount borrowed and the period of time instead of the outcome of the project.

Other reasons, regarding the prohibition of *riba*, can be stated if we take a look at the raison d'être (right to exist) of money . Money has two purposes, it is a medium of exchange and it should facilitate the storage of value. Therefore, it isn't seen as capital as long as it isn't involved in a real economic activity. Only if it is mixed with labour or any other kind of capital, or it is used to finance a real factor of production, it has the right to claim the returns on this capital. Stated differently, only if money is transformed into capital through a real economic activity, there is a claim for returns. If this is not the case, as it is in a conventional loan contract, the financier has no claims on monetary benefits and according to Islamic scholars his lending act should be charitable (Iqbal and Mirakhor (2011)). These statments can also be used to formulate arguments against the general view, that the time value of money isn't recognized in Islamic finance. It is only recognized, if money is part of an economic activity and exposed to some risks. By the simple act of lending, no economic activity takes place and therefore a compensation would be unjust.

It is also often stated, that modern conventional economic theory isn't able to provide a good explanation in favor of interest rates. There is no single theory which justifies the use of an *ex ante* positive interest

rate in modern economic theory. Another critical point is, that interest would violate property rights. In the words of Iqbal and Mirakhor (2011), "Interest on money loaned represents an unjustifiable and instantaneous property rights claim. It is unjustifiable because interest is a property right that falls outside the legitimate framework of individual property rights recognized by Islam".
Furthermore, there are two different types of *riba*, *riba al-nasiah* and *riba al-fadl* (Sarker (1999)). *Riba al-nasiah* refers to the accrued interest in a deferred money transaction. An example would be a conventional debt contract. *Riba al-fadl* arises in a barter exchange, where a given commodity is exchanged by itself, but with unequal quantity or quality. An example would be, where apples are exchanged for other apples but there is uncertainty about the quality of the apples. Commodities should be exchanged with money, to limit the opportunity of unjust increase.

Gharar

Gharar mainly means uncertainty, but can also be translated as fraud, hazard or danger which could lead to a loss. It mainly refers to uncertainty in contracts, where there is a lack of information regarding any specification of the item which is involved in trade. An example, which emerges frequently in the literature, is the purchase of an unborn calf in the mothers womb. There is, for example, uncertainty about the health of the calf (in the sens of the quality of the good) and about the date of delivery. The reason for the prohibition of *gharar* is that the parties in a contract should be protected against any deception through uncertainty. It is argued, that if *gharar* exists, there would be uncertainty about delivery and settlement.
Gharar also affects the availability of insurance and derivative contracts, since both of them involve *gharar*. In the derivative contract it is argued, that the object may not exist at maturity and therefore uncertainty and *gharar* is involved. The same is said about an insurance contract, it could be the case that the insured will never receive any payment from the insurance. Again, we would have a contract with untertainty about

the payoffs and therefore *gharar* is part of it.

Maysir

Mysir means gambling or any other game of chance. This is prohibited because it should have no effect on the economy in the Islamic point of view. Gambling is just a zero-sum game, where one party loses what an other party wins. This is contrary to trade, where typically both parties win. Examples of financial contracts which would involve *mysir* are derivatives and insurance. For example, one can make a huge loss or gain simply by investing in a futures contract. The critique is, that no effort is put into such an activity and that what he gains an other will lose. Therefore, the overall wealth of the economy isn't increased by such a contract. The same is true for insurance contracts, where rental payments are made for an event which may never occure. Both of these contracts are seen as gambling, and are therefore prohibited.

2.2 Primary Modes

As mention above, the primary modes can be divided into two partnership contracts. First of all, we want to take a closer look at the *mudaraba* contract.

Mudaraba

The *mudaraba* contract is often referred to as trust based financing. Here, the *rabb al-mal* (financier, investor, bank, principal) entrusts capital to the *mudarib* (entrepreneur, manager, agent) who will invest the money in a project. According to Iqbal and Mirakhor (2011), the *mudarib* is free to choose any project in which he likes to invest. The *rabb al-mal* has no management righs over the *mudarib*. The *rabb al-mal* provides the entire capital to finance the project, while the *mudarib* brings in the expertise needed to manage the project. The profits, which result from the project,

will be shared in a pre-determined ratio. All losses regarding the project, will be solely borne by the financier. It is worth mentioning, that the *rabb al-mal* is only liable for his initial capital contribution, this is some sort of limited-liability structure. The *mudarib* is only responsible for bearing the losses if there is evidence of misconduct or negligance on his behalf. The general principle behind the profit and loss distribution is, that the *rabb al-mal* risks his capital and the *mudarib* risks his time and the effort put into the project. It is often stated, that the *mudaraba* integrates the most important factors of production such as capital, labour and knowledge (Iqbal and Mirakhor (2011)).

In practice, the *mudaraba* can be used in short-term trade and investment finance. It is most often used by banks for the purpose of deposit taking. Apart from this function, the *mudaraba* is not very popular in practice (Visser (2009)).

When we talk about *mudaraba*, agency problems arising with this contract, become a popular topic (Visser (2009)). There are basically two problems concerning this contract. The first one is, that the *rabb al-mal* is solely responsible for losses, and therefore incentives for the *mudarib* to make an effort could be negatively influenced. The other problem is that the profits are shared between the *rabb al-mal* and the *mudarib* which could lead to the same effect. Another difficulty for the *rabb al-mal* is to observe the profits which were made in a given project.

Mudaraba can be of two different types (restricted or unrestricted). An unrestricted *mudaraba* is free of restrictions concerning spcifications about the period, the business, the line of trade, industry or service and the suppliers or customers. The restricted version of the *mudaraba* has restrictions on at least one of these terms (Chapra (1998)). If the *mudarib* hurts any of these restrictions or acts contrary to them, he is solely responsible for any consequences. Furthermore, if there are losses associated with disregard of these restrictions, these losses can't be charged to the *mudaraba* account (Chapra (1998)).

Musharaka

The second mode of financing in the primary sector is the *musharaka* contract. The *musharaka* is a special case of the *mudaraba*, where the parties (there can be more than two parites) share in the profits and in the losses. The parties can bring in either capital or labour to share in the gains form a project. The share of profit is again pre-determined and should always be denoted as a proportion or a percentage (Visser (2009)). The loss has to be shared according to the capital contribution of the partners. Again, partners face a limited liability structure, meaning that they are only liable for the initial capital contribution and nothing more. The major difference to the *mudaraba* is that not only the financier is liable for financial losses, but also the entrepreneur. Another difference is, that in the *musharaka* the partners have similar rights and liabilites (Van Greuning and Iqbal (2008)).
Losses, which could occure during the projects lifetime, have to be offset agains any profits, with the result that the capital sum is the same as the principal value. It is therefore recommended to build reserves out of the prior profits to automatically offset any losses (Chapra (1998)).
A special case of the *musharaka* is the *musharaka mutanaqisah* or "diminishing partnerhsip" (Iqbal and Mirakhor (2011)). This vehicle is popular in the financing of real estate. At the beginning of the partnership the bank (or the financier) is the sole owner of the property. As time goes on and the agent (customer) fulfils his obligation of payment, the ownership regarding the property diminishes for the bank. At maturity, when the last payment is received by the financier and all other obligations are met, the cusomer becomes the sole owner of the property.
However, partnerships or PLS contracts are more or less a theoretical issue. For example, Aggarwal and Yousef (2000) found that Islamic banks mainly use other contracts than PLS contracts because of moral hazard problems. Another interesting observation was made by Chong and Liu (2009), they observed that in Malaysia only 0.5% of Islamic bank finance is based on PLS contracts.

2.3 Secondary Modes

Murabaha

The last core principle in Islamic finance is the *murabaha* contract or cost plus (or mark-up) sale contract. The general mechanism is, that the financier buys a specific product for his client and resells it to him for the price the financier payed plus a mark-up. Payments are made at a later date and can be made in installments or by paying back the whole principal sum.
The word "*murabaha*" comes from the arabic word "*ribh*", which can be translated into "profit". In theory the mark-up in the *murabaha* is explained as a payment for the service provided by the financier and as a guaranteed profit margin. The mark-up is affected by some variables like the type of the product, the type of security or collateral, the credit worthiness, and the lenght of the financing time (Iqbal and Mirakhor (2011)). But, in practice it is observed that the mark-up uses the LIBOR as a benchmark and therefore is more or less an interest rate. Therefore, to make the *murabaha Sharia*-compliant the financier has to bear all the risks associated with the product. Furthermore, he is liable for the whole delivery process the prodcut may be involved in (Visser (2009)). To make this point clear, the financier is the owner of the product.
It is important to mention, that if we talk about a *murabaha* contract we basically talk about two different contracts. One contract is signed between the financier and the vendor of the original product and the other is signed between the financier and his client. If there would be only one contract, the *murabaha* would not be *Sharia*-compliant because it would act as an interest-based contract. In the words of Chapra (1998), "It would not be lawful for the bank to have only one contract with the purchaser, the only service rendered by it being the remittance of the amount to the supplier on behalf of the purchaser. In this case the transaction would not be different from an interest-based financial arrangement".
Another issue arises if early payment is possible in the contract. Then,

the mark-up would become time-dependent and therefore not allowed. To circumvent this problem, the client has no right to claim a reduction of the mark-up in the case of early payment. Of course, the financier is able to offer a rebate, but this cannot be part of the contract when it is signed (Visser (2009)).
In theory two major differencs are mentioned between the *murabaha* and a loan. The first one is, that in the *murabaha* contract, not money is lent but assets are purchased. And second, the *murabaha* is mainly exposed to price risk of the underlying assets and a loan is exposed to credit risk. In the words of Iqbal and Mirakhor (2011), "The former is a sales contract in which the price is increased for deferment of payment; the latter is an increase in the amount of debt for deferment". The problem here is, that the first difference (and therefore the socond) is easy to circumvent. The client just has to resell the good he bought in the *murabaha* to a third party and obtains a loan likewise contract. This method is especially criticized by *fiqh*-scholars when the third pary is the financier of the commodity (this method is also known as a *tawarruq* contract).
In practice, the *murabaha* is the most popular Islamic financial contract. It has it's main use in trade finance and is used to finance machinery, consumer durables, and trade supplies.

Bai' salam

The *bai' salam* or *bay' al-salam* is a purchase contract with deferred delivery. The buyer pays for the goods in advance and receives delivery at a later date. The payment can't be made in installments and the full negotiated price has to be payed at the time of the contract. This makes the *bai' salam* similar to a forward contract but with a different cash flow structure. The *bai' salam* is therefore an exception regarding the general rule which prohibits forward sales. But the contract is seen as useful because the seller receives cash to invest and the buyer eliminates the uncertainty in the future price. The Prophet itself permitted the contract, in the words of Iqbal and Mirakhor (2011), "Was permitted as a special case by the Prophet (*pbuh*) because pre-payment of the price

allowed the farmers to buy seeds and raw materials, and for personal consumption in order to produce the fruits and crops".
There are mainly two differences between the *bai' salam* and a conventional forward contract. The frst difference is that the full negotiated price has to be payed in advance. The second is, that at maturity the buyer has to take delivery of the goods. The argument by muslim scholars behind these two differences are, that *maysir* becomes more restricted. The downside is, that the hedging purpose of the *bai' salam* gets aggravated.
It's main use takes place in financing the agricultural sector or small-medium enterprises (SME's).

Ijara and *Ijara wa iqtina*

Ijara and *ijara wa iqtina* are both lease arrangements. In both, the financier buys goods on his own account and leases them to his client (lessee). Payments are made in installments, which can be either fixed or floating. To make these arrangements *Sharia*-compliant, the lessor has to be the owner of the leased goods for the whole time of the lease arrangement. It is just the usufruct which is leased. This is in common with the general rule, that the financier has to be exposed to some risks associated with the object and that he is responsible for any liabilities. Furthermore, there should always be some real asset involved in such arrangements as it is the case in the other contracts.
One reason for the *ijara wa iqtina* to come into existence is that in the *ijara* the lessor runs some risk of misuse of the object by the lessee. He is the owner of the object, and therefore responsible for all defects concerning the object, especially if it prevents the lessee from its use (Chapra (1998)).
The difference between *ijara* and *ijara wa iqtina* is, that in the latter the lessee has the right to buy the good at the end of the lease period at a pre-determined purchase price. This could also be the case in the normal *ijara* contract, but here the lessee has no right to do so. Instead the lessor is free to make an offer to him. The installments in the *ijara*

wa iqtina are higher than in the normal *ijara* becuase it contains some kind of call option premium.
If the lessee is not able to fulfil his obligations, the lessor may impose a penalty payment. The only requirement these penalty payments have to meet, is that they should be free of *riba* (interest).
Differences between the Islamic lease contracts and the conventional one can be summarized in two points. The first is, that in the *ijara* contract, the lessor has to own the underlying object, whereas in the conventional contract, the lessee is the owner of the object. Second, penalty payments should contain no interest or compound interest (Iqbal and Mirakhor (2011)).
In practice the *Ijara* or *ijara wa iqtina* applies in different businesses, it is mainly observed in transportation, aviation and engineering industries.

Sukuk

Sukuk is the Islamic version of a conventional bond, it is often translated as 'Islamic bond'. The purpose of this financial contract is to move funds from agents with a surplus of funds to an agent which has a shortage. If we compare it to its conventional counterpart some distinctions appear, of which the most essentlial is, that the *sukuk* is more like an equity contract rather than a debt contract. This is because the *sukuk* represents ownership of the underlying asset, which is always part of a *sukuk* transaction. A *sukuk* is therefore a pledge of cash flows, which should be generated by the underlying asset.
We can differentiate between two types of the *sukuk* contract, the first is called asset-backed and the second asset-based. Asset-backed means that the investor or *sukuk*-holder owns the asset, which has to be involved in an *sukuk* issuance. In the second case, the invesor has so called "beneficial ownership in the asset". This term addresses property rights, and means that one person has the right to use the asset but another is the legal owner of the asset (Afshar (2013)).
Because the *sukuk* depends on the performance of the underlying asset, no pre-determined interest rate is promissed to the investors (since in-

terest is forbidden anyway). Instead, the rate of return an invesor can expect depends on the performance of the asset. This is in common with the general rule, that you can't expect a gain simply by capital provison and without participating in the risks associated with a project.
The *sukuk* is, in most cases, transacted via a SPV (Special Purpose Vehicle). There are mainly five steps in which the *sukuk* is involved. Here, we want to give a quick overview of the structure of transactions in the *sukuk al-ijara*, which is a special case of a *sukuk*.
In the first step, the assets are sold by the seller (fund raiser) to the SPV (see Figure 1). Then the SPV issues certificates which equal the purchase price of the asset. Subsequently a lease arrangement between SPV and the seller of the asset is signed, whereby the seller of the asset is also the lessee of the asset. In the fourth step (which is point 4. and 5. in Figure 1), all the rental payments received by the SPV through the lease arrangement are passed on to the investors (*sukuk* holders). In the fifth and last step (this step cant' be seen in Figure 1), the SPV sells the asset back to the seller at a pre-determined value. This is where the difference to the conventional counterpart occures. According to Afshar (2013), "the sale price must be based on net value of assets, its market value, fair value or price to be agreed at time of their actual price. This price could be lower, greater, or equal to the purchase price". The initial capital of the investor is not guaranteed and therefore the capital return is also not guranteed. In the *sukuk* the major risk lies in the value of the underlying asset (price risk). Whereby the main risk of a conventional bond is the credit risk of the issuer.

Istisna

The *istisna* is a partnership contract in manufacturing. To manufacture an asset, the buyer of the *istisna* hands in an order to the producer, who then produces the requested product for the buyer. Buyer and manufacturer have to make clear statements regarding the specifications and the price of the assets, which is a mutual agreement.
There is great flexibility regarding the payment, which makes it a very

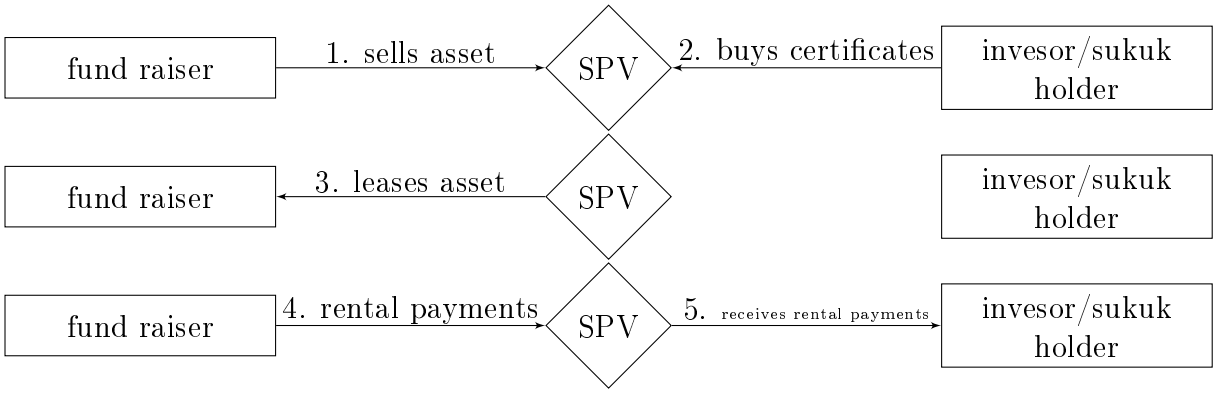

Figure 1: Structure of a *sukuk al-ijara* transaction.

attractive contract. Payment can be made in advance, at the time of delivery, or in installments. Even a mix of any of these payment options is possible.
In practice, the *istisna* contract is often used in heavy manufacturing orders, such as aircraft manufacturing, locomotive and ship building (Van Greuning and Iqbal (2008) and Iqbal and Mirakhor (2011)).

3 The Model: Comparision between debt and equity

Now that we have a deeper knowledge about Islamic financial contracts and their prohibited elements, we want to take a closer look at the asymmetric information problems which could arise in such an economy. We do so, by introducing a model which compares equity and debt contracts in an environment where agents have an incentive to divert their cash flows out of a given project. The model is adopted from Aggarwal and Yousef (2000), they compare the well known profit sharing contracts (*mudaraba* or *musharaka*) with the mark- up principle (*murabaha* or *ijara*). We will use the expressions profit-sharing or equity and mark-up or debt, interchangeable. The asymmetric information problem in this model arises because the receiver of the funds has an incentive to use the cash in a wasteful manner after agreeing on a financial contract.

The asymmetric information problem is therefore a moral hazard problem, where an agent changes his mind after the contract is closed.
We have two different individuals, a bank which acts as financier and an entrepreneur which uses the received funds to finance a project. The problem of the bank is to create an optimal contract given that it faces a moral hazard problem. It is assumed that the bank has the bargaining power, which means that the bank decides which contract to offer to the entrepreneur. This assumption is deemed to be realistic, because the Islamic financial market for financial intermediation is still an emerging one and therefore we can't expect a lot of competition in this market (Aggarwal and Yousef (2000)).
The model is divided into three periods, in $t = 0$ the entrepreneur has to borrow money from the bank to finance his investment project. The project generates uncorrelated returns in the following periods, these are denoted by $\hat{x}_1$ for the first and $\hat{x}_2$ for the second period repectively. The payoffs lie in the the following interval $\hat{x}_t \sim [0, x^H]$, whereby x^H denotes the highest payoff possible. Note that the payoffs can't be negative. Payoffs have a cummulative distribution function which is denoted by $F(x_t)$ and a continuous probability density function which is denoted by $f(x_t)$. Furthermore, a hazard rate is defined as $\frac{1-F(x_t)}{f(x_t)}$, which is non increasing in x. It tells us that the probability of default is smaller for higher payoffs. It is further assumed, that the entrepreneur is risk-neutral and that he has zero endowment. This implies that he has to borrow money from the financial intermediary. The model is further simplified by assuming no discounting or interest rates. The definition of debt contract is therefore not that of a financial contract which pays interest, but rather a contract which pays fixed payments. In a full debt contract, the bank can be sure about its payments, whereas in an equity contract it can't be sure about these payments because they depend on the projects payoff, which is uncertain *ex-ante*.
A moral hazard problem can occure, because the entrepreneur is given incentives to divert his payoffs. Diverting payoffs means that the entrepreneur uses his payoffs in a wasteful manner, an example is the consumption of perquisites. Perquisites are only utility spending to the

entrepreneur but not to the bank. The bank therefore has the task, of developing incentive compatible contracts to reduce the entrepreneurs incentive of diversion. Diversion can also be seen as investing in a project with negative NPV, whereby the entrepreneur benefits alone. If the entrepreneur diverts an amount of y his utility is given by (see Aggarwal and Yousef (2000))

$$u(y) = cy \text{ where } 0 \leq c \geq 1. \tag{1}$$

On the other hand, if he does not divert the cash flows he receives direct cash payments form the firm instead, this utility is given by (see Aggarwal and Yousef (2000))

$$v(y) = y. \tag{2}$$

These two equations tell us, that in general the entrepreneur prefers the direct cash payment of the firm. But if for example, his share in the firm (α) is less then c, his utility from a direct cash payment is smaller than that of diversion, that is $v(\alpha y) < u(y)$. Of course the same is true for a debt contract, where the debt payment is so high that diverting becomes the dominant strategy for the manager.
The cost of the project is denoted by $\hat{I}$, it lies between the following interval $[0, E(x_1)+E(x_2)]$, where $E(x_1)$ and $E(x_2)$ are the expected cash flows in period one and two respectively. The cost is distributed continuously with probability density function $g(I)$. It is assumed that the realized cost of the project (I) is fully observalbe to everyone at t=0. Furthermore, the project has always positive expected NPV. This implies that the projects should always be finaced by the bank from a social welfare perspective, even if the bank incures a loss. Another assumption regarding the cost is that the cash-flow out of the project is independent of the cost. This means, that the cost (I) gives no additional information about the expected project payoffs. Regardless of the initial cost of the project, the payoffs are totally independent of it (Aggarwal and Yousef (2000)). These assumptions may not be realistic, but the purpose of the model is not to give hints when to invest in a given project, but to analyze the moral hazard problem in financial contracts.

If the bank decides to finance a project on a debt basis, there is a probability that the entrepreneur defaults on his debt payments. This could be because the cash flow out of the project is not high enough to cover his debt obligations in that period, or if he decides to divert the cash flows. In either case, the bank does not receive the pre-determined payment and therefore the bank has the right to liquidate the assets of the entrepreneur. The liquidation value is denoted by L_t. If the entrepreneur can't meet his debt obligations in the first period, the bank can liquidate the assets for L_1. If the firm is liquidated in the first period, no second period cash flow is realized. This basically reflects the assumption that only the entreprenuer has the knowledge to run the firm, and if he is unable to meet his obligations, the bank can only sell the assets because of a lack of expertise. A related assumption is, that the first period liquidation value can't be higher than the expected second period cash flow ($E(x_2) \geq L_1$). It is therefore social welfare increasing to continue the project, but because the bank suffers a loss it will liquidate the firm. This assumption covers the idea that debt financing comes at a cost. The liquidation value in the second period is assumed to be zero. The reason behind this assmption is that the firm ends after the second period ($L_2 = 0$) (Aggarwal and Yousef (2000)). With this in mind, we want to formulate the optimal contract for the bank, given a specific level of moral hazard.

3.1 Optimal contracts from the bank's perspective

In this section we want to find out which contract is the optimal one for the bank, given a fixed level of moral hazard. To do so, the bank can choose between PLS contracts (*mudaraba* and *musharaka*) and mark-up contracts (*murabaha* and *ijara*). As already mentioned, we will use the PLS principle and equity as a synonym as well as the mark-up principle and debt. It is also possible to choose a mix between debt and equity. If there is debt involved in the method of finance, the entrepreneur can default on these debt payments. If he does, the bank receives control rights over the assets and can liquidate them.

A general contract is described as follows $\{\alpha, D_1, D_2, I\}$, where α is the equity share of the entrepreneur ($(1-\alpha)$ is the equity share of the bank), D_1 is the face value of debt which has been borrowed in the first period, D_2 is the second period face value of debt and I is the total amount of funds provided by the bank (Aggarwal and Yousef (2000)). The contracts comprise the face value of debt, because the market value of debt may be lower than the face value, this is because the entrepreneurs can default. With this general contract, we can also specify two special cases. An all equity contract is represented by $\{\alpha, I\}$ and an all debt contract by $\{D_1, D_2, I\}$.

The bank faces the problem, to maximize its expected return, $E(\pi_B)$, subject to the three variables which specify a contract (all but I). The maximization problem is given by (Aggarwal and Yousef (2000)):

$$\max_{\alpha, D_1, D_2} \int_0^{x_1'} L_1 f(x_1) dx_1 + \int_{x_1'}^{x^H} \Bigg(\alpha D_1 + (1-\alpha) x_1 + \int_{x_2'}^{x^H} (\alpha D_2 + (1-\alpha) x_2) f(x_2) dx_2 \Bigg) f(x_1) dx_1 \tag{3}$$

The first part of this equation is $(\int_0^{x_1'} L_1 f(x_1) dx_1)$, here the entrepreneur defaults on his first period debt payment. In this case the bank receives ownership of the assets, but because it has not enough knowledge to use them, the bank will liquidate the asset for L_1. The entrepreneur will default on his debt obligations if his first period cash flow x_1 is smaller than some treshold level x_1'. The treshold level is defined later by some incentive compatibility and limited liability conditions. Basically, his first period cash flow can be too small for two reasons. First, the project was not profitable enough in the first period to meet his debt obligation. Second, the entrepreneur diverts the first period cash flow and has not enough money left to bear his burden regarding the debt payment. Normally we would have a second period liquidation term

($\int_0^{x_2'} L_2 f(x_2)dx_2$) in this maximization problem, but because we assumed $L_2 = 0$, this part drops out. If the first period cash flow is higher than the threshold level ($x_1 \geq x_1'$), the entrepreneur does not default and the bank earns its equity share in addition to the first period debt payment ($D_1 + (1-\alpha)(x_1 - D_1) = \alpha D_1 + (1-\alpha)x_1$). According to the equation in the brackets, debt holders get served first and only the difference between equity and debt is distributed among the investors. Additional to the first period payments, the bank earns the expectation of the second period return ($\int_{x_2'}^{x^H} (\alpha D_2 + (1-\alpha)x_2)f(x_2)dx_2$). The reasoning is the same, the bank receives his return only, if the second period cash flow is higher than its threshold level ($x_2 \geq x_2'$). If it is actually higher, the bank receives its second period debt payment and second period equity share ($D_2 + (1-\alpha)(x_2 - D_2) = \alpha D_2 + (1-\alpha)x_2$). We multiply all the discussed expressions by their appropriate probability density function and integrate it at the correct interval. For example, we integrate $f(x_1)$ from 0 to x_1' to obtain the probability that the actual value of x_1 lies in this interval. After that, we multiply it by L_1 to receive the expected value of liquidation in the first period.

The threshold level of the first and the second period cash flow is subject to some incentive compatibility and limited liability conditions. If all of these conditions are satisfied, the entrepreneur won't divert cash flows and he is unable to default. The conditions are given as (Aggarwal and Yousef (2000)):

$$v(\alpha x) \geq u(x) \text{ or } \alpha \geq c \tag{4}$$

$$\alpha(x_1 - D_1) + \int_0^{x_2'} c x_2 f(x_2)dx_2 + \int_{x_2'}^{x^H} \alpha(x_2 - D_2)f(x_2)dx_2 \geq c x_1 \tag{5}$$

$$\alpha(x_2 - D_2) \geq cx_2 \tag{6}$$

$$x_1 - D_1 \geq 0 \tag{7}$$

$$x_2 - D_2 \geq 0 \tag{8}$$

These five equations are the so called incentive compatibility and limited liability conditions. Equation (4) - (6) are the incentive compatibility conditions, if all three are met the entrepreneur has no incentives to divert his cash flow. Equation (7) - (8) are the limited liability conditions, if these are met the entrepreneur cannot default unless he diverts cash flows. His earings through the project would be sufficient to meet his debt obligations.

Condition (4) says, that the entrepreneurs utility form consuming his stake (α) of the cash flow has to be larger than the utility he can expect form diverting the cash flow. As we can see, this condition can also be written as $\alpha \geq c$. Which means that his stake of the cash flows out of the project have to be sufficiently high. If they are not, the entrepreneur will divert cash and because the bank can't observe the entrepreneur, it will earn less or nothing. Stated differently, the bank has to gurantee the entrepreneur at least a fraction of c of the equity, otherwise the entrepreneur will divert the cash flows.

The next condition is Equation (5), it is the first period incentive compatibility condition. The statement is, that the utility from not diverting in the first period plus the expectation for the second period should be higher than the utility form diverting in the first period. The first term on the left is the utlity the entrepreneur receives in the first period if he decides not to divert. The second term is the expected utility if he decides to divert in the second period, the utility he earns is cx_2 but because we are in the first period we have to build expectations. The last term on the left hand side reflects the case where the entrepreneur

decides not to divert in the second period, again we have to build expectations beacause we are in the first period. Overall, his return from not diverting should lead to a higher expected return if the contract is first period incentive compatible. If the contract is not first period incentive compatible, the entrepreneur will divert and receive cx_1 (the RHS of the equation). This has implications for the bank, its first period equity share ($(1-\alpha)(x_1 - D_1)$) plus the face value of debt (D_1) cannot be so high that the optimal strategy for the entrepreneur is diverting.
Equation (6) is the second period incentive compatibility condition. It states exactly the same as Equation (5) for the second period. The difference is, that we have no third period and therefore no third period expected return. For a contract to be second period incentive compatible, the utility for the entrepreneur from paying back the face value of second period debt plus the equity share, should be higher than diverting the second period cash flow.
The last two equations are the limited liability conditions for the first and second period (Equation (7) and (8)). They state that the cash flows should be higher than their related face value of debt. If these conditions are not satisfied, the entrepreneur will default on his debt obligations because the cash flows weren't high enough. The bank becomes the owner of the assets and liquidates them. If the entrepreneur defaults in the second period, the bank earns nothing because the second period liquidation value is assumed to be zero. These two conditions can also be seen as zero-endowment conditions, because the entrepreneur has zero endowment to cover his debt obligations in the case of a shortfall. Therefore he loses control over his assets.
Now that we have knowledge about some constraints, we want to examine the optimal contracts for the bank. The authors (Aggarwal and Yousef (2000)) chose a way, where they examined the optimal contracts in reverse order. This means that we will start with an examination of an optimal contract in the second period, and after that we will do the same for the first period. In the second period they distinguished between two types of contracts, the first one is a full equity contract and the second an equity and debt contract. In the equity contract we assume $\alpha = c$ and

$D_2 = 0$, in the notation of contracts this is $\{c, D_1, I\}$. We will label this full equity contract C_E, for the present. Because we are in the second period, we only have to look at the second period conditions, these are Equation (6) and (8). For C_E, both conditions are met. Equation (6) is met with equality, this is $cx_2 = cx_2$, and Condtion (8) is met with every realization of x_2, note that we have assumed that x_t is always greater or equal to zero ($\hat{x}_t \sim [0, x^H]$). Therefore, the full equity contract C_E satisfies both conditions. Now, an alternative contract is designed. This contract is a mixture between debt and equity, let's call this contract C_{DE}. In this contract we assume $\alpha' \in (c, 1]$ and $D_2' > 0$, in contract notation $\{\alpha', D_1, D_2', I\}$. The equity stake of the entrepreneur (α) for this contract has to be higher than c, because the entrepreneur has additional costs in form of the debt payments. If we take into consideration the specifications of the C_{DE} contract in Equation (6), we receive the following "cutoff level" for the second period cash flow (Aggarwal and Yousef (2000))

$$x_2' = \frac{\alpha' D_2'}{\alpha' - c}.$$

Now we can distinguish between three different realizations of x_2. The easiest of them is that the realization of the cash flow in the second period equals the "cutoff level", this is $x_2 = x_2'$. In this specific case, the bank is indifferent between the the full equity (C_E), and the debt and equity contract (C_{DE}). Both conditions are met, Equation (6) is satisfied with equality. Equation (8) is met for every realization of x_2, this can be seen if we change Equation (6) as follows

$$D_2' = x_2'(\frac{\alpha' - c}{\alpha'}).$$

Because $\frac{\alpha'-c}{\alpha'} < 1$, x_2' always has to be larger than D_2' to satisfy this condition. Therefore, Equation (8) is also alwalys satisfied for any realization of $x_2 = x_2'$. The second case is, where the realization of the second period cash flow is higher than the "cutoff level", this is $x_2 > x_2'$. In this situation, the incentive compatibility condition is always met. The entrepreneur will not divert any cash flow because his utility from not diverting is higher than that from diverting. The problem in this

case is, that it is *ex post* inefficient. The entrepreneur earns an excess return because $\alpha' > c$. Of course this is only *ex post* inefficient, because the bank can't observe the diversion level *ex ante*. In the last case we have $x_2 < x_2'$, because Equation (6) is not satisfied, the entrepreneur will divert his cash flow and may default on his debt obligations. In this case the contract is surely not optimal from a banks perspective.
As we have seen, the C_{DE} contract is not met for every realization of x_2 as it is the case in the C_E contract. We therefore have more uncertainty regarding the satisfaction of the incentive compatibility condition in the case of a debt contract, which makes it less attractive to the bank. Because of this, we can conclude that in the second period any debt contract is dominated by the full equity contract. The case where $\alpha' < c$ and $D_2' \geq 0$ is not worth mentioning, because in this case Equation (4) and Equation (6) are clearly violated. Therefore, such a contract can't be optimal for the bank. So far, the optimal second period contract is the full equity contract with $\alpha^* = c$ and $D_2^* = 0$.
Now that we have figured out the optimal contract in the second period, we will do the same for the first period, given our result from the second period analysis. We have seen that the optimal amount of second period debt is zero and that the optimal sharing rule is $\alpha = c$. Beause of this, we can simplify the first period incentive compatibility constraint (5). We plug in the optimal second period debt and the optimal sharing rule to obtain a reduced version of equation (5), which is given as (Aggarwal and Yousef (2000))

$$\alpha(x_1 - D_1 + E(x_2)) \geq cx_1. \tag{9}$$

They now introduced two different contracts and compared them regarding their compliance with the reduced version of the first period incentive compatibility condition (9) and the first period liability condition (7). The first contract is described by $\alpha = c$ and $D_1 \leq E(x_2)$, in contract notation $\{c, D_1, I\}$. We will call such a contract a lesser debt contract and label it C_{ld}. This contract satisfies our reduced incentive compatibility condition for every realizations of x_1. But, we can't be sure that Con-

dition (7) is always met, that is the entrepreneur may default because his first period cash flow is not high enough to bear his debt burden. The second contract which is introduced is a greater debt contract, its specifcations are $\alpha' \in (c, 1]$ and $D_1' > E(x_2)$. We will call a contract with these specifiacations a greater debt contract and label it C_{gd}, in contract notation $\{\alpha', D_1', I\}$. Such a contract has again, like in the second period, a so called "cutoff level". We receive the "cutoff level" by plugging the contract specifications into the reduced incentive compatibility condition (9). It is given by (Aggarwal and Yousef (2000))

$$x_1' = \frac{\alpha'(D_1' - E(x_2))}{\alpha' - c}.$$

Again, we can discriminate between three different realizations of x_1. If $x_1 = x_1'$ the bank is indifferent between the C_{ld} contract and the C_{gd} contract. For a realization of $x_1 > x_1'$, Equation (9) is satisfied but we have again the problem that the entrepreneur receives an excess return because we have $\alpha' > c$. If the realization of the first period cash flow is lower than its cutoff level ($x_1 < x_1'$), the entrepreneur has more utility from diverting and therefore has no incentives to pay back the face value of first period bebt. In this case the bank becomes the owner of the assets and therefore receives the first period liquidation value L_1. This is clearly not the optimal contract for the bank, we can see this by investigating the banks earning function under $\alpha = c$ and $D_1 = E(x_2)$. The earning function is given by (Aggarwal and Yousef (2000))

$$D_1 + (1 - \alpha)(x_1 - D_1 + E(x_2)) \geq E(x_2) + (1 - c)x_1 > L_1. \qquad (10)$$

Earlier we made the assumption that $E(x_2) \geq L_1$, therefore it is always optimal for the bank to design a contract in a way to reach the second period, because the returns for the bank are higher in this case, this can be seen in (10). In the C_{gd} contract, if realizations are smaller than the "cutoff level", the bank receives just the liquidation value L_1 which is always smaller than the expected second period cash flow plus the first period equity share. In addition, the C_{gd} contract would produce a higher return than shown in Equation (10), because we assumed $D_1' > E(x_2)$.

So far, we have only checked whether the contracts satisfy the first period incentive compatibility condition. We also have to check which of these contracts saftisfy the limited liabilty condition (7) the most. By doing so, we assume that $x_1 < E(x_2)$. For the C_{gd} contract the limited liability condition is clearly not met, because $D_1' > E(x_2)$ and therefore $x_1 < E(x_2) < D_1'$. This would result in a default by the entrepreneur and therefore can't be the optimal contract for the bank. The same is true for a contract with the following specification $D_1 = E(x_2)$. Here we would have $x_1 < E(x_2)(= D_1)$, this would also lead to default because the entrepreneur has not enough money to cover his debt obligations. The last contract is the C_{ld}, here we can't make clear statements about default ($x_1 < E(x_2) \geq D_1$). The relationship between the first period cash flow and the face value of first period debt is not clear, and therefore we can't make any conclusions about default.

This in turn implies that the C_{ld} contract fits both of the conditions better than all the other contracts. There is no uncertainty regarding the fulfilment of the first period incentive compatibility condition and there is uncertainty of the fulfilment of the first period limited liability condition. In the C_{gd} contract the opposite is true, we have uncertainty regarding the fulfilment of Equation (10) and we have no uncertainty regarding the fulfilment of Equation (7) for a critiqual level of first period cash flow ($x_1 < E(x_2)$). This reasoning implies that the C_{ld} contract dominates all the other contracts in the first period. Another conclusion can be made, because the first period limited liability condition (7) is not always met for the C_{ld} contract, it implies that $x_1' = D_1$. This becomes useful when we look at the banks optimization problem in the next equation. Additionaly it tells us that if the realized first period cash flow is below its cutoff level, the entrepreneur will default. If the realized cash flow is higher, the entrepreneur will repay his debt and the limited liability condition is satisfied (Aggarwal and Yousef (2000)).

Until now, we have derivated the optimal value of the equity share and the optimal level of second period debt. The last variabel we need an optimum for is the first period debt level (recognize that contracts depend on three variables $\{\alpha, D_1, D_2, I\}$). We will see, that this optimum first

period debt level crucially depends on the extent of moral hazard in an economy. The banks problem is now simplified because of the preceding analysis, we will use $\alpha^* = c$, $D_2 = 0$ and $x_1' = D_1$ and receive the following maximization problem of the bank[2] (Aggarwal and Yousef (2000))

$$\max_{D_1 \in [0, E(x_2)]} \int_0^{D_1} L_1 f(x_1) dx_1 + \int_{D_1}^{x^H} \Big(D_1 + (1-c)(x_1 - D_1 + E(x_2)) \Big) f(x_1) dx_1 \tag{11}$$

This is now the simplified version of the maximization problem we already saw in Equation (3). If we do the partial derivative with respect to D_1, we can observe the following result[3] (Aggarwal and Yousef (2000))

$$\frac{\partial E(\pi_B)}{\partial D_1} = (L_1 - D_1 - (1-c)E(x_2)) f(D_1) + c(1 - F(D_1)) \tag{12}$$

This is the first partial derivative with respect to D_1. The next step will be, to find out the optimal amout of debt for specific levels of moral hazard (c). The first contract we want to take a closer look at is the full equity contract, we therefore assume that $D_1 = 0$. Equation (13) states the result of this additional assumption (Aggarwal and Yousef (2000))

$$L_1 - (1-c)E(x_2) + \frac{c}{f(0)} \leq 0. \tag{13}$$

By solving this equation for c, we will obtain the cutoff level of moral hazard for all equity contracts c^*. Stated differently, up to this cutoff level c^*, all equity contracts are optimal for the bank. The first cutoff level is given by (Aggarwal and Yousef (2000))

$$c^* = \frac{E(x_2) - L_1}{E(x_2) + \frac{1}{f(0)}} = \frac{E(x_2) - L_1}{E(x_2) + hr(0)}. \tag{14}$$

This cutoff level refers to a low level of moral hazard or a low level of diversion. If the level of moral hazard is greater than that cutoff level

[2]Further explanations regarding the derivation can be found in the Appendix.
[3]Partial derivative can be found in the Appendix.

($c > c^*$), a mix between debt and equity becomes the optimal contract. I introduced a new variable, beacuse the second term of the denominator is similar to the hazard rate ($hr(x)$). This is better seen in the succeeding analysis. We utilize $\bar{D}_1 > 0$ in equation (12) to receive the following (Aggarwal and Yousef (2000))

$$L_1 - \bar{D}_1 - (1-c)E(x_2) + \frac{c(1-F(\bar{D}_1))}{F(\bar{D}_1)} = 0. \tag{15}$$

If the level of moral hazard is actually higher than the first cutoff level, the bank will offer only a contract which involves a mix between debt and equity. If we solve Equation (15) for c, we get the following

$$c^{irr} = \frac{E(x_2) + \bar{D}_1 - L_1}{E(x_2) + \frac{1-F\bar{D}_1)}{f(\bar{D}_1)}} = \frac{E(x_2) + \bar{D}_1 - L_1}{E(x_2) + hr(\bar{D}_1)}.$$

I labeled this equation c^{irr} because it is irrelevant for the further examination of optimal contracts. I did it for completeness and to see the similarity to the next equation.
The last step is, that we want to see when $D_1 = E(x_2)$ becomes the optimal contract. We therefore analiyze Equation (12) at $D_1 = E(x_2)$ and receive

$$L_1 - E(x_2) - (1-c)E(x_2) + \frac{c(1-F(E(x_2)))}{f(E(x_2))} \geq 0. \tag{16}$$

Solving this equation for c leads to the second cutoff level of moral hazard, note the similarity to c^{irr}. The second cutoff level is given by (Aggarwal and Yousef (2000))

$$c^{**} = \frac{2E(x_2) - L_1}{E(x_2) + \frac{1-F(E(x_2))}{f(E(x_2))}} = \frac{2E(x_2) - L_1}{E(x_2) + hr(E(x_2))}. \tag{17}$$

For an actual moral hazard level $c \geq c^{**}$, a contract of debt and equity becomes the optimal contract, whereby the optimal amount of first period debt should equal the expected second period cash flow. This is also the maximum of first period debt in a contract. It is useful that we have implemented the hazard rate in our equations, because we can now see

that the more debt ($D_1 = E(x_2)$) cutoff level of moral hazard (c^{**}) is higher than the less debt ($D_1 = 0$) cutoff level of moral hazard (c^*). The nominator is clearly higher for the second cutoff level c^{**}, because we multiply the expected second period cash flow times two, all other things equal. The denominator should be smaller for c^{**} because the hazard rate is smaller for $E(x_2)$ than it is for zero. The hazard rate for an expected cash flow of zero should be near to one. These two facts should result in $c^* < c^{**}$.

To summarize the preceding analysis, the optimal first period amount of debt is given as follows (Aggarwal and Yousef (2000))

$$D_1^* = \begin{cases} 0 \text{ for } c^* \geq c \\ \bar{D}_1 \text{ for } c^{**} > c > c^* \\ E(x_2) \text{ for } c \geq c^{**} \end{cases} \tag{18}$$

For a moral hazard level smaller that c^* the bank chooses a full equity contract. If the level of moral hazard lies between the two cutoff levels, a small debt level should be preferred. Last, if we are in an environment with a high level of moral hazard the contract should involve a high amount of debt. Note that all of these contracts comprise equity.

The relationship between the optimal amount of first period debt and the level of moral hazard can also be displayed graphically. To do so, we need to equal Equation (12) to zero and solve it for D_1^*, this gives us the following result

$$D_1^* = L_1 - (1-c)E(x_2) + c\frac{1 - F(D_1))}{f(D_1)}. \tag{19}$$

After obtaining Equation (19) we can state the first partial derivatives with respect to the independent variables (Aggarwal and Yousef (2000))

$$\frac{\partial D_1^*}{\partial c} \geq 0; \frac{\partial D_1^*}{\partial L_1} \geq 0; \frac{\partial D_1^*}{\partial E(x_2)} \leq 0. \tag{20}$$

The first partial derivative states that the relationship between first period debt and the derivation level is positive. Meaning, that for a higher

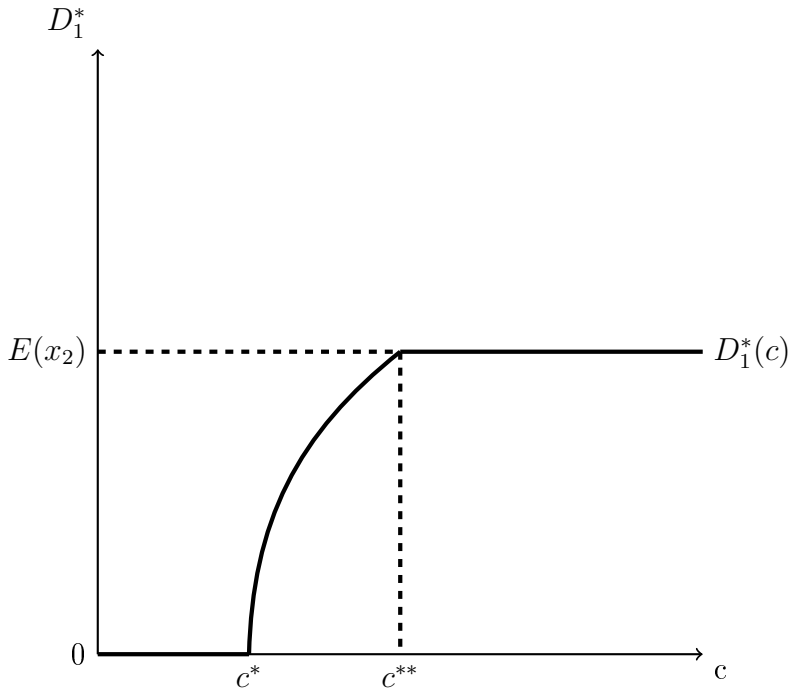

Figure 2: Relationship between optimal first period debt and the extend of moral hazard (in accordance with Aggarwal and Yousef (2000)).

level of moral hazard the optimal amount of debt should also be higher. This relationship is plotted in Figure (2). We have the optimal amount of first period debt on the ordinate and the extend of moral hazard on the adscissa. The relationship between the two is the same we predicted via the partial derivative.

The first derivative of D_1^* with respect to L_1 is also larger than zero. It is argued, that for a higher liquidation value the riskiness of debt in the sense of lesser default decreases and therefore the face value of debt increases. The first derivative of D_1^* with respect to $E(x_2)$ is smaller than zero. The argument behind it is, that as the expected second period cash flow increases, the first period cost of default increase and therefore the value of debt is decreasing in the expected second period cash flow.
The analysis of the paper from Aggarwal and Yousef (2000) focuses on the question whether a profit sharing contract (equity) or mark-up contract (debt) is dominant for some level of moral hazard. Therefore, the focus of investigation lies in the regions where $c \leq c^*$ and $c > c^*$. In the

first case, the dominant finance method is all equity. The highest costs possible under an all equity contract are defined as follows (Aggarwal and Yousef (2000))

$$I^E = (1-c)(E(x_1) + E(x_2)). \tag{21}$$

This cost function displays the gain of the bank in the case of an all equity contract. The bank won't fund a project with higher expected costs than I^E because if it would, the probability of suffering a loss would be higher than that of making a gain. Stated differently, the expected profit share of the bank should yield at least the costs of funding the project. Because the realized costs of financing are fully observable when the financing contract is signed, the bank will only finance projects with costs up to I^E. If $I > I^E$, the bank won't finance the project with an all equity contract because it will generate an expected loss. This in turn implies, that all equity contracts work fine as long as the costs of the project are low or the rate of diversion is low. For example, if the rate of diversion increases the highest possible costs decrease ($\frac{\partial I^E}{\partial c} < 0$). This implies that in an economy with a high rate of diversion lesser projects will get financed on an equity basis. When the rate of diversion is high, the moral hazard problem makes sure that financing on an all equity basis becomes impossible.

At the second part, where we have $c > c^*$ the debt and equity contract becomes the optimal choice for the bank. In this case, the expected return of the entrepreneur is defined as follows[4] (Aggarwal and Yousef (2000))

$$\begin{aligned} &\int_0^{D_1^*} c x_1 f(x_1) dx_1 + \int_{D_1^*}^{x^H} c(x_1 - D_1^* + E(x_2)) f(x_1) dx_1 \\ &\qquad = cE(x_1) + c(1 - F(D_1^*))(E(x_2) - D_1^*). \end{aligned} \tag{22}$$

The first part of Equation (22) reflects the case where the entrepreneur decides to divert cash flows and the second part is where he doesn't. The

[4]See Appendix for derivation.

second term of Equation (22) (after the equal sign) is just a simpler way to write down the equation. Additionaly the highest costs possible in a debt and equity contract is defined (Aggarwal and Yousef (2000))

$$I^{DE} = F(D_1^*)L_1 + (1 - F(D_1^*))(cD_1^* + (1-c)E(x_2)) + (1-c)\int_{D_1^*}^{x^H} x_1 f(x_1)dx_1. \tag{23}$$

If the actual costs of the project are smaller or equal to I^{DE}, the project is financed with the debt and equity contract. If the realized costs are above these costs, the project can't be financed at all. The highest possible costs of the project in the debt and equity case do not only depend on the expected cash flows and the rate of diversion, but also on the liquidation value and the first period debt. The higher the liquidation value of the firm, the higher the maximum amount a bank can finance under such a contract. The same is true for the expected second period cash flow. The only variable which influences the maximum amount of funds negatively is the rate of diversion, as it was the case in the pure equity contract. One of the most important conclusions can be seen, when looking at the last part of the equation. In this part $((cD_1^* + (1-c)E(x_2)) + (1-c)\int_{D_1^*}^{x^H} x_1 f(x_1)dx_1)$, we ascertain that as the rate of diversion increases a larger part of the project will get financed with debt (c) instead of equity ($1-c$). In words of the authors (Aggarwal and Yousef (2000)), "As moral hazard increases, debt becomes the predominant instrument of finance".

3.2 Social welfare implications

We compared the two contracts with respect to their profitability from the banks perspecitive. In this section, we want to compare them in a social welfare manner. We have already seen that the bank preferes the debt and equity contract because it generates higher expected return in an environment where a higher level of moral hazard is expected. The question now is, if such a contract is optimal for the whole society or

only for the bank?
For this purpose two different welfare variables are defined. Each of them measure the overall welfare in the economy, one of them in an environment with pure equity and the other in a world full of debt and equity contracts. It should be made clear, that in a so called debt and equity environment the contracts will always involve debt and that there is no possiblility for a full equity contract. If we would make the investigation in a world where the bank has no bargaining power and where there are both contracts available, this would clearly be a welfare increasing contract compared with the two cases we will now look at.
The first measure is the "gross social welfare per period under pure equity" measure or simply GSW^E (see Aggarwal and Yousef (2000)). The measure is defined as follows (Aggarwal and Yousef (2000))

$$GSW^E = (1-c)(E(x_1)+E(x_2)+c(E(x_1)+E(x_2) = E(x_1)+E(x_2). \quad (24)$$

The measure in the pure equity case is quite simple. It is just the equity share of the bank in both periods plus the equity share of the entrepreneur. This simply becomes the expectation of the first period cash flow in addition to the expectation of the second period cash flow. Stated differently, only the outcome of the project influences the social welfare and there are no costs for society associated with a pure equity contract. This changes if we take a look at the other measure.
The second measure is the "gross social welfare per period under debt and equity" measure or GSW^{DE} (see Aggarwal and Yousef (2000)). The definition is as follows (Aggarwal and Yousef (2000))

$$\begin{aligned} GSW^{DE} = F(D_1^*)L_1 + (1 - F(D_1^*))(cD_1^* + (1-c)E(x_2)) \\ +(1-c)\int_{D_1^*}^{x^H} x_1 f(x_1)dx_1 + cE(x_1) \qquad (25) \\ +c(1 - F(D_1^*))(E(x_2) - D_1^*) < E(x_1) + E(x_2) = GSW^E. \end{aligned}$$

This equation reflects the sum of Equation (22) and Equation (23). It is again the sum of the returns of the only two agents in this economy, but

this time the result is not simply the sum of the expected output of the project. It is less than GSW^E, because in this case the economy faces the cost of default and therefore the cost of liquidation. Liquidation can only appear in the debt case, if the entrepreneur decides to divert his cash flow and is therefore unable to pay back the debt payments. If the entrepreneur decides to divert cash flows in the full equity case, the bank simply receives less. In the full equity case, the act of diverting cash flows is just a redistribution of wealth, whereas it could lead to a cost in the debt and equity case and is therefore associated with a welfare loss.
By just looking at these two measurements, the conclusion would be that the full equity contract has an advantage over the debt and equity contract in the sense that it has higher social welfare. This result is misleading, because it could be that we finance more projcts with a debt and equity contract than we would in a pure equity environment (Aggarwal and Yousef (2000)).
To account for this problem, Aggarwal and Yousef (2000) defined two further measures. The two new measures are similar to the old ones, beside the difference that they are integrated up to their maximum amount of investment and multiplied by the density function of the investment costs. Another difference is, that they are net of investment costs. The integration an multiplication with the density function is made to account for the possibility that in a debt and equity environment more contracts are signed, because the highest costs possible are higher and therefore more contracts could get signed.
The equation for the "expected net social welfare under pure equity" is (Aggarwal and Yousef (2000))

$$\int_0^{I^E} (E(x_1) + E(x_2) - I)g(I)dI. \tag{26}$$

As we can see, it is the same as GWS^E apart form the difference that it is net of investment costs and that it is integrated form zero to the maximum possible amount funded through an equity contract (I^E).

The "expected net social welfare under debt and equity" is (Aggarwal and Yousef (2000))

$$\int_0^{I^{DE}} \Bigg(F(D_1^*)L_1 + (1 - F(D_1^*))E(x_2) + (1-c)\int_{D_1^*}^{x^H} x_1 f(x_1)dx_1 + cE(x_1) - I \Bigg) g(I)dI. \tag{27}$$

On the basis of these two equations, Aggarwal and Yousef (2000) analyzed welfare implications regarding our two contracts. They basically found three different cases in which either of these contracts dominates the other one.

The first cases is, where they aussume a small level of moral hazard and therefore $c \leq c^*$. With this assumption, the dominant contract is the equity contract.

The next two cases are best explained by having a look at a Figure (3). In both of these cases it is assumed that the level of moral hazard is high, or $c > c^*$. If this is the case, the maximum possible quantity of debt and equity contracts is higher than the maximum quantity of pure equity, because the maximum possible costs to carry in such contracts is higher ($I^{DE} > I^E$). Therefore, area C in Figure (3) reflects the value of additional welfare because higher cost contracts may get signed and therefore the overall amount of signed contracts in such an economy is higher. Area B is the additional welfare of an all equity contract because $GSW^E > GSW^{DE}$. The reasoning behind this is, that we have default costs and liquidation costs in the case of debt.

In the second case it is assumed that area $B > C$ and therefore the equity contract still dominates the debt and equity contract. The assumpion implies that the addiotional wealth of having no default is higher than the addiotional wealth of having more contracts signed.

Assuming this relationship the other way around, ($C > B$) would lead to the dominance of the debt and equity contract. In this case the additional welfare of more contracts being signed would be higher than the welfare

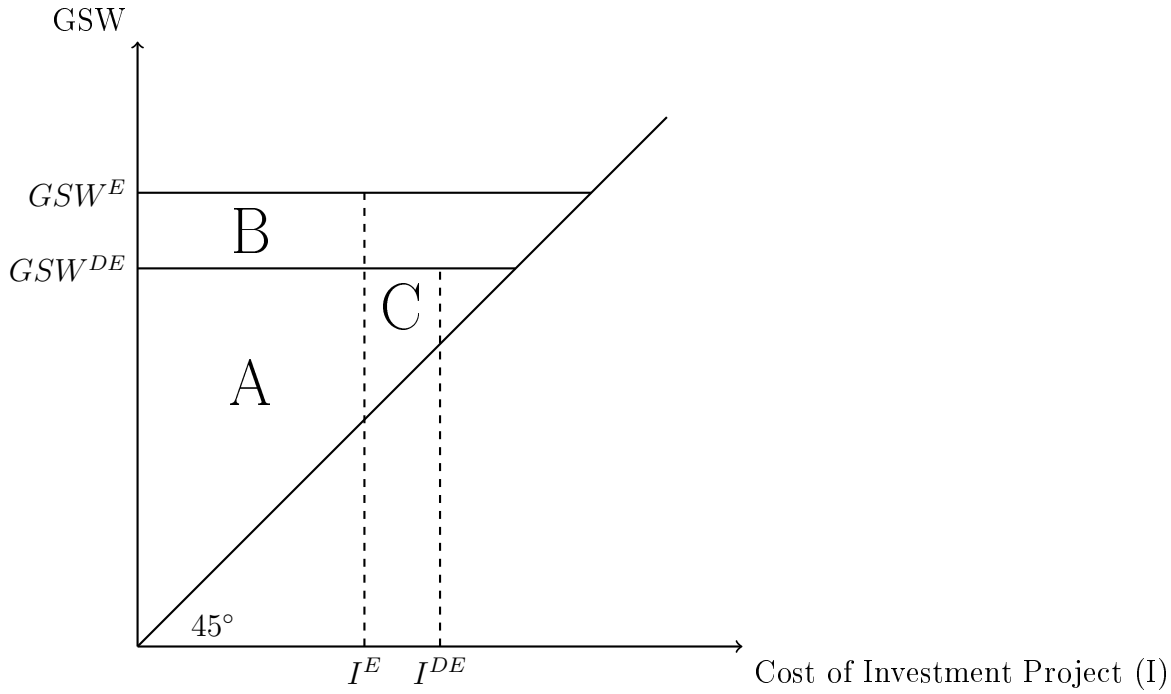

Figure 3: Welfare comparison between the two contracts (in the style of Aggarwal and Yousef (2000)).

increase of being unable to default. Overall this would lead to higher social welfare. The conclusion therefore is, that if we try to prohibit all kind of debt like instruments, in an environment where moral hazard becomes a serious issue, we may suffer welfare losses because there are projects which do not receive finance in an all equity environment.
It is difficult to verify if a country or a financial system has a low or a high diversion level. But, it is stated by the authors that it is realistic to assume that developing countries in general have greater moral hazard problems. If we talk about Islamic finance and Islamic financial markets this assumption should be met. It is therefore advisable to discuss about a strict prohibition of any kind of debt like instruments.

3.3 Conclusion of the model

The model from Aggarwal and Yousef (2000) analyzed the performance of contracts within an environment of asymmetric information. The bank

faces the problem of financing uncertain projects, whereby entrepreneurs tend to divert their cash flows. Two different contracts should help mitigate this incentive problem of the entrepreneur, a PLS contract and a mark-up contract. The contracts were assessed on the banks perspective, with the assumption of a profit maximizing bank. Furthermore, the two contracts were analyzed regarding their implications for social welfare.
The basic result of the investigation is, that the optimal contract depends crucially on the assumed level of moral hazard. It is observed, that if moral hazard becomes a serious problem to society, debt like instruments should dominate equity like instruments. It is expected that the debt like instument is favoured by the bank as well as for society as a whole. Equity finance in contrast, has the advantage of lower costs in a low moral hazard environment. The model therefore suggests, that there is a trade off between costs due to default, and costs due to moral hazard.
With the assumption that the Islamic financial system is kind of an emerging market, and it is therefore even more plagued by the moral hazard problem, it can be concluded that the prohibition of debt like instruments entails social welfare costs. Another conclusion is, that if a society allows both contracts, social welfare could be increased even more.

4 Linear return model: Thoughts about incentives

In the preceding section we learned that moral hazard becomes a problem in combination with building optimal contracts. In this section we follow a different approach, we want to analyze a linear relationship between the returns and the effort put into a project, given the project is financed with a PLS contract or a mark-up contract.
The follwoing anaysis is based on the different return schemes of the two contracts and what implications this could have on building optimal contracts. We will use the simplest form of both, the PLS contract and the debt contract. A PLS contract is a contract, where profits out

of a project will be shared in a pre-determined ratio. In contrast, a debt contract is independent of the profits out of the project and simply demands a fixed payment. We will just look at one period, therefore we will summarize all fixed payments plus the principal into one variable.

4.1 The model

The sole purpose of the model is to examine the incentives for the entrepreneur when financing projects with two different methods of finance. The PLS contract is a share contract, where all the profits are shared in a pre-determined ratio. The proportion of invesment returns the entrepreneur receives is symbolized by α. The mark-up contract is characterised by fixed payments in each period. Because we will only look at the last period, where the projects outcome and the sum of all debt payments are known, we can sum up all the debt payments as one variable. We will call this variable c, it stands for all the coupon payments in addition to the principal value of the debt contract.
To make things even simpler, we assume that the outcome of the project depends linear on the effort of the entrepreneur. A related assumption is, that the effort alone defines the outcome of the project. We therefore assume, that nothing but the effort of the manager influences the return of the project. These assumptions are very restrictive, but the only purpose of the model is to make statements about the incentives of the manager when entering in either the PLS contract or the mark-up contract. The effort of the entrepreneur is symolized by e.
The reason for choosing a linear approach is, beacuse an α sharing rule is nothing other than dividing the returns in a linear manner. In the case of a debt contract, the entrepreneur receives the whole outcome of the project, but he has to pay fixed payments and the principal value. The relationship between the net returns of the project and the effort of the manager is therefore a linear one, with a slope which equals the slope of the relationship between effort and gross returns. In the case of PLS financing, the slope of the net returns line is α times the slope of the gross returns.

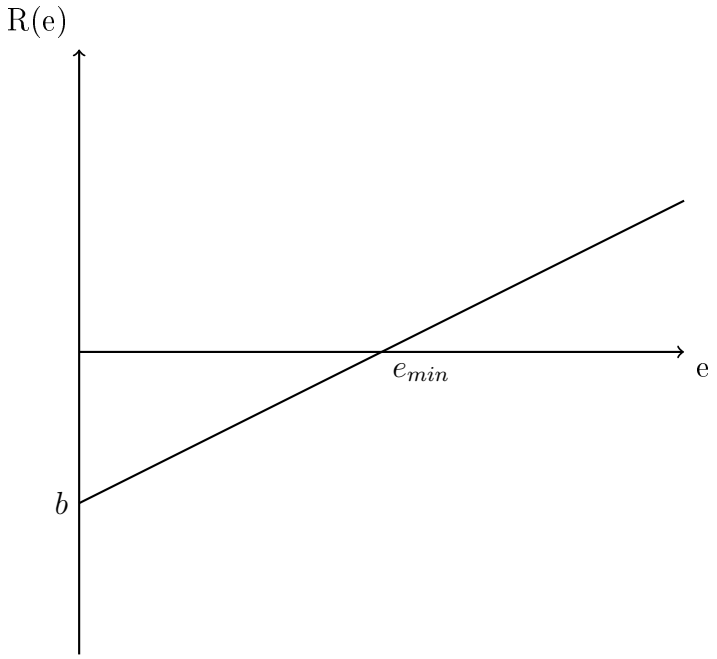

Figure 4: Relationship between the gross return of the project an the effot of the manager.

The relationship between the gross returns and the effort of the manager is given as

$$R(e) = \beta e - b. \tag{1}$$

The lowest possible gross return is b, which is negative. Therefore, if the entrepreneur decides to put a low level of effort into the project, he will suffer a loss. This is best seen by looking at Figure (4). There is also a minimum level of effort given, it describes the situation where the manager has put in as much effort to earn a gross return of zero. Beta is assumed to be smaller than 1, which means that for every one point increase in effort the manager is expected to receive a gross return which is smaller than the one point increase in effort.

The net return is defined as the gross return after paying out the financier. Because we have two different kinds of financing, two different net returns are defined. The variable net return describes the case where PLS financing was used, and the fixed net return where the mark-up contract was used.

The equation for the net return in the PLS case is defined as

$$r(e)^{var} = \alpha R(e) = \alpha(\beta e - b) = \alpha' e - \alpha b. \tag{2}$$

The gross return ($R(e)$) is simply multiplied by the accepted sharing rule (α). In this case it is assumed that profits and losses are shared with the financier, which is compareable with a *musharaka* contract. We can summarize the multiplication of alpha and beta and define the new variable α', which is strictly smaller than α because we assumed $\beta < 1$. The slope of Equation (2) is therefore flatter than in Equation (1).
The next equation is the net return in the mark up contract, it is defined as

$$r(e)^{fix} = R(e) - c = \beta e - b - c = \beta e - C. \tag{3}$$

The slope of this equation is the same as in Equation (1), the only thing that changes is the intercept with the ordinate. The intercept is shiftet downwards by the size of variable c. We can summarize the two inercepts as one, we will label this new intercept $C = (b + c) > b$. The two equations are displayed in Figure (5).

The variable return graph exhibits an intercept which is always greater than the intercept of the fixed return scheme. This is because we assumed that losses are also shared with the financier in the variable return scheme. In the case of fixed return, the entrepreneur has to carry the losses of the project plus the rates of debt financing on his own. We can conclude, that for low levels of effort the variable return scheme should perform better for the entrepreneur. Therefore, if he decides to finance a project and he knows that he is unable to put enough effort into it, then he should finance it with PLS.
Another observation can be made if we look at the two different minimum effort levels in Figure (5). It is seen, that the the minimum effort level for the variable financing method is smaller than that of the fixed financing method (e_{min} describes the minimum level of effort, after e_{min} the entrepreneur is expected to make a gain). Therefore, the entrepreneur has to work much harder in the debt case, compared to the equity case, to receive a net return of zero. This implies, that his incentives in the lower

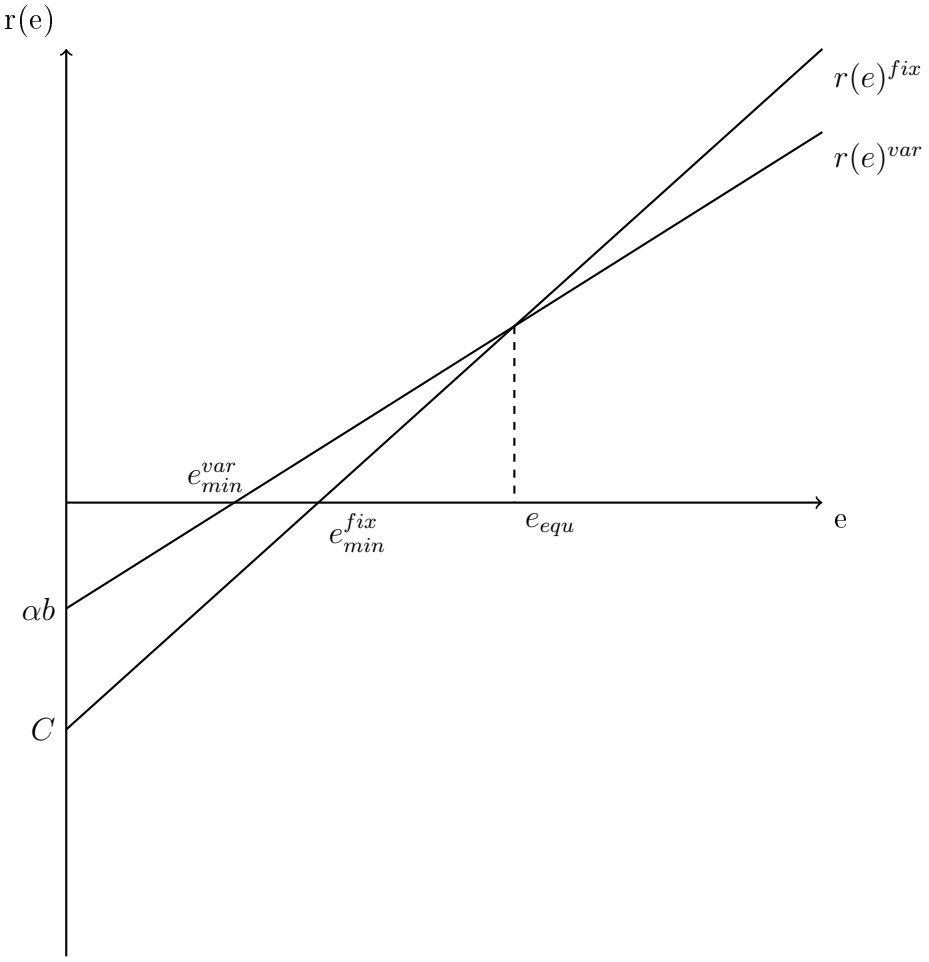

Figure 5: Relationship between the net return of the project an the effort of the manager with different methods of finance.

effort level section should be much stronger in the debt case, because he knows that too little effort will result in a loss. In the variable case the entrepreneur knows that losses will be shared with the financier and that his minimum effort level e_{min}^{var} is smaller compared to the debt case, which in turn should have negative incentives on his work attitude (meaning that he is unwilling to work hard).
Up to e_{equ} the PLS contract has an advantage over the mark-up contract, regarding the net return. After this point the mark-up contract will earn higher returns than the PLS contract. This is because the slope of the fixed return scheme is uneffected by contract specifications. Only the intercept of the ordinate is affected by the fixed return scheme. In the variable case, the overall gross return is affected by the sharing rule, and therefore the whole effort of the manager is affected. This leads to lower net return for higher effort levels. The implications are, that the fixed return contract should lead to more incentives to work hard for the manager, because he receives the whole gain out of the project. Whereas in the equity contract, he is forced to share the high return with the financier. Overall, this would lead to the manager having lower incentives to work hard in the equity case, and higher incentives to work hard in the debt case.
If we look at incentives implied by these two contracts, the debt contract should lead in a higher effort level by the manager. This is because he faces more incentives in the lower effort region. He suffers higher losses and more losses because his minimum effort level is higher compared with the equity case. In the upper effort region (beyond e_{equ}), the manager has more incentives to work hard because he earns exactly what he has worked for. In the equity contract, he is forced to share the return he worked hard for. The conclusion is, that in the debt contract the incentive structure regarding the effort of the manager is much better.

4.2 Implications for financier

Regarding this simple model, the entrepreneur is expected to work much harder when in a debt like contract. If the financier knows about this

issue, he is reluctant to offer equity based contracts. The implicit implication of this would be, to see an economy where the debt like financing method becomes the dominant one, given the bank has bargaining power. Stated differently, the financier is more likely to offer debt contracts to an unknown entrepreneur rather than an equity contract.

This problem is somehow similar to the famous "market for lemons" problem shown by Akerlof (1970). In his paper, trade is uncertain to occure because the buyer of the goods can't observe the quality of them and he therefore fears buying a so called "lemon". A "lemon" is a good which has a low quality. The example made by Akerlof (1970) was the market for used cars. In this market bad cars but also good cars are offered. The buyer fears buying a low quality car, if his fear is so high that he decides not to buy a car at all, and if all buyers share the same fear, it could lead into market failure. This is a typical example of an adverse selection problem.

The "lemons" problem can also be seen in the market for our two contracts. The "lemons" are the projects where the entrepreneur decides to finance his project through equity. The good projects will be financed through a debt contract, because the entrepreneur is confident about the success of the project. The financier has now the problem to distinguish between good and bad projects. This problem would be easy to solve if the entrepreneurs are honest regarding their favorit method of finance. If they are not, the bank does not know which project is a good one and which is a bad one, because the entrepreneurs may lie. The solution of the financier is to offer only debt contracts. The market for PLS contracts or equity will therefore dissappear.

This phenomena can be observed in reality. For Malaysia, Chong and Liu (2009) found that the whole Islamic banking system financed only 0,5% in a PLS fashion (*mudaraba* and *musharaka*). Inspired by their work, I did the same with current data. The results can be found in Table 2[5]. As we can see, the concept of financing has changed a little. Todays ratio of PLS financing is higher than it was in 2004 (the year when Chong and Liu (2009) did their observation). But still, with 5,64% of overall financ-

[5]Source: Homepage of Bank Negara Malaysia

Concept of finance	RM in million[6]	%
Bai Bithaman Ajil (deferred payment sale)	82,298	30,85%
Ijarah (lease arrangement)	67,041	25,13%
Murabaha	50,686	19,00%
Musyarakah (*Musharaka*, joint venture)	14,903	5,59%
Mudaraba	0,146	0,05%
Istisna	0,815	0,31%
Others	50,865	19,07%
Total Financing	266,757	100%

Table 2: Different concepts of finance at Bank Negara Malaysia in September 2013.

ing the ratio is quiet low. If we take a look at the *murabaha* (mark-up) financing alone, it exhibits a financing ration of 19%. Further evidence for the dominance of mark-up finance can be found in Aggarwal and Yousef (2000). They found that over the period from 1983-1994 mark-up financing by the Bank Islam Malaysia (BIM) averaged 95% of new financing. Other banks showed slightly lower mark-up financing ratios, but they still dominated the PLS financing method. The highest ratio of PLS financing could be found by the entire Iranian banking system, it averaged about 30% from 1985 to 1993. All other banks showed significantly lower ratios of PLS financing, they averaged less than 10%.
One explanation could be, that PLS methods of finance suffer from adverse selection problems as well as from moral hazard problems. Adverse selection leads to the dominace of mark-up financing because the financier get's rid of the eventual problem that the entrepreneur hides the true quality of the project. The moral hazard problem also leads to the dominance of the mark-up financing method, because it tends to mitigate the problem that the entepreneur decides to report lower cash flows (or diverts cash flows) after the contract is signed.

[6]Exchange rate: $\frac{RM}{EUR}$ =4,48

5 Asymmetric Information: Theoretical evidence

There are several other works which also deal with the problem of asymmetric information. In this section we want to highlight some of them to get a better understanding of what theory predicts if we compare PLS financing with mark-up financing, when asymmetric information is a serious issue.

An interesting survey has been done by Jalaluddin and Metwally (1999), they asked australian SME's about their readiness to fund their projects in a PLS manner. Roughly 60% responded that they would be willing to fund their projects with a PLS contract. After the survey, they used the data to perfom two regression analysis, a probit and a logit model. Both regressions were used on the same independent variables, which should explain why a given entrepreneur would enter into a PLS contract. The results were, that there is a positive relationship between the probability of financing through PLS and the business risk. This means that an entrepreneur with a risky project is more willing to enter into a PLS contract rather than an entrepreneur with a lesser risky project. They also found that if the costs of borrowing (through interest) are high, the probability of financing through PLS are higher. In addition, they found negative relationships between the probability of PLS funding and some independent variables. If the expected returns of the projects are high, or the rate of management intervention is high because of the PLS contract, then it is predicted that the probability of PLS financing is low. The relationship between expected returns and the probability of PLS financing comes close to what we have seen in the model before. It was stated, that the entrepreneur who favours the PLS method is not that sure about the outcome of the project and the payoffs are therefore expected to be more volatile.

YOUSFI (2013) applies agency models to analyse *mudaraba* and *musharaka* contracts under moral hazard. She asks the question, if these contracts could solve the moral hazard problem? She concludes that the *mudaraba*

contract is actually able to obtain the first best solution, and is therefore able to mitigate the moral hazard problem. Her explanation is, that the entrepreneur fears having no payment in the case of failure. The conclusion for the *musharaka* is, that it is unable to obtain the first best solution, but only the second best solution, and therefore the moral hazard problem can't be solved by such a contract. The explanation is, that the *musharaka* does "not provide enough powerful incentives" to the agents (YOUSFI (2013)). This is somehow different to our model, where we would expect much worse incentives in the *mudaraba* than in the *musharaka*. The argument in our model is, that in the *mudaraba* only gains are shared but the losses are solely born by the financier and therefore the entrepreneur should have less incentives to work hard.

A comparison between debt and equity under asymmetric information can be found in Narayanan (1988). His model provides evidence that debt is a welfare enhancing contract, because "it impoves the average quality of firms in a market". This is because debt financing acts as barrier for inferior firms to enter a market. Inferior firms are seen as lower quality or riskier firms. He also concludes that debt is always better than equity because it increases the market value of a firm. Of course, all the results are obtained under the asymmetric information assumption. The results of Narayanan (1988) are pretty much in common with the implications of the linear model.

An investigation of the investment accounts of Islamic banks has been done by Safieddine (2009). He applied agency theory to the banks and found that invesment account holders (IAH's) expose their money to risks but lack influence on the management. Invesment accounts of Islamic banks are created through a so called "two-tier *mudarabah*" where the bank enters into two different *mudarabah* contracts, one with the depositor and one with the user of funds or the entrepreneur (Iqbal and Mirakhor, 2011, p. 117). The depositor is therefore exposed to risks associated with the investment decission of the bank, but the bank does not face any risk, because in the *mudarabah* contract the supplier of funds is solely liable for losses. If the IAH's lack influence and monitoring possibilites on the management due to difficulties gathering information, then

there is room for agency problems. The lack of access to relevant informations for the IAH's aggravates the general problem of moral hazard in such contracts. The solution to this problem is to implement stronger governance structures, which can't be observed in practice (Safieddine (2009)).

Khan (1989) developed a model which is used to compare variable return schemes (VRS, like equity or PLS) with fixed return schemes (FRS, like debt or mark-up). He found that under the assumption of symmetric information the VRS dominates, because it spreads the risk much better than does FRS. As soon as he relaxes the assumption of symmetric information, the FRS becomes the dominant method of financing. According to Khan (1989) the dominance of FRS under asymmetric information has two reasons. First, lesser monitoring takes place because only a "reported return below the fixed return is suspicious". Second, the FRS allows for lower monitoring costs because it "minimizes information requirements". Because of these two reasons he concludes that the dominance of the debt contract stems form the asymmetric information problem observed in partice.

The last work I want to mention is the work from Khan (1995). He asks the question, why PLS financing isn't as popular beside the well known asymmetric information hypothesis? He answers the question when looking at the demand and supply side of PLS financing. One of the arguments for low demand is that, "banks prefer to deal with mature companies but mature companies do not need the risk spreading character implied by PLS". Another demand decreasing factor stems directly from the characteristics of PLS, Khan (1995) mentions three of these characteristics. First, "provision for the entrepreneur to re-invest his savings in the project is not clearly defined in PLS contracts". Second, "the entreprneur can't become the sole owner of the project under PLS". Third, "no provision in the PLS contract to conveniently raise additional funds". All of these characteristics should lead to lower demand for PLS contracts. On the supply side he mentions that banks are reluctant to sign PLS contracts because of "adverse selection problems and long term involvement in projects". The main reason, why PLS suf-

fers adverse selection problems, is that the bank has no opportunity to demand a collateral. But because collaterals serve as a tool to sort out bad projects in a conventional debt contract, it is concluded that PLS is vulunerable to adverse selection (Khan (1995)).
All of these works come more or less to the same results. The mechanism of profit-and loss-sharing works fine in a world of symmetric information. But as soon as the parties in a contract have different informations and/or different objectives, the risk-sharing advantage of PLS actually becomes a disadvantage. As soon as the financier has doubts about the honesty of his customers and the more costly effort he has to provide to get informations about his customers, the more he will prefer to claim a fixed return instead of a variable one. The disadvantage of PLS stems from the effort the financier has to put into screening and monitoring mechanisms which should help solve the adverse selection and moral hazard problems. As long as these mechanisms come at a non-negligible cost, the PLS mehtod of finance will always be dominated by the mark-up principle.

6 Conclusion

The Islamic financial system is an alternative to the conventional system. Its main characteristics are the prohibition of *riba*, *gharar* and *maysir*. These prohibited elements should help make the Islamic economic system more just and free of any kind of exploitation. The mentioned prohibitions stem directly form the *Quran*, which also helped formulate the *Sharia*. All Islamic financial contracts should be in accordance with the *Sharia* to make them fair. Because of these restrictions, the Islamic financial system prefers to transact in partnership contracts rather than in debt like instruments. Partnership contracts fulfil the requirements imposed by religion, law, thoughts and any other kind of restricting factors.

The drawbacks with these prohibitions come to light if we impose such an economy with asymmetric information. In particular, moral hazard problems are expected to make the utilization of parnership contracts a difficult undertaking. As we have seen, if moral hazard is a serious issue, not only banks prefer the debt way of financing projects, it is also expected to be social welfare increasing. One argument in favour of the debt contract being social welfare increasing, is that more projects could be financed in this way, rather than in pure partnership financing. Another argument is, that the debt contract could lead to more effort by the management of the project, and therefore of the overall sucess of the project. Both effects are expected to be social welfare increasing.

The Islamic financial system is a good alternative to the conventional system. The existence of partnership contracting and profit-and loss-sharing principles seems reasonable, and I personally like the idea of participating in the risks associated with an enterprise. But, to make these contracts more relevant in practice, efforts have to be undertaken to make these contracts more resistant against asymmetric information problems. Otherwise, the *murabaha* will remain the dominant Islamic financial instrument and the profit-and loss-sharing principle remains in the backgound. As of today, the Islamic financial system faces a trade-off between compliance with their religious beliefs and economic prosperity.

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Appendices

Equation (5) with $\alpha = c$ and $D_2 = 0$, α only on LHS

$$\alpha(x_1 - D_1) + \int_0^{x_2'} cx_2 f(x_2)dx_2 + \int_{x_2'}^{x^H} \alpha(x_2 - D_2)f(x_2)dx_2 \geq cx_1$$

$$\alpha(x_1 - D_1) + \alpha\int_0^{x_2'} x_2 f(x_2)dx_2 + \alpha\int_{x_2'}^{x^H} x_2 f(x_2)dx_2 \geq cx_1$$

$$\alpha(x_1 - D_1) + \alpha\int_0^{x^H} x_2 f(x_2)dx_2 \geq cx_1$$

$$\alpha(x_1 - D_1) + \alpha E(x_2) \geq cx_1$$

$$\alpha(x_1 - D_1 + E(x_2)) \geq cx_1$$

Equation (3) with $\alpha = c$ and $D_2 = 0$ and $x_1' = D_1$. There is no need to maximize over α because we already have the optimal one, and D_2 is assumed to be zero. I made the assumption, that $\int_{x_2'}^{x^H} x_2 f(x_2)dx_2 = E(x_2)$, otherwise the result can't be obtained. I used the fundamental theorem of calculus and integration by parts method.

$$\max_{\alpha,D_1,D_2} \int_0^{x_1'} L_1 f(x_1)dx_1 + \int_{x_1'}^{x^H} \left(\alpha D_1 + (1-\alpha)x_1 + \int_{x_2'}^{x^H} (\alpha D_2 + (1-\alpha)x_2)f(x_2)dx_2\right) f(x_1)dx_1$$

$$\max_{D_1 \in [0,E(x_2)]} \int_0^{D_1} L_1 f(x_1)dx_1 + \int_{D_1}^{x^H} \left(cD_1 + (1-c)x_1 + (1-c)\int_{x_2'}^{x^H} x_2 f(x_2)dx_2\right) f(x_1)dx_1$$

$$\max_{D_1 \in [0,E(x_2)]} \int_0^{D_1} L_1 f(x_1)dx_1 + \int_{D_1}^{x^H} \left(cD_1 + (1-c)x_1 + (1-c)E(x_2)\right) f(x_1)dx_1$$

$$\max_{D_1 \in [0,E(x_2)]} \int_0^{D_1} L_1 f(x_1)dx_1 + \int_{D_1}^{x^H} \left(D_1 + (1-c)(x_1 - D_1 + E(x_2))\right) f(x_1)dx_1$$

To make things easier we split the function into three parts, the **frist** of them is

$$\max_{D_1 \in [0, E(x_2)]} \int_0^{D_1} L_1 f(x_1) dx_1$$

$$\max_{D_1 \in [0, E(x_2)]} \left\{ L_1 F(x_1)|_0^{D_1} \right\}$$

$$\max_{D_1 \in [0, E(x_2)]} \left\{ L_1 F(D_1) - L_1 F(0) \right\}$$

$$\max_{D_1 \in [0, E(x_2)]} \left\{ L_1 F(D_1) - L_1 \right\}$$

$$L_1 f(D_1)$$

Restult of the first part $\rightarrow L_1 f(D_1)$

The **second part** is first derivated and is then split into the last part, because mathematics would be to complicated otherwise.

$$\max_{D_1 \in [0, E(x_2)]} \int_{D_1}^{x^H} \Big(D_1 + (1-c)(x_1 - D_1 + E(x_2)) \Big) f(x_1) dx_1$$

$$\max_{D_1 \in [0, E(x_2)]} \int_{D_1}^{x^H} \Big(cD_1 + (1-c)(x_1) + (1-c)E(x_2) \Big) f(x_1) dx_1$$

$$\max_{D_1 \in [0, E(x_2)]} \left\{ \int_{D_1}^{x^H} cD_1 f(x_1) dx_1 + \int_{D_1}^{x^H} (1-c)(x_1) f(x_1) dx_1 + \int_{D_1}^{x^H} (1-c)E(x_2) f(x_1) dx_1 \right\}$$

$$\max_{D_1 \in [0, E(x_2)]} \left\{ cD_1 F(x_1)|_{D_1}^{x^H} + (1-c) \int_{D_1}^{x^H} (x_1) f(x_1) dx_1 + (1-c)E(x_2)|_{D_1}^{x^H} \right\}$$

$$\max_{D_1 \in [0, E(x_2)]} \Bigg\{ \Big(cD_1 F(x^H) - cD_1 F(D_1) \Big)$$

$$+ \Big((1-c)E(x_2)F(x^H) - (1-c)E(x_2)F(D_1) \Big) + (1-c) \int_{D_1}^{x^H} x_1 f(x_1) dx_1 \Bigg\}$$

$$c - (cF(D_1) + cD_1 f(D_1)) - (1-c)E(x_2) f(D_1) + \max_{D_1 \in [0, E(x_2)]} \left\{ (1-c) \int_{D_1}^{x^H} x_1 f(x_1) dx_1 \right\}$$

$$c(1 - F(D_1)) + (-cD_1 - (1-c)E(x_2)) f(D_1) + \max_{D_1 \in [0, E(x_2)]} \left\{ (1-c) \int_{D_1}^{x^H} x_1 f(x_1) dx_1 \right\}$$

Restult of the second part $\rightarrow c(1 - F(D_1)) + (-cD_1 - (1-c)E(x_2)) f(D_1)$

Now we want to do the derivation of the **last part**, which is $\max_{D_1 \in [0, E(x_2)]} \Big\{ (1-c) \int_{D_1}^{x^H} x_1 f(x_1) dx_1 \Big\}$. We will use the integrations by parts method with $u'(x) = f(x_1)$ and $u(x) = F(x_1)$ and $v(x) = x_1$ and $v'(x) = 1$.

$$\max_{D_1 \in [0, E(x_2)]} \Big\{ (1-c) \int_{D_1}^{x^H} x_1 f(x_1) dx_1 \Big\}$$

$$\max_{D_1 \in [0, E(x_2)]} \Big\{ (1-c) \Big((F(x_1) * x_1 - \int F(x_1) * 1 \Big) \Big|_{D_1}^{x^H} \Big\}$$

$$\max_{D_1 \in [0, E(x_2)]} \Big\{ (1-c) \Big((F(x_1) * x_1 - F^{(2)}(x_1) \Big) \Big|_{D_1}^{x^H} \Big\}$$

$$\max_{D_1 \in [0, E(x_2)]} (1-c) \Big\{ F(x^H) x^H - F(D_1) D_1 - F^{(2)}(x^H) + F^{(2)}(D_1) \Big\}$$

$$(1-c) \Big(- f(D_1) D_1 - F(D_1) + F(D_1) \Big)$$

$$(1-c) \Big(- f(D_1) D_1 \Big)$$

$$c f(D_1) D_1 - f(D_1) D_1$$

Restult of the third part $\rightarrow c f(D_1) D_1 - f(D_1) D_1$

The last step is to **sum up all three parts**, which results in the first order condition of the banks optimization problem $\frac{\partial E(\pi_B)}{\partial D_1}$:

$$\frac{\partial E(\pi_B)}{\partial D_1} = L_1 f(D_1) + c(1 - F(D_1)) + (-cD_1 - (1-c)E(x_2)) f(D_1) + c f(D_1) D_1 - f(D_1) D_1$$

$$\frac{\partial E(\pi_B)}{\partial D_1} = (L_1 - D_1 - (1-c)E(x_2)) f(D_1) + c(1 - F(D_1))$$

Derivation of **Equation (22)** with $F(x^H) = 1$:

$$\int_0^{D_1^*} cx_1 f(x_1)dx_1 + \int_{D_1^*}^{x^H} c(x_1 - D_1^* + E(x_2))f(x_1)dx_1$$

$$c\int_0^{D_1^*} x_1 f(x_1)dx_1 + c\int_{D_1^*}^{x^H} x_1 f(x_1)dx_1 + c\int_{D_1^*}^{x^H} (E(x_2) - D_1^*)f(x_1)dx_1$$

$$c\int_0^{x^H} x_1 f(x_1)dx_1 + c\left\{ (E(x_2) - D_1^*)F(x_1)|_{D_1^*}^{x^H} \right\}$$

$$cE(x_1) + c\left\{ F(x^H)(E(x_2) - D_1^*) - F(D_1^*)(E(x_2) - D_1^*) \right\}$$

$$cE(x_1) + c(1 - F(D_1^*))(E(x_2) - D_1^*)$$

Plagiatserklärung

Ich bezeuge mit meiner Unterschrift, dass meine Angaben über die bei der Abfassung meiner Arbeit benutzten Hilfsmittel sowie über die mir zuteil gewordene Hilfe in jeder Hinsicht der Wahrheit entsprechen und vollständig sind.
Ich habe das Merkblatt zu Plagiat und Betrug vom 22. Februar 2011 gelesen und bin mir der Konsequenzen eines solchen Handelns bewusst.

Ort, Datum	Unterschrift