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Interest Versus Profit-Loss Sharing Credit Contract: Effciency and Welfare Implications

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Abstract

In this paper we attempt to answer a fundamental question of whether a profit-loss sharing (PLS) based banking system can be welfare improving than an interest based banking system by developing a rigorous theoretical modelling. In the framework of production technology we firstly show that under production certainty and competitive market both PLS and interest based systems are efficient and just. However, under an uncertain situation due to a productivity shock, we prove that only the PLS system is just, since it fairly distributes the risk at individual level amongst lender and borrower. We verify our result by quantifying the effects on income distribution for both lender and borrower. Two indicators, namely the standard error of distribution and Gini ratio are considered. We also propose a mechanism that will improve the performance of a PLS system from capital owners perspective by introducing a so-called risk pooling bank. We prove that such a bank absorbs all the risk encountered by the capital owners and thus maintains their income distribution, and at the same time reduces the risk faced by borrowers.

Keywords: Profit-loss sharing, Islamic banking, income distribution, risk pooling agent.
JEL Classification Codes: G28, P43, P51

1. Introduction

The banking system of the world is dominated by interest based credit contract system. That is, banks typically charge their debtors a certain level of interest rate above the principal and then redistribute the proceed to depositors. Some part of the proceed is of course retained within the banks as compensation for intermediary services. Under such a system, banks typically serve as liquidity pool, risk pool, and intermediary agent. As financial intermediary banks can also improve the efficiency of allocation of scare resource namely capital, from fund surplus parties to fund deficit parties. However, this system is relatively new and modern invention. Under agrarian economy, credit contract is traditionally carried out through a profit-loss sharing system (PLS). This arrangement can still be found in rural area in many part of the world until now (Crane & Leatham, 1993). For instance, in Indonesia a peasant can borrow money to local money lender which will be repaid in the harvesting season and the amount paid will depend on the farm yield. The system is then brought into a modern banking system by the so-called Islamic banking system. PLS is though as a credit system that complies with the teaching of Islam. However, one should note that this is not a system that is exclusively Islamic. As pointed before, we can find various form of PLS system all over the world regardless the country is Islamic or not.

Islamic banking is now an emerging industry. More than fifty countries worldwide have formally adopted this system, notably the Gulf Cooperation Council (GCC) countries, Pakistan, Malaysia and Indonesia. Moreover, some multinational banks like Citibank and HSBC have already developed Islamic division or units. Rapid development of the industry is greatly visible in many Muslim countries. Islamic-compliant assets worldwide total close to an estimated USD500 billion and have been growing at more than 10% per year over the past 10 years. Islamic banks market shares are currently 12% in Malaysia and 17% in the six GCC countries (Standard & Poor's, 2008). In Indonesia, the share of Islamic banks in credit market is currently 3% while the share of their assets is 2.3% (Bank Indonesia, 2009).

This relatively sharp development poses a fundamental question of whether the Islamic banking system can be welfare improving as compared to the more conventional banking system. If so, in what area the improvement is offered? This is in fact the subject of this paper. Most of the scholars of Islamic economics claim that Islamic banking is more just financial system, see e.g., (Chapra, 1985). Specifically (Algaoud & Lewis, 2007) provide critiques to conventional financial practices from the Islamic system point of view. However these claims are generally not accompanied by rigorous theoretical modeling, except that (Hasan, 1985) analytically shows that PLS financing is more profitable to financiers in the long run than interest financing and (Haque & Mirakhor, 1986) formulates investment behavior in a profit-sharing system as a principal-agent problem and investigates the relevant issues under conditions of uncertainty and moral hazard. The later paper proves that the assertion of investment decline cannot be justified and that, under certain conditions, a profit-sharing system may lead to an increase in investment.

Even though the superiorities of PLS scheme are revealed, some drawbacks have been reported. As in (Dar & Presley, 2000), PLS features marginally in the practice of Islamic banking and finance, i.e., less than 20% worldwide, meanwhile the Islamic Development Bank (IDB) has so far not used PLS in its financial business except in a few small projects. Recently (Chong & Liu, 2009) reports that a large majority of Islamic bank financing in Malaysia is still based on interest mechanism. They suspect that the rapid growth in Islamic banking is largely driven by the Islamic resurgence worldwide rather than by the advantages of the PLS paradigm.

We are in the spirit of PLS system reinforcement. Our paper is intended to provide a mathematical proof on the justness of PLS mechanism as a monetary system in a sense of fairly sharing the risk between lender and borrower under an uncertain circumstance. We further extent the effect of the PLS-based credit contract on welfare adjustment and propose a risk pooling agent mechanism for improving the performance of PLS system in supporting capital owners' appeal.

2. Production Technology

Consider a one shot game situation. In the beginning of the period all economic agents make decision and the result of that decision is perfectly verifiable at the end of the period. There is no asymmetric information problem involved here. We are fully aware that this problem is very prevalent in the credit market. However, it is not the problem we want to address and solve in this paper. The economy consists of two groups: capitalist (who owns capital goods and does no work) and entrepreneur who owns labor and runs a firm. Each group has a relatively large population. Every firm needs capital goods which is borrowed from the capitalist. This goods is non exhaustible and will be returned in perfect condition after being used by the entrepreneur. In other words there is no need to depreciate the value of the capital goods. Of course the firm has to pay a certain rental cost for that goods (capital rent). Because we want to discuss about a credit market, from herein the capital goods is just called as capital.

It is also assumed that both groups are risk neutral agent. We are fully aware that risk aversion would be more appropriate assumption. However, as will be clear later, it is not the issue we want to address currently. Risk neutrality is used to make everything simpler in modeling as well as numerical solution. One can easily relax this assumption without great difficulty if he or she wishes to analyze the implication of risk aversion. In addition, it is assumed that both capital and labor are indivisible. This assumption is needed to limit the solution of the model into just two possibilities: the capital and labor are employed in the production or both are not used. This seems to be unrealistic in mimicking the credit market where capital is divisible almost perfectly (portfolio issue). Likewise, one unit of labor can be divisible in a way that laborer adjust its effort or man-hour according to incentive they face (incentive issue). However, portfolio and incentive issues are not the case we want to discuss here. Moreover, even if they are divisible the qualitative conclusion of the simulation result remains the same with the expense that we should spent more energy to deal with a more complicated simulation. Therefore, there is no need to go into such complication.

The production function adopted is a constant return to scale technology. On each firm, output Y is a function of capital K and labor L such that

$$Y = F(K, L). \tag{1}$$

Because F is homogeneous of degree one, i.e., $F(cK, cL) = cF(K,L)$ for a constant c, we can restate (1) as

$$\frac{Y}{L} = F\left(\frac{K}{L}, 1\right). \tag{2}$$

Alternatively,

$$y = f(k) \tag{3}$$

where $y := Y/L$ and $k := K/L$. We assume, moreover, f is an increasing concave function of k, i.e.,

$$f' > 0, \quad f'' > 0.$$

Note that the marginal product of capital (MPK) and its marginal value (MVPK) are, respectively, given by

$$\text{MPK} = f',$$

$$\text{MVPK} = \pi\text{MPK}, \tag{4}$$

where π is the price of output y. In order to make things simpler, we normalize the price of y to unity, i.e., $\pi = 1$. The profit gained by the entrepreneur is simply $y - rk = f - rk$, where in the conventional credit market the price of capital is called interest rate r. Profit maximization leads to MPK $- r = 0$, which means that in a purely competitive market, marginal product of capital should be equal to the price of capital, i.e.,

$$r = \text{MPK}. \tag{5}$$

In other words, efficiency in this credit market occurs if and only if interest rate equal to marginal product of capital. As long as this market is efficient then it is just.

How about the credit market under PLS arrangement? To be efficient and just, the price of capital under this system p must be equal to its marginal product:

$$p = \text{MPK}. \tag{6}$$

This can be satisfied as long as the PLS system operates under competitive market. But, the problem is the price of capital is not quoted as explicitly as interest rate. It is implicitly quoted as a share of profit. Under our production function, the total amount of profit given to creditor is equal to the share times production or αy, where α is the share.

Suppose that there is an optimum share α^* that can warrant efficiency condition. The amount paid to creditor must equal to the price of capital times the capital borrowed, such that

$$\alpha^* y = pk.$$

Because y/k is the average product of capital (APK), it must be true that

$$\alpha^* = \frac{\text{MPK}}{\text{APK}}. \tag{7}$$

In other words, the efficiency in the PLS system can hold if and only if the share is equal to marginal product divided by average product. If the share is above this optimal level then the capital is said to be overpriced. If it is below, then the capital is underpriced. In comparison to Hasan (1985), he states that, in a system where interest and PLS mechanisms co-exist, the optimal ratio of PLS scheme is primarily determined as a function of the overall rate of profit on investment, the prevailing rate of interest, the degree of leverage, and the risk premium estimates. More precisely, the optimal ratio of Hasan (1985) is given by $\alpha^* = \lambda(r + a)/b$, where λ is the financial leverage, i.e., the ratio of financier's contribution to total capital, r is rate of interest, a is risk premium fraction, and b rate of profit on total investment.

So far we have proven that, it is possible to find an optimal level of PLS arrangement. This only requires that the price of capital is equal to its marginal product. In other words, if PLS system operates under competitive market then efficiency is warranted. Thus the system is just.

There is an important implication from the above explanation: under production certainty and competitive market the PLS as well as interest based credit market will end up with the same price of capital. Either the price is quoted explicitly as interest rate or quoted implicitly as the share does not matter. Thus both system is effcient and just. However, the real word is far from certain. In the following sections we will prove that PLS will yield different results compared to the conventional system.

3. Production under Uncertainty

Suppose we define productivity shock μ to be uncertain and it affects the production function in a way such that

$$Y = g(\theta)F(K, L). \tag{8}$$

This has a strong implication that "risk" is independent of labor and capital. It affects directly production function, and not via input. However, we may assume that it affects each firm differently. Alternatively, its effect on each firm is assumed to be a random process. Shock to each firm is not correlated.

As with (2), we can restate (8) as

$$y = g(\theta) f(k), \tag{9}$$

where the mean and the variance of $g(\theta)$ are given by

$$E[g(\theta)] = \mu,$$
$$\text{var}[g(\theta)] = E[g(\theta) - \mu] = \sigma^2. \tag{10}$$

The marginal product of capital is provided by

$$\text{MPK} = g(\theta) f'(k). \tag{11}$$

Without lost of generality we may assume that $\mu = 1$. Since the shock to each firm may be different, the marginal product of each firm may also be different. The shock is assumed to be observable by both lender and borrower and thus the result is verifiable perfectly by both sides. However, the shock is unknown ex-ante. Only the mean and variance that are known *ex-ante* and the same across all firms. Furthermore, we need to assume that both lender and borrower are risk neutral in a way that only the expected result that affects their decision making. Our purpose is not in assessing the effect of risk preference on decision making and market equilibrium. Risk neutrality is naturally the most straightforward in terms of mathematical solution.

Firstly, we shall attempt to solve the market equilibrium for interest based credit market. Under competitive market, the interest rate should be equal to expected marginal product of capital. Thus, the price of capital is the average marginal product:

$$r = E[\text{MPK}] = \overline{\text{MPK}}. \tag{12}$$

This level of interest rate should be paid by all firms irrespective whether the shock affect positively or negatively. For those suffering an adverse shock, the market interest rate is above the marginal product. Hence the capital is being over priced. For those enjoying positive shock, the capital is under priced.

To see this problem, we may discuss three cases as follows: (i) neutral shock where $g(\theta) = 1$, (ii) adverse shock where $g(\theta) < 1$, and (iii) positive shock where $g(\theta) > 1$. A positive shock, by definition, will increase the level of production for a certain level of input. Conversely, the adverse shock tends to reduce production.

1) In the case that an idiosyncratic shock is neutral, the marginal product of capital remains unaffected. It should equal to the expected marginal product, i.e.,

$$r = E[\text{MPK} \mid g(\theta) = 1] = \overline{\text{MPK}} = r.$$

In other words, the marginal product of capital is exactly equal to the market interest rate and therefore it is efficient. Under this circumstance, the marginal cost of borrowing is exactly equal to the marginal value product of capital. The price is right.

2) However, in the case of an adverse idiosyncratic shock, the expected marginal product of capital becomes smaller than the average marginal product and hence less than the prevailing market interest rate. The marginal value product of borrowed capital is therefore less than its marginal cost. For borrowers experiencing adverse shocks, the cost of borrowing is simply too expensive:

$$r = E[\text{MPK} \mid g(\theta) < 1] < \overline{\text{MPK}} = r.$$

3) Conversely, for a borrower having a favorable shock, the expected marginal value product of borrowed capital is higher than the market interest rate. Therefore, the price of capital is too cheap:

$$r = E[\text{MPK} \mid g(\theta) > 1] > \overline{\text{MPK}} = r.$$

Based on the above discussion, an interest rate based credit contract is only efficient and just if and only if the shock does not affect the marginal product of capital. It cannot be efficient and just if the shock is either adverse or favorable for the borrower. It is not just for the borrowers when they have to pay a market interest rate that is higher than the marginal value product of borrowed capital. It becomes not fair for the lenders in the case of favorable shock, as they cannot exploit the excess marginal value product enjoyed by the borrower.

To assess this more clearly, we conduct a numerical simulation in the next section. Qualitatively it should be clear that all lenders have the same income that is rk. This level of income is equivalent to the case of production without uncertainty. In other words, the lenders do not bear any risk. By definition the net income for the borrowers should be $y - rk$. Because the level of y depends greatly on $g(\theta)$, the net income to the borrower will vary according to σ^2. In other words, it is the borrower who bears all the risk.

In summary, it is clear that an interest based credit market can only provide efficiency on average or market level. In terms of individual borrower and creditor, market efficiency cannot be warranted. The problem is that the risk is not being equally shared between borrower and lender. The situation becomes significantly different if the credit contract is arranged under a PLS system. Under such a system, the risk is distributed equally amongst borrower and lender. This can be explained as follows. We start by deriving a just PLS regime. By taking uncertainty into account, an efficient PLS regime can exist if and only if

$$\alpha^* y = pk,$$

which leads to

$$\alpha^* = \frac{\overline{\text{MPK}}}{\overline{\overline{\text{APK}}}}. \tag{13}$$

That is the share given to lenders must equal to the average marginal product divided by the average of average product. Note that:

$$\overline{\text{MPK}} = E[\text{MPK}], \quad \overline{\text{APK}} = E[\text{APK}],$$

where the expected marginal product and expected average product is the same for every borrower. What is different is the actual MPK and APK, not the expected one. Thus the optimal share α^* is the same for every firm. In other words, α^* is a common or market driven share.

In order to prove α^* is the optimal share for everybody, we need to show that it is independent of the shocks, i.e., regardless of whether the shock is neutral, adverse, or favorable, α^* is constant as defined in (13). Let us see the proof.

Suppose that α_j^* is the optimal share that is applied to borrower *j*. If $\alpha_j^* = \alpha^*$ for all *j*, then α^* is common for every firm. By definition, it is true that

$$\alpha_j^* = \frac{\text{MPK}_j}{\text{APK}_j}. \tag{14}$$

That is the optimum level of profit and loss sharing applied specifically to firm *j*. However, equation (14) can be restated as

$$\alpha_j^* = \frac{g(\theta_j) f'(k)}{g(\theta_j) f(k)/k} = \frac{f'(k)}{f(k)/k} = \frac{\overline{\text{MPK}}}{\overline{\overline{\text{APK}}}} = \alpha^*. \tag{15}$$

Thus the optimal share is the same for every j. In other words, α^* is a common PLS scheme. However, one must see clearly from (15) the price of borrowed capital is not the same for every firm. The capital is specifically priced according to the actual shock faced by borrower, that is

$$p_j = \text{MPK}_j = g(\theta_j) f'(k). \tag{16}$$

For firms facing a neutral shock the price is

$$p_j = E[\text{MPK}_j] = f'(k) = \overline{\text{MPK}}. \tag{17}$$

This means that the price of capital is equal to that of in the interest based credit arrangement. Only in this case that both systems yield the same level of price of capital. For the case of an adverse shock we have

$$p_j = g(\theta_j) f'(k) < \overline{\text{MPK}}. \tag{18}$$

In other words the price is less than average price. It is also easy to see that in the case of a favorable shock, the price of capital become higher. Thus, the price of capital is correlated with the shock. The risk is shared between the borrower and lender. This in fact the main difference between PLS and the conventional credit market. Because the risk is shared, efficiency is always warranted both at individual level and aggregate level. Since, the marginal cost of capital is always equal to marginal value product, this pricing is efficient and just. At the aggregate level, the average price must equal to average marginal product and therefore it is also efficient at the aggregate level. Note that, the conventional credit market can only warrant efficiency at the aggregate level, and not at the individual level.

4. Effects on Income Distribution

The discussion in the previous section has an important implication on income distribution for both lender and borrower. The conventional system is typically favorable for lenders as they do not bear the risk. It is therefore imperative to see that this system has an adverse effect on income distribution amongst the borrower. Those facing adverse shocks should bear all the misfortune, and those facing favorable shock will enjoy all the windfall. In contras, the PLS system provide a basis for risk sharing. However, as a consequence the income distribution amongst lenders is adversely affected.

To facilitate the above mentioned conjecture, we shall resort the analysis to a numerical simulation. First, we adopt a CRS Cobb-Douglas production technology such that

$$Y = \theta K^{\alpha} L^{1-\alpha}. \tag{19}$$

As usual α is marginal product of capital as well as the share of return to capital owner. As will be clear, this particular property make it easy to compare directly PLS and conventional credit contract. We normalize both labor owned by borrower and capital owned by lender to one for the ease of calculation. We also assume that $E[\theta] = 1$ and $\mathrm{var}[\theta] = \sigma^2 = 0.57^2$. Moreover, we set $\alpha = 0.2$ for convenience. One can set any number as long as $\alpha < 1$.

In the case of conventional credit system, the total payment to capital owner is calculated as rk and therefore the return to labor owner should be $y - rk$. In the PLS regime, the return to capital owner is simply the optimal share.

To assess income distribution, we use two indicators: the standard error of the distribution and the Gini ratio. The less evenly distributed, the higher the standard error and Gini ratio. We assume that the population of lender and borrower are the same and large enough. For the purpose of simulation the population is set to ten thousands. This also means that there are ten thousands idiosyncratic uncorrelated shocks. The result of the simulation is summarized in Table 1.

Table 1: Income distribution

	Average	Std. Dev.	Gini
Production without uncertainty			
Interest based credit			
Income to labor owner	0.8	0	0
Income to capital owner	0.2	0	0
PLS based credit			
Income to labor owner	0.8	0	0
Income to capital owner	0.2	0	0
Production with uncertainty			
Interest based credit			
Income to labor owner	0.8	0.57	0.41
Income to capital owner	0.2	0	0
PLS based credit			
Income to labor owner	0.8	0.46	0.33
Income to capital owner	0.2	0.11	0.33

As expected, under production without uncertainty PLS is as efficient as interest based credit market. The table indicates that both systems offer the same income stream to both labor and capital owners. The income to labor owner is 0.8 per unit of labor. The income to capital owner is 0.2 per unit of capital. In other words, the prices of labor and capital are equal to their marginal value product. Moreover, there is no problem of income distribution as all economic agents have the same income, depending only whether they are labor or capital owners. A different situation appears when we introduce uncertainty on the production function. Both systems offer the same level average income only. However there are some contrasts that should be taken into account.

Under the conventional credit market, creditors enjoy no variability in income as indicated by zero Gini ratio and standard deviation. Creditors simply do not bear any risk in the production. In contrast, labor owner bears all the risk of production as the standard error of their income equal to the standard error of the productivity shock (0.57). This is also indicated by a high Gini ratio (0.41) suggesting a quite high income disparities. Therefore, the conventional system leads to a serious income distribution problem on the part of labor owners. This system is socially less desirable from the borrowers' point of view.

Under a PLS system, the average incomes are just the same as in the conventional system. The main difference is in the income distribution. The risks are shared between labor owners and capital owners. Income variation amongst creditors is equal to the share times the standard deviation of productivity shock ($\alpha\sigma$). The standard error of income to the labor owners is simply $(1 - \alpha)\sigma$ which should be less than σ. Thus this system reduces the risk faced by borrowers but at the same time increases the risk faced by creditors. Thus this system is favorable for debtors but not for creditors.

The question is what happens if the two system compete in the same credit market. Note that most of Islamic countries adopt the so called dual system where conventional system compete head to head with the PLS system. While the PLS system is favorable for debtors, it is not preferable by capital owners. If we assume that capital owners are risk averse, they would certainly put more preference for the conventional system.

In the following section we will argue that the answer to that question lies on the intermediated credit market via banks. Under such a system, capital owners can bear no risk but at the same time the borrowers can reduce the risk. We shall discus this line of argument very shortly.

5. Islamic Bank as a Risk Pooling Agent

In the previous section, it is suggested although borrowers may prefer the PLS credit system, risk averse creditors will prefer the conventional one. Unless both sides are risk neutral, the two system are indifferent. The question is there any mechanism that will improve the performance of a PLS system so that it becomes more attractive to capital owner? Yes indeed, provided that there is an Islamic bank that acts as a risk pooling agent which absorbs all the risk faced by capital owner. Here is the proof.

Suppose that there is an Islamic bank that is large enough, say that can serve ten thousand borrowers and depositors. This bank offers a PLS system to the borrowers as well as depositors. Moreover, the bank does not incur any cost so that all the income collected from borrowers is distributed to depositors (capital owners). Of course one can easily relax this assumption by introducing a certain share of income that is retained within the bank. But this is very trivial and will not affect the general conclusion.

Suppose there are n depositors and each put K units of capital in the bank, and therefore the total loanable fund is nK. This fund is allocated evenly to n borrowers. The production function is as in (9). Moreover, the optimal profit and loss sharing α^* is satisfied. Hence, the banks total income $E[B]$ should be

$$\begin{aligned} E[B] &= E\left[\sum_{j=1}^{n} \alpha^* g(\theta_j) f(k)\right] \\ &= \alpha^* \sum_{j=1}^{n} E[g(\theta_j) f(k)] \\ &= n\alpha^* E[y]. \end{aligned} \tag{20}$$

Note that on average, the income extracted per borrower is $\alpha^* E[y]$. However, each borrower pays different amount that is $\alpha^* y_j$ for borrower j. Thus, the variance of the payment should be $\alpha^{*2}\sigma^2$. The income retained by borrower j is thus $(1 - \alpha^*)\, y_j$ and the variance of borrowers income is $(1 - \alpha^*)^2\sigma^2$ which is less than σ^2. In other words, the PLS scheme can reduce the risk faced by borrower.

However the risk is not transmitted to depositors as the bank has a risk pooling mechanism. As long as n is large enough, it can always be warranted that $E[g(\theta)] = 1$ so that the total income to the bank is

$$E[B] = n\alpha * f(k). \tag{21}$$

It is clear that the risk factor $g(\theta)$ disappears from (21). It is exactly the risk pooling mechanism in the sense that adverse and favorable shocks cancel-out. In essence, the bank faces no risk at all. This "risk-free" income is then distributed equally to depositors. Statistically speaking, depositors face no risk. Considering this, the existence of an Islamic bank can improve income distribution on the part of capital owners. At the same time, it also reduces the risk faced by borrowers. This is clear from numerical simulation presented in Table 2 and we may compare it with Table 1. The average income of capital owner is still the same, but with zero variance. The income is evenly distributed. This is in fact one of the advantage of intermediated Islamic credit market. Now, what if the bank is operating under the conventional system? It will not improve income distribution on the both side. The income among borrowers has a variance of σ^2, that of depositors is zero. It can be said that Islamic bank is superior in terms of income distribution relative to the conventional one.

Table 2: Income distribution in the presence of risk pooling bank

	Average	Std. Dev.	Gini
Production with uncertainty			
Interest based credit			
Income to labor owner	0.8	0.57	0.41
Income to capital owner	0.2	0	0
PLS based credit			
Income to labor owner	0.8	0.46	0.33
Income to capital owner	0.2	0	0

6. Conclusion

We have argued that under production certainty and competitive market assumption, PLS-based as well as interest-based credit markets are efficient and just provided that the price of capital is the same as its marginal product. In uncertain circumstance, we have shown that the interest-based credit contract is only efficient and just for neutral shock. It is not just for borrowers experiencing adverse shocks, and it becomes unfair for lenders in the case of favorable shocks. Generally speaking, an interest-based credit market can only provide efficiency at aggregate level. Conversely, we have proven that in PLS-based credit market the risk is shared between lender and borrower. Hence, efficiency is always warranted both at individual and aggregate levels.

Our simulation on income distribution shows that in conventional credit market, lenders enjoy no variability of income and do not bear any risk. In this case, there is a quite high income disparity. While in the PLS system, income variation is distributed, income disparity is reduced, and risk is shared.

We have also proposed a mechanism that will improve the performance of a PLS system such that it becomes more attractive to capital owners by introducing a so-called risk pooling bank. We analytically prove that such a bank absorbs all the risk challenged by the capital owners.

References

[1] L.M. Algaoud and M.K. Lewis. (2007). 'Islamic critique of conventional financing', in M.K. Hassan and M.K. Lewis (eds.), *Handbook of Islamic Banking*. Northampton: Edward Elgar.

[2] Bank Indonesia. (2009). Indonesia Banking Statistics, July 2009.

[3] M.U. Chapra (1985), *Towards a Just Monetary System*. Leicester: The Islamic Foundation.

[4] B.S. Chong and M.-H. Liu. (2009). "Islamic Banking: Interest-Free or Interest-Based?" *Pacific-Basin Finance Journal*, 17:1, 125-144.

[5] L.M. Crane and D.L. Leatham. (1993). "Profit and Loss Sharing in Agriculture: An Application of Islamic Banking." *Agribusiness* vol. 9, no. 4, pp. 403–412.

[6] H.A. Dar and J.R. Presley. (2001). "Lack of Profit Loss Sharing in Islamic Banking: Management and Control Imbalances." *Economic Research Paper* No. 00/24, Loughborough University.

[7] H. van Greuning and Z. Iqbal. (2008). *Risk Analysis for Islamic Banks*. Washington: The International Bank for Reconstruction and Development / The World Bank.

[8] N.U. Haque and A. Mirakhor. (1986). "Optimal profit sharing contracts and investment in an interest-free islamic economy." *IMF Working Paper*, WP/86/12.

[9] Z. Hasan. (1985). "Determination of Profit and Loss Sharing Ratios in Interest-Free Business Finance", *Journal of Research in Islamic Economics*, 1:3, 13-29

[10] M.K. Hasan and M.K. Lewis. (2007). *Handbook of Islamic Banking*. Northampton: Edward Elgar.

[11] M. Iqbal and D.T. Llewellyn. (2002). Islamic Banking and Finance: New Perspectives on Profit-Sharing and Risk. Northampton: Edward Elgar.

[12] Standard & Poor's. (2008). *Islamic Finance Outlook 2008*.

[13] A. Thomas. (2006). *Interest in Islamic Economic*. New York: Routledge.

[14] H. Visser. (2009). *Islamic Finance: Principles and Practice*. Northampton: Edward Elgar.

[15] I. Warde. (2000). *Islamic Finance in the Global Economy*. Edinburgh: Edinburgh University Press.