ISLAMIC DEVELOPMENT BANK
ISLAMIC RESEARCH AND TRAINING INSTITUTE

PROFIT-LOSS SHARING MODEL FOR EXTERNAL FINANCING

1415H(1994)
JEDDAH, SAUDI ARABIA

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BOUALEM BENDJILALI

Research Division

Research Paper — No. 26

Research Paper - No. 26

Edition
1415H (1994)

Published by :

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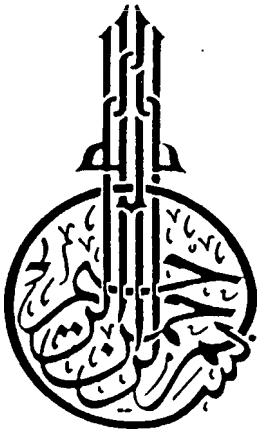

In the name of Allah, the Most Merciful, Most Beneficent

CONTENTS

FOREWORD

The objectives of the Islamic Research and Training Institute (IRTI) established by the Islamic Development Bank (IDB) in the year 1401H/1981 is to undertake internally as well as externally theoretical and applied research with a view to developing methods and models for the application of the Islamic *Shari'ah* in the fields of economics, finance and banking.

Although many studies have been undertaken in the area of profit-loss sharing of financing, little attention has been given to the development of profit-loss sharing models for an open economy. This study on "Profit-Loss Sharing Model for external financing" builds and analyses a basic model for a small open-economy with external financing in an environment of uncertainty, conform to *Shari'ah.* The model relates foreign capital resources and domestic investment opportunities through the *Mudarabah* Islamic mode of financing. The study explicity derives the optimal levels of the foreign country's expected profit-sharing ratio and the optimal level of capital investment for the two situations, the situation of possible diversion of funds coupled with the existence of political risk and the situation of possible diversion of funds with no political default. The model is used by both partners as a guide in their negotiation process to reach the equilibrium. In each case, the effect of a change in the foreign capital contribution on the expected profit-sharing ratio and the optimal level of the amount of capital invested in the project is analyzed.

It is hoped that the publication of this paper will be useful not only to those who are actively involved in research and teaching Islamic economics, banking and finance but also for the policy makers in the Muslim countries.

Prof. Dr. Abdel Hamid El-Ghazali
Director, IRTI

I
INTRODUCTION

INTRODUCTION

Muslim countries have a growing need for external funds. The difference between domestic savings and investment requirements is rising in most Muslim countries. In order to bridge this gap, these countries have adopted a policy of external borrowing which, in consequence, has made them dependent on external resources. During the last decade, the size of the external debt of Muslim countries increased tremendously: US$ 62 billion in 1975, US$ 180 billion in 1983 and US$ 295 billion in 1988. Debt payments have become an important issue. The yearly interest payments of Muslim countries was US$ 1 billion in 1975, US$ 6.5 billion in 1983 and US$ 42 billion in 1988. This amounts to an increase of 646 percent from 1983 to 1988. These facts show the alarming proportions that this debt has reached. In addition, they indicate the degree of economic dependency to which Muslim countries have been driven, in spite of their vast resources. Scarcity of capital and liquidity, coupled with the reimbursement of this heavy debt, constitute the major impediments to the economic development of the Muslim *Ummah.*

Existing systems of external capital mobilization, which take the form of loans, direct investments, etc., supplement domestic savings at the cost of foreign economic and political dominance. Moreover, the use of mobilized external funds via interest-based modes, in most, if not in all cases, turns out to be a burden on the taxpayers or an additional cost of production. Since the capitalist system is based on interest and since the main feature of the Islamic financial system is the prohibition of interest, it is difficult for noninterest modes to be accepted in an interest-based environment. The modes advanced by international financial institutions, such as, the IMF, the World Bank, etc., cannot be of any help in an Islamic economic setting. Islam, however, has encouraged trade from which Islamic law has developed specific forms of financial modes. The most important of these modes are *Mudarabah, Musharaka, Murabaha* and *Bai-Salam,* which constitute the principal means of earning profits without resorting to interest. Most of these modes present not only a vehicle for lending and borrowing, but also the means of participation in all investment activities on a profit-sharing basis.

Several Muslim academicians have made attempts to explain the Islamic alternatives to the conventional modes of financing. In particular,

emphasis has been placed on profit- loss sharing models of financing (P.L.S.). These models have been widely discussed in the current literature on Islamic economics from the theoretical point of view. However, to our knowledge, the development of profit-loss sharing models for an open economy has been marginalized, if not completely ignored. Hence, some important questions emerge. The first question that comes in mind is: Is it possible to convince a non-Muslim financier to invest in a joint venture in a Muslim country? The answer to this question depends on three factors:

i) The foreign financier will go along with this type of investment only if the expected return from these investments is at least greater than the return from investing the same amount in the international capital market.

ii) The possibility of diverting part of the funds allocated to the project to the *Murabaha* market.

iii) The presence of political risk, viz., risk of expropriation or nationalization which is mainly due to the political instability of the Muslim country.

The political risk is handled by including in the contract a clause stipulating that the foreign country has the right to seize a fraction of the Muslim (domestic) country's traded good in case of political default. If, for example, the, domestic country nationalizes the joint project, it will face difficulties in conducting its foreign trade. On the other hand, it is understood by both parties that there is a possibility of transferring part of the funds allocated to the project to the *Murabaha* market in emergency cases. When this happens, the diverted funds are distributed among the two countries according to their capital contributions.

The objective of this paper is to construct a basic model for a small open-economy with external financing in an environment of uncertainty. The model discusses a situation in which a Muslim country is in urgent need of foreign resources to finance a vital social development project. The foreign financier is taken to be a non-Muslim institution or country. The model relates foreign capital resources and domestic investment opportunities through the *Mudarabah* Islamic mode of financing. The research focuses on the derivation of the necessary optimality conditions that permits the existence of a solution under the different possible cases. In other words, the study spells out the conditions under which the foreign partner chooses to invest in the project instead of investing in the international capital market. More. precisely, the research aims at deriving the optimal

values of the quantity of capital needed in the project as well as the optimal profit-sharing ratios for each of the partners for the different possible situations. The model is used by both countries as a guide in their negotiations to reach equilibrium. In addition, one of the contributions of this study is its rigorous treatment of the problem.

The paper is organized as follows. Section Two presents the model's mathematical formulation, notations, assumptions and objectives. Section • Three focuses on the derivation of the necessary optimality conditions for the different possible cases, and Section Four concludes with some recommendations and possible extensions.

II

FORMULATION OF THE MODEL

FORMULATION OF THE MODEL

1. NOTATIONS :

D : good produced domestically by the Muslim country.

F : good imported by the Muslim country.

W1 :resources of the Muslim country at the beginning of period 2,in units of D.

B :external resources made available to the Muslim country by a foreign financier at the beginning of period 1, in units of D.

K : capital invested in the project at the beginning of period 1, in units of D.

i : rate of mark-up on *Murabaha* transactions in the international market.

r : rate of interest in the international market.

π : production function.

p : probability that the production takes a positive value $\pi(K)$.

C^D : consumption of good D in period 2.

C^F : consumption of good F in period 2.

C : total consumption in period 2.

δ : ratio at which good D is traded in exchange of good F.

γ : fraction of output D exported by the Muslim country to import good F.

β : rebate on export price in retaliation to the default of the Muslim country.

λ : financier's profit share from the project.

x : dummy variable $x = 1$ if the Muslim country defaults
$x = 0$ otherwise

dummy variable $\bar{x} = 1$ when $K < W_1 + B$
$\bar{x} = 0$ when $K = W_1 + B$

R : max (i, r)

$r' = 1 + R$
$i^* = 1 + i$

We shall consider in this model a foreign financier and a small open-economy of a Muslim country which is in need of foreign financial resources for its development. By small open-economy, we mean that the Muslim country will not be able to affect the world prices of traded goods. For this, we make the following assumptions.

2. ASSUMPTIONS :

a. The Muslim country is risk neutral, has a life span of two *periods, has only one project which produces one good (D) and imports a good (F) by trading part of. its domestically produced good.

b. For the sake of simplicity of exposition, the utility of the Muslim country is represented by

$$U(C) = C_D + C_F \quad \text{..........................} (1)$$

c. The production function of the project is twice differentiable and takes

$$y = \begin{cases} \pi(K) > 0 & \text{with probability } p \\ 0 & \text{" } 1-p \end{cases} \quad \text{..........} (2)$$

with $\pi'(K) > 0$ and $\pi''(K) \leqslant 0$

that is, the production function it (K) is stochastic and, is an increasing function of K with a decreasing rate. The probability (p) depends in general on the economic environment, such as, market conditions, etc. The output (y) can be interpreted as GNP.

d. The amount needed by the Muslim country to finance the project is greater than its first period endowment (W1). In addition, the foreign country accepts Mudarabah as the mode of financing. In this case, the amount of capital required for investment must satisfy the following inequality:

$$K \leqslant W_1 + B \text{ B ....} (3)$$

The amount of capital (K) actually invested in the project depends on the management of the decision makers who might divert part of the

resources raised for the project to the financing *Murabaha* transactions, in order to get faster profits at a negligible risk.

e. The profit-sharing ratio of the financier from the project takes the form

$$\lambda = \lambda(K) \quad \text{with} \quad \lambda' \geq 0 \quad \text{and} \quad \lambda'' \leq 0.$$

The share of the financier in the profits will depend on the level of capital actually invested in the project. The higher the amcunt of B invested in the project, the greater will be the profit share requested by the foreign financier. This is so, because to a greater financial contribution corresponds a higher risk as compared to *Murabaha* transactions.

f. The foreign financier may face a political risk of default, or expropriation risk, which, in general is due to political instability.

3. SHARI'AH FRAMEWORK :

In this study, *Mudarabah is* used as a mode of financing with a mixture of capital (*Mudarabah Maa Khalt Al Amwal*)[1] between the Muslim country and the foreign partner. The foreign country participates with an amount of capital equal to B while the domestic country participates with an amount equal to its first period endowment (W1). The project is managed by the Mudarib who is allowed by the contract to divert part of the funds to the *Murabaha* market in case of such emergency needs as meeting temporary liquidity demands, etc.

Given the previous assumptions, the project might face a positive profit or a loss. The contract fixes the profit share that goes to the financier and the one that goes to the *Mudarib.* The financier is, in our scenario, composed of both the Muslim country and the foreign country while the *Mudarib* comprises only the Muslim country.

Let A. denote the optimal rates of the profit share accruing to the financier in case the project makes a positive profit and (1- λ) the ratio of the profit share accruing to the *Mudarib. X.* percent of the profits is then distributed between the Muslim country and the foreign financier according to their respective capital contributions since the financier comprises both countries. λ times the total profits is divided according to the ratios $\frac{W_1}{W_1+B}$ for the Muslim country and $\frac{B}{W_1+B}$ for the foreign country which represent the ratios of their capital contribution. If the *Mudarib* diverts part of the

funds allocated to the project to the *Murabaha* market to get faster profits at a lower risk to meet the liquidity demand, the foreign country asks for its share which equals the amount of funds diverted to the *Murabaha* market times *the Murabaha* rate (assumed to be equal to the interest rate for simplicity of exposition) times the ratio $\frac{B}{W_1+B}$ which represents its capital contribution. In case of a loss, the financier bears the loss. More precisely, the Muslim country and the foreign country bear respectively the total loss according to their respective capital contributions since finance is supplied by both countries..

THE FOREIGN COUNTRY.:

The objective of the foreign country is to maximize its expected profit. The general form of its net expected profit is equal to the sum of profits obtained from the project, profits obtained from the *Murabaha* market if part of the funds are diverted by the *Mudarib* to the *Murabaha* market and gains obtained from the existence of political risk. In mathematical notation, the net expected profit takes the following form:

$$E[\text{Profits}] = \{\lambda \frac{B}{W_1+B}(\pi p - W_1 - B) + \bar{X}i\,(W_1 + B - K)\frac{B}{B+W_1} + \gamma\left(1 - \frac{\lambda B}{W_1+B}\right)\pi p \beta X\}\frac{1}{1+r} \quad \ldots\ldots (4)$$

The first, second and third terms between brackets in the right hand side of equation *(4)* represent 'respectively the profit share that accrues to the foreign financier from the project, the profit share that accrues to the foreign financier from the *Murabaha* market and the amount seized in case of expropriation. All three terms are expressed in terms of good D. These three terms are multiplied by the expression $\frac{1}{1+r}$ express the profit in present value terms.

If there is neither political default, nor diversion of funds to the *Murabaha* market, the net expected profit of the external financier becomes'

$$E[\text{Profits}] = \frac{\lambda}{1+r}\frac{B}{W_1+B}(\pi p - W_1 - B). \quad \ldots\ldots (5)$$

If there is no political default but some of the funds are diverted by the *Mudarib* to the *Murabaha* market, the net expected profit becomes

$$E[\text{Profits}] = \frac{1}{1+r}\left\{\lambda \frac{B}{W_1+B}(\pi p - W_1 - B). + i\frac{B}{W_1+B}(W_1+B-K)\right\} \quad (6)$$

In this case, the amount actually invested (K) into the project is strictly greater than W1 and strictly less than $W_1 + B$.

Finally, in case of the presence of political risk and the diversion of funds, the dummy variable X and X take the value one and, hence, the net expected profit becomes

$$E[\text{Profits}] = \frac{1}{1+r}\left\{\lambda \frac{B}{W_1+B}(\pi p - W_1 - B). + i\frac{B}{W_1+B}(W_1+B-K) + \gamma\beta\pi p\left(1-\frac{\lambda B}{W_1+B}\right)\right\}. \quad (7)$$

As mentioned earlier, the foreign country will be maximizing its expected net profit depending on the economic situation it is facing which is represented by one of the previous equations.

5. THE MUSLIM COUNTRY :

The Muslim country is an expected utility maximizer, with the same utility as previously defined. It maximizes its second period expected utility function which depends generally on three components: the expected gain from the project, the expected return from the Murabaha market, which itself depends on the amount of capital diverted to it, and, finally, the loss incurred from political instability. It is also possible to look at the total second period expected utility of consumption as the sum of the expected second period consumption of good D plus the expected second period of good F. The expected second period consumption of good F in terms of good D is equal to

$$E(C^F) = \gamma\left(1-\frac{\lambda B}{W_1+B}\right)\pi p(1-\beta X) \quad (8)$$

Equation (8) shows that in case of political default, that is when X = 0, the expected second period consumption of good F in terms of good D is equal to the fraction y of good D exported. On the other hand, when there is political default, the expected consumption in period two in terms of good D is equal to the fraction y (1 - B) which is less than the previous quantity by a fraction equal to y B. This ratio represents the percentage of good D seized by the foreign country. The expected quantity seized is equal in this situation to $2\gamma\pi p\left(1-\frac{\lambda B}{W_1+B}\right)$. The second period expected

utility consumption of good D is equal to

$$E(C^D) = (1 - \gamma)\left(1 - \frac{\gamma B}{W_1 + B}\right)\pi p + W_2 + i^*(W_1 + B - K) - \frac{r^* B}{B + W_1}(W_1 + B - K) \quad (9)$$

The first term in the right hand side of equation (9) represents the net return of the Muslim country's share from the project. The second term represents the second period endowment. The third and fourth terms represent together (their difference) the return from the Murabaha market of the amount of funds diverted to that market.

Combining equations (8) and (9), we get the total expected second period consumption of the Muslim' country:

$$E(C) = \left(1 - \gamma \frac{B}{W_1 + B}\right)(1 - \gamma\beta X)\pi p + W_2 + \left(i^* - r^* \frac{B}{B + W_1}\right)(W_1 + B - K) \quad \ldots\ldots (10)$$

The objective of the Muslim country is to maximize equation (10) subject to some constraints. One of the constraints is that the foreign financier does not invest if his expected profits from investing in the project are strictly less than the return from investing the same quantity in the international capital market or *Murabaha* market. From now on, we assume that the *Murabaha* rate that prevails in the Murabaha market is equal to the rate prevailing in the international capital market.

6. EQUILIBRIUM :

The maximization of equation (4) subject to the appropriate constraints leads to the derivation of the foreign country's marginal gain curve. This curve represents the locus of points (K, a.) that maximizes equation (4) under the appropriate constraints'. On the other hand, the maximization of-equation (10) under its appropriate constraints leads to the. derivation of the Muslim country's marginal gain curve, that is, to the locus of pairs of the amount of capital actually invested in the project (K), and of the foreign country's expected profit-sharing ratio, which maximizes the second period expected consumption of the Muslim country. The intersection of these two curves gives the equilibrium. The first maximization problem gives the foreign marginal gain curve which we denote by FMG curve

$\lambda_F = \lambda_F$ (K, W_2, B, other exogenous variables).

The second maximization problem derives the Muslim (domestic) marginal gain curve (DMG) which can generally be mathematically expressed by

$\lambda_F = \lambda_F$ (K, W_2, B, other. exogenous variables).

The intersection of these two curves gives the equilibrium point when it exists. The equilibrium point E determines the optimal values of λ^* and K .

The model is therefore used by both countries as a guide in the negotiations. It helps them to reach an equilibrium (λ^*, K^*) that simultaneously maximizes both objectives.

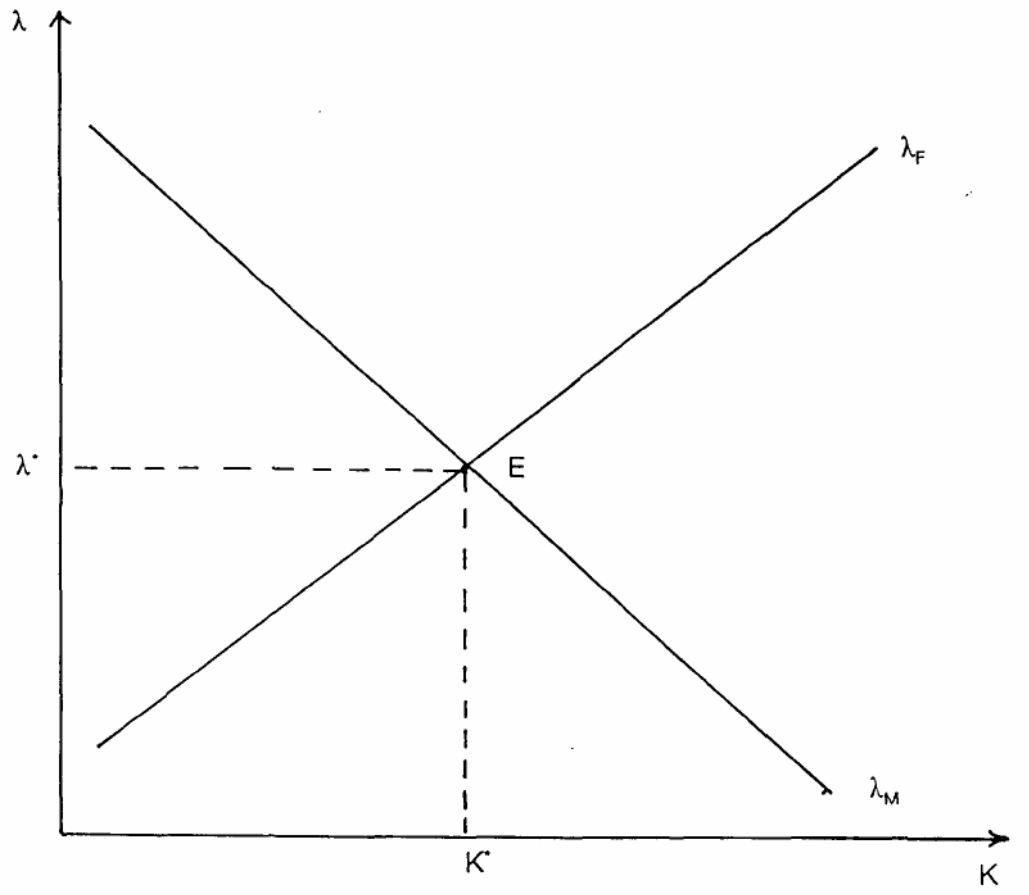

Figure 1

III
DERIVATION OF THE OPTIMALITY CONDITIONS

DERIVATION OF THE OPTIMALITY CONDITIONS

In this section, we present three different possible combinations. The first case deals with a situation of no political risk and no diversion of funds. The second analyzes the case of no political risk and the possible diversion of funds, and the third looks at the more general case of the existence of political risk coupled with the diversion of some of the funds allocated to the project towards the *Murabaha* market.

1. CASE NO. 1 : NO POLITICAL RISK AND NO DIVERSION OF FUNDS :

This case deals with a situation in which there is neither political default nor diversion of funds. Since there is no diversion of funds, the amount of capital invested in the project (K) is exactly equal to the sum of the capital contributions of both countries (W_1+B). Hence, the third term in equation (10) vanishes. In addition, since there is no political risk, the dummy variable X takes the value zero. Taking this into account, equation (10) becomes

$$E(C) = \left(1 - \frac{\lambda B}{W_1 + B}\right) \pi p + W_2 \qquad (11)$$

The Muslim country's objective is to maximize its expected second period consumption subject to two constraints. The first constraint is that the foreign country's expected net gain be greater or equal. to the net return from the *Murabaha* market.' The second constraint is that the Muslim country's expected net gain from investing W_1 into the project be greater or equal to the net gain from investing it in the *Murabaha* market. The mathematical formulation of the problem becomes

$$\text{Max } E(C) = \left(1 - \frac{\lambda B}{W_1 + B}\right) \pi p + W_2 \qquad (12)$$

---

1. We assume the rates of return from the *Murabaha* market and international capital market are equal, that is, i = r.

subject to

$$\frac{\lambda B}{K}(\pi p - K) \geq iB, \quad \text{.....(13)}$$

$$(1 - \frac{\lambda B}{K})(\pi p - K) \geq iW_1 \quad \text{.....(14)}$$

By combining both constraints given by equations (13) and (14), the problem (12) (14) becomes .

$$\text{Max } E(C) = (1 - \frac{\lambda B}{K})\pi p + W_2$$

subject to

$$(\pi p - K) \geq iK$$

where $K = W_1 + B$.

Assuming that the constraint is. binding, the necessary optimality condition for. the Muslim country becomes[2]

$$B\lambda' + \lambda - 1 = 0 . \quad \text{.....(15)}$$

Equation (15) relates the financier's profit-sharing ratio (X) to the change of this profit-sharing ratio with respect to any small change in the foreign country's capital contribution (A.'), through a first order differential equation in X given by equation (15).

The general solution of this differential equation takes the form[3]

$$\lambda = 1 = \frac{C - E(C)_{B=0}}{B}, \quad \text{.....(16)}$$

where C is -a constant of integration independent of B.

At B = 0, the expected second period consumption is equal to. $E(C)_B = o = (1 + i) W_1 + W_2$. As shown by equation (16), as B increases indefinitely, the profit share accruing to the financier which comprises both countries tends to increase to one. Equation (16) also shows that the profit-sharing ratio of the financier (the *Mudarib)* and, in particular of the foreign financier, increases as his capital contribution increases. Naturally,

2. See Appendix 1 for a more detailed proof of this relationship.
3. See Appendix 1 for the derivation of the solution.

the profit share accruing to the *Mudarib* decreases as a consequence. The profit-sharing ratio of the financier is an increasing function of B. As the foreign country's involvement increases, through its increase in capital contribution, the risk of its exposure increases and, therefore, it will demand a higher profit-sharing ratio.

It is also a natural restriction for the constant C to be greater than $E(C)_{B=0}$ in order for the profit-sharing ratio to be a fraction between zero and one. The maximization problem given by the set of equations (12) - (14) has. a .solution. λ^* which represents the optimal profit- sharing ratio that goes to the financier given the amount of capital (B) the foreign financier is willing to invest. The existence of this solution indicates that both constraints given by equations (13) and (14) are completely satisfied. Thus, the foreign financier would rather invest in a Muslim country via the *Mudarabah* mode than invest in the international capital market.

2. CASE NO. 2 : NO POLIITICAL RISK AND THE POSSIBILITY OF THE DIVERSION OF FUNDS :

This case studies the possible diversion of funds to the Murabaha market by the *Mudarib.* We assume that the Muslim country has at some point in time an emergency need and, thus, finds it appropriate to divert part of the funds allocated to the project towards the Murabaha market. It is also possible that some good investment opportunities arise in the *Murabaha* market that lead the Muslim country to divert part of the capital to the Murabaha market in order to obtain faster profits at a lower risk. When such a situation occurs, the amount of capital actually invested in the project (K),. is strictly less than the sum of the initial capital contributions (W_1 + B). In this economic environment, the objective of the Muslim country is to maximize its expected second period consumption. Since there is no political risk involved, the dummy variable X is equal to zero. From equation (10), the objective function becomes

$$E(C) = (1 - \lambda_1)\,\pi p + W_2 + i^{\cdot}\,\frac{W_1}{W_1 + B}\,(W_1 + B - K), \qquad \text{.....(17)}$$

where $\lambda_1 = \lambda\,\frac{B}{W_1 + B}$ represents the profit-sharing ratio of the foreign country.

The first term in the right hand side of equation (17) represents the expected net return from the project. The second term represents the second period endowment, and the third term is the return from investing $(W_1 + B - K)^{\cdot}$ in the *Murabaha* market at the rate of return (i). The necessary condition for a maximum for the Muslim country is equal to

$$\frac{dE(C)}{dK} = \pi' p (1 - \lambda_1) - \pi p \lambda_1' - i^* \frac{W_1}{W_1 + B} = 0 \quad \text{.....(18)}$$

Let $i^*_B = i^* \frac{W_1}{W_1 + B}$,

then Equation (18) can be written

$$\frac{d}{dK} [\pi p (1 - \lambda_1)] = \pi' p (1 - \lambda) - \pi \frac{d (\lambda p)}{dK} = i^*_B \quad \text{.....(19)}$$

Equation (19) shows that the Muslim country invests to the point where its net' expected marginal gain from investing in the project equals the fraction of its capital contribution times the *Murabaha* market rate, that is, to the opportunity cost of investing in the *Murabaha* market:

Let $G = \lambda_1 p$, then equation (19) becomes

$$\pi G' + \pi' G = \pi' p - i^*_B \quad \text{.....(20)}$$

Equation (20) represents the locus of points (K, G) such that $\frac{dE(C)}{K} = 0$. In other words, it represents the pairs of the capital and the foreign country's expected profit-sharing ratio $(K,\lambda_1 p)$, which maximize the second period expected consumption. In other words, the locus of optional combinations of invested capital (K) and the optimal foreign country's expected profit-sharing ratio ($\lambda_1 p$) is governed by a first differential equation in G. We shall denote this curve by the domestic marginal gain curve (DMG). For simplicity of exposition let us consider the following production function.

Let $\pi(K) = \sqrt{K}$, then $\pi' = \frac{1}{2\sqrt{K}}$. The differential equation given by Equation (20) becomes

$$G' + \frac{1}{2K} G = \frac{1}{2K} p - \frac{i^*_B}{\sqrt{K}} \quad \text{.....(21)}$$

The solution of this first order differential equation is equal to[4]

$$G = \frac{A}{\sqrt{K}} + p - i^*_B \sqrt{K} \quad \text{.....(22)}$$

where $A > 0$.

The sign of the slope of the curve given by equation (22) is negative, that is,

$$\frac{dG}{dK} < 0 \quad \text{.....(23)}$$

Equation (22) and (23) show the inverse relationship between the foreign country's expected profit-sharing ratio and the amount of capital actually invested in the project. On the other hand, the foreign country must satisfy the following condition:

$$\lambda_1 (\pi p - W_1 - B) + i_B (W_1 + B - K) = iB \quad \text{.....(24)}$$

The left hand side of equation (24) represents the gain from going into the joint venture with the Muslim country by investing the amount B, while the right hand side represents the net gain from investing B in the international capital market. Equation (24) in terms of G becomes[5]

$$G = i_B \frac{K}{\pi^*} \quad \text{.....(25)}$$

where $\pi^* = \pi - \frac{W_1 + B}{P}$ and where $i_B = i \frac{B}{W_1 + B}$.

The slope of equation (25) is positive, that is, $\frac{dG}{dK} > 0$.[6] The graph of equation (25) gives the locus of points (K, G) that satisfies equation (24). Combining both graphs, we get a solution (K^*, G^*) that simultaneously satisfies both equation (24) and (22). In other words, it gives the optimal values of the quantity of capital (K) that must be invested in the joint project and the optimal profit-sharing ratio that should go to the foreign financier and which simultaneously satisfy both parties.

See Appendix 2, Proposition 1.

5. See Proof in Appendix 2, Proposition 2.
6. See Proof in Appendix 2, Proposition 2.

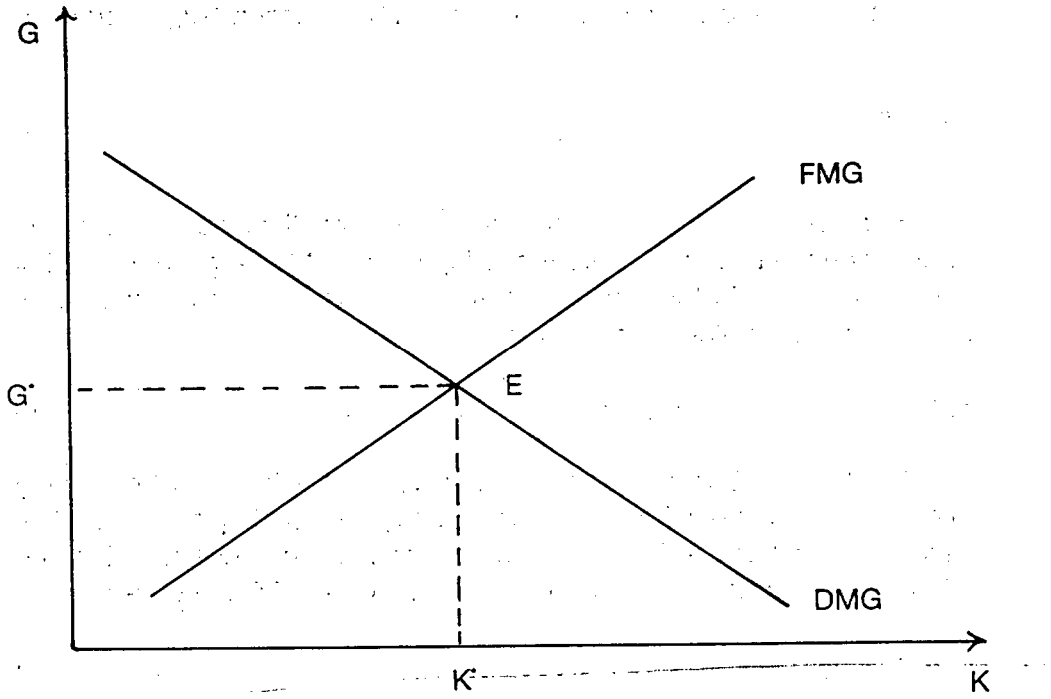

Figure **2**

In Figure 2, we plot both curves: the domestic marginal gain curve (DMG) which is downward sloping and the foreign marginal gain curve. (FMG) which is upward sloping. The two curves intersect at point E. Point E represents, therefore, the equilibrium between the foreign financier and the Muslim country in the presence of the diversion of funds. These two curves are given for a given amount W_1 and .B. For each quantity, B corresponds to a curve DMG and a curve FMG.

Static Analysis :

We now turn to the question of how a change in the initial amount of the capital contribution of the foreign financier affects at the same time the optimal quantity allocated to the project and the optimal profit-sharing ratio that goes to the foreign country. We will study the change in the direction of these two variables and not the amount by which they change.

---

7. **See** Appendix 3, Proposition 1 for. the proof....

For the domestic country, from equation (21) the change in G given the change in B is positive.'

$$\frac{dG}{dB_{DMG}} > 0 \quad \text{.....(25)}$$

In other words, as B increases by a small amount, the domestic marginal gain curve shifts upward. Any increase in the initial capital contribution of the foreign country increases the foreign country's profit-sharing ratio.

On the other hand, any positive change in the initial foreign capital contribution (B) shifts the foreign marginal gain curve upward. This upward shift in the FMG curve shows that for a given K, as B increases, the profit-sharing ratio accruing to the foreign country increases.

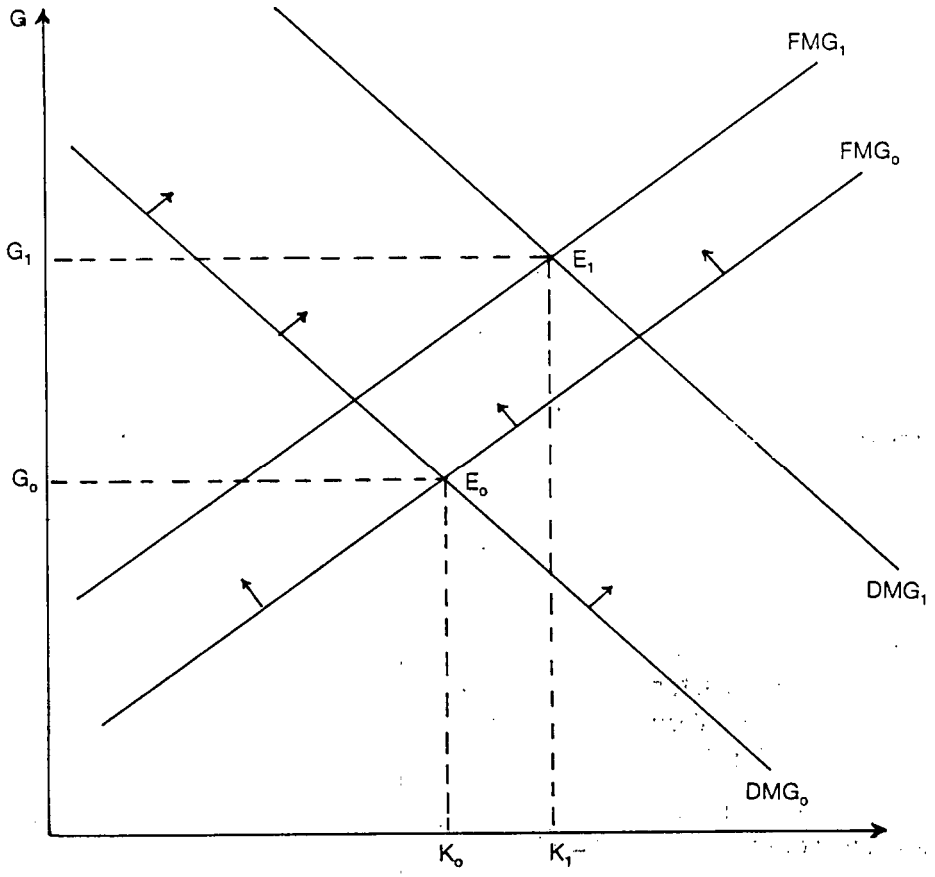

Figure 3

'Moreover; it is not clear whether the direction of the amount of capital actually invested in the project (K) increase or decrease since this depends on the amount of capital diverted to the *Murabaha* market by the *Mudarib.* The greater the amount of capital invested in the project (that is, the larger the difference K_1 - K_0 is), the higher the profit-sharing ratio of the foreign country. This is illustrated in Figure 3. As B increases, the domestic marginal gain curve shifts up from DMG_0 to DMG;. In addition, as B increases, the foreign marginal gain curve shifts up from FMG_o to FMG_1. The equilibrium point moves from E_0 to E1 resulting in an increase in the profit-sharing ratio accruing to the foreign country from G0 to G_1 as shown in Figure 3. However, the amount of capital invested in the project (K) depends on the magnitude of the shiftings of these two curves. This amount can be greater or smaller than the original amount of capital invested (K_0).

3. CASE NO. 3 : POLITICAL RISK COUPLED WITH THE POSSIBILITY OF THE DIVERSION OF FUNDS :

This case represents the more general situation, in which, we assume the existence of political default from the Muslim country coupled with the diversion of funds to the *Murabaha* market. As in the previous case, we assume that economic circumstances are such that the *Mudarib* diverts some of the funds to-the *Murabaha* market. Thus, the amount of capital invested in the joint project is strictly less than the initial total amount (W_I + B). The rest of the amount is directed to the *Murabaha* market. The imposition of trade sanctions in the case of expropriation reduces the risk due to the presence of political instability.

The expected second period consumption of the Muslim country is equal to

$$E(C) = (1 - \lambda \frac{B}{W_1 + B})(1 - \gamma\beta)\pi p + W_2 + i^* \frac{W_1}{W_1 + B}(W_1 + B - K) \quad (26)$$

The first term in the right hand side of equation (26) represents the expected gain received from the project minus the expected seized quantity due to the existence of political default. The second term on the same side of that equation is the second period endowment of the domestic country. The third term represents the net gain from the *Murabaha* market.

For a given amount B, the necessary optimality condition for the Muslim country is such that the marginal expected second period consumption with respect to the invested capital (K) must be equal to zero. Mathematically, we have

$$\frac{dE(C)}{dK} = 0,$$

which implies

$$\frac{d}{dK} \{ (1 - \lambda_1) (1 - \gamma\beta) \pi p \} = i^*_B \quad \text{.....(27)}$$

where i^*_B has been defined earlier.

The right hand side of equation (27) is equal to the product cf the Muslim country's profit-sharing ratio of its capital contribution times one plus the *Murabaha* rate (1 + i). In other words, the right hand side of equation (27) represents the Muslim country's gain from investing one unit of capital in the *Murabaha* market. On the other hand, the left hand side represents the Muslim country's expected marginal gain accruing from the project minus the part seized by the foreign country for each unit of capital invested in the project. By using the definition of G, equation (27) becomes[1]

$$\pi G' + \pi' G = \pi' p + \frac{1}{1 - \gamma\beta} i^*_B \quad \text{.....(28)}$$

This differential equation in G governs the change of G as K changes. In other words, as K changes, equation (28) gives the set of the profit-sharing ratios of the foreign country that maximizes the expected second period consumption of the Muslim country.

Let the production function ***n*** (K) take the form $i_t = \sqrt{K}$. By replacing i_t and A ' in equation (28), we get

$$G' + \frac{1}{2K} G = \frac{P}{2K} - \frac{1}{(1 - \gamma\beta)} \frac{i^*}{\sqrt{K}} \quad \text{.....(29)}$$

The solution of this first order differential equation is equal to

$$\hat{G} = \frac{A_o}{\sqrt{K}} + P - \frac{i^*}{1 - \gamma\beta} \sqrt{K} \quad \text{.....(30)}$$

The slope of equation (30) which represents the change in G given the change in K is negative. In other words, as K increases, G decreases with all other variables remaining constant. In addition, as B increases,

1. See Appendix 4, Proposition 1 for the derivation of equation (28).

the domestic marginal gain curve shifts up. This is so because from equation (30), a simple computation leads to

$$\frac{d\hat{G}}{dB} = \frac{\sqrt{K}}{(1-\gamma\beta)} \frac{i^{*}_{B}}{(W_1 + B)} > 0$$

and

$$\frac{d\hat{G}}{dK} = \frac{-A_o}{2K\sqrt{K}} - \frac{i^{*}_{B}}{2(1-\gamma\beta)\sqrt{K}} < 0 \qquad \text{.....(31)}$$

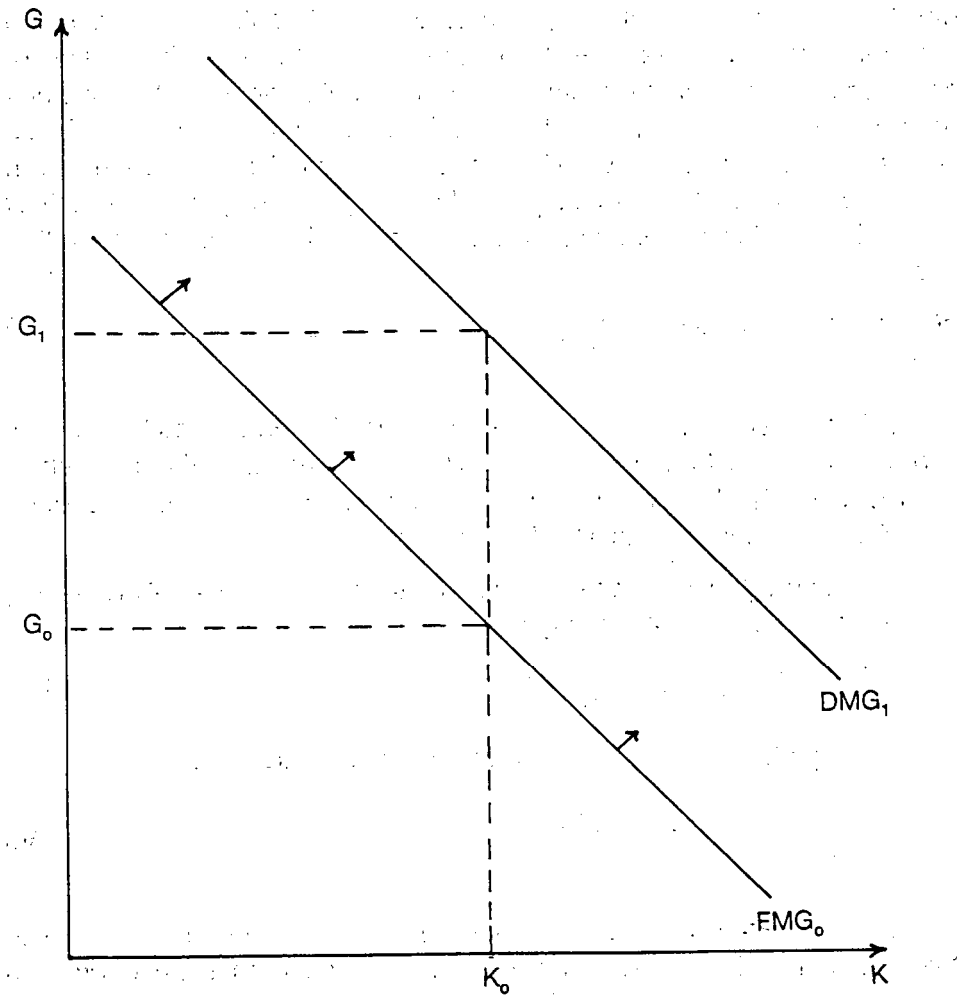

Figure 4

In Figure 4, the negative slope is shown by the downward curve. For $K = K_0$ as B increases from $B0$ to B_1, the domestic marginal gain curve shifts up from DMG_0 to DMG_1. This shifting induces an increase in G from G_0 to G1. On the foreign country side, we must meet the following necessary condition:

$$\lambda_1 (\pi p - W_1 - B) + i_B (W_1 + B - K) + \gamma\beta\pi p (1 - \lambda_1) = iB \quad \text{.....(32)}$$

where λ_1 and i_B have already been defined.

Using the variable G, equation (32) becomes[1]

$$G = \frac{K}{\hat{\pi}} i_B \quad \text{.....(33)}$$

$$\text{when } \hat{\pi} = (1 - \lambda\beta)\,\pi - \frac{W_1 + B}{P}$$

Moreover, the slope of equation (33) is positive,[2] that is, $\frac{dG}{dK} > o$, as long as the expected net gain per capita ($p \frac{\hat{\pi}}{K}$) is greater than the marginal expected net gain ($p\hat{\pi}'$). On the other hand, the change in G, given a change in B, is positive.[3] Equation (33) represents, therefore, the foreign marginal gain curve in the situation of the existence of political risk associated with the existence of the diversion of funds.

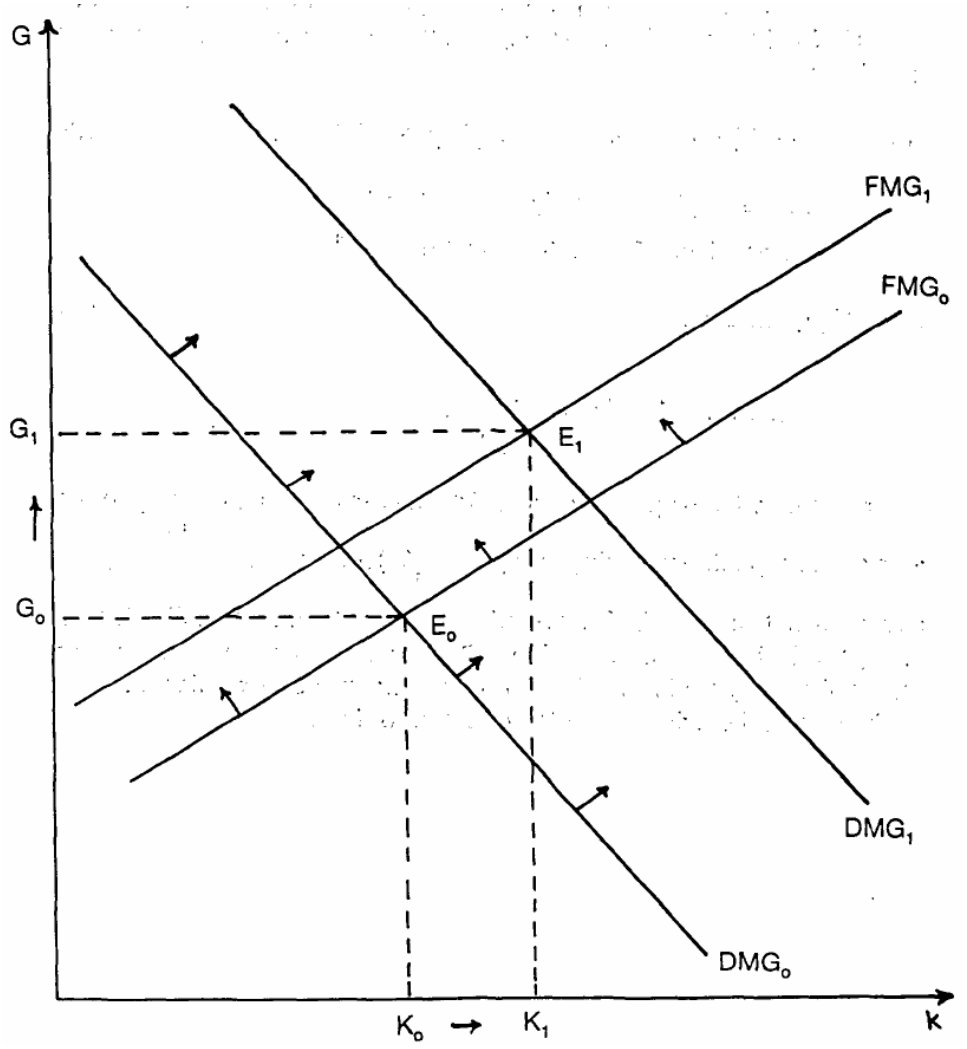
G
FMG1
FMGo
G1
E1
Go
Eo
DMG1
DMGo
Ko
K1
K

Figure 5 shows that when B is equal to B_0, the domestic marginal gain curve (DMG_o) intersects with the foreign marginal gain curve (FMG_o) at the equilibrium point (E_o). This equilibrium point (E_o) determines the levels K_o and G_o which represent respectively the optimal amount of capital that should be invested jointly in the project and the optimal expected profit-sharing ratio that goes to the foreign financier in the presence of political risk and the diversion of funds. From the same graph, it can be seen that as the foreign partner increases its contribution (B) from B_0 to B_1, the foreign marginal gain curve shifts upward from FMG_0 to FMG_1. In addition, this same increase in B affects the domestic marginal gain curve by shifting it up from DMG_o to DMG_1. The two new curves intersect at a new equilibrium (E_1). To the new equilibrium (E_1) correspond new optimal levels of K and G; K_1 and G_1. The new optimal value (G_1) is greater than G_o. The foreign country is therefore requiring an increase in its profit-sharing ratio to compensate for the higher risk it is taking by allocating a larger amount of capital contribution to the project. However, the new optimal level of capital invested in the project (K_1) might be greater, lower or equal to the original level (K_o) depending on the magnitude of the shifting of the curves DMG_o and DMG_1.

The fourth case of no diversion of funds and the presence of political risk is a special variation of this third case and is left as an exercise for the reader**.**

IV
CONCLUSION AND POLICY RECOMMENDATIONS

CONCLUSION AND POLICY RECOMMENDATIONS

CONCLUSION :

Several Muslim countries currently suffer as a result of the large scale borrowing that they have undertaken despite their vast resources. The accumulated debt of these countries is so large that they have been forced to introduce austerity measures in order to pay the interest on it. Even with these austerity measures, domestic savings fall short of domestic investment requirements. This, in fact, has forced most Muslim countries to look for external financing.

For a Muslim country which prohibits *Riba,* the only way to secure external financing is to convince the foreign investor to accept Islamic modes of financing. In this paper, we have viewed this scenario in a profit-loss sharing environment. A mathematical model has been presented in which two countries, a Muslim (domestic) country and a foreign country, engage in a joint venture. The objective of the domestic country is to maximize its expected second period consumption in an Islamic framework. The Muslim country is in need of external financing and works in an economic environment where there is a possibility of the diversion of funds to the *Murabaha* market and a possibility of the existence of political risk. The mathematical model formulates these two situations. On the other hand, the foreign country's objective is to maximize its expected profit. In each situation, the model derives the necessary optimality conditions for the existence of a solution.

More precisely, in this paper we have explicitly derived the optimal levels of the foreign country's expected profit-sharing ratio and the optimal level of capital investment. These optimal values are the result of the intersection of the domestic marginal gain curve (DMG) and the foreign marginal gain curve (FMG). In each case, we have studied the effect of a change in the foreign capital contribution on the expected profit-sharing ratio as well as on the optimal level of the amount of capital invested in the project. The model has shown that in both situation, (i.e., the situation of the possible diversion of funds coupled with the existence of political risk and the situation of the possible diversion of funds with no political default), the optimal level of the expected profit-sharing ratio increases as

B increases. However, there is no clear cut on the direction of change of the optimal level of capital invested in the joint project as B increases. As the foreign capital contribution increases, the two marginal gain curves (DMG and FMG) shift upward but without a definite sign of the direction of change of the optimal level of capital invested in the joint project as B increases. As the foreign capital contribution increases, the two marginal gain curves (DMG and FMG) shift upword but without a definite sign of the direction of the change in the optimal quantity of capital invested in the project (K). The sign of the change in K as B increases depends on the magnitude of the shifting of the two marginal gain curves. The model has also derived, in the case of no political risk and no diversion of funds, an explicit first order differential equation that governs the change of the financier's profit-sharing ratio (λ) as the foreign capital contribution changes. In this last case, the solution of the first order differential equation shows the existence of the inverse relationship between the financier's profit-sharing ratio and the foreign capital contribution. Moreover, it shows that as B increases, the financier's profit-sharing ratio tends to increase to one.

POLICY RECOMMENDATIONS :

Islamic modes of financing are not being used by Muslim countries with non-Islamic countries or non-Islamic financial institutions in financing joint projects. Moreover, some modes have not been used between Islamic countries or Islamic financial institutions to any significant extent. Due to the financing potential of Mudarabah used in the particular economic set- - ting in this study, the following recommendations might be suggested:

1. In this paper, *Mudarabah* have been used to finance a joint project in the presence of political risk as well as the possibility of the diversion of funds. In this particular economic setting, the following steps are necessary:

    a) Estimation of the consumption function of the Muslim country.

    b) Estimation of the production function by means of the estimation of similar projects.

Obtainment of proxy for the political risk.

c) • With these elements, the model will- be able to determine en- dogenously and simultaneously the expected shares for each of the

two countries as well as the optimal level of capital needed for the joint project.

2. In order to develop the use of Islamic financial modes by Islamic financial institutions, in particular, Islamic banks, it is vital to create a data bank for OIC member countries that will facilitate the flow of information. From these data, estimations of the different objective functions of the different member countries can be analyzed in the light of each country's present economic setting. Estimation of the different economic factors needed in the present analysis can be determined which will allow researchers to give a more realistic economic evaluation.

3. There is also a need for new institutions in different member countries to study and suggest to Islamic financial institutions different economic scenarios appropriate for the *Mudarabah* mode of financing.

4. In view of these considerations, more rigorous research is needed for the different economic scenarios. Statistical estimation methods as well as simulation methods have to be used in order to bridge the gap between theory and reality. This research can be extended to deal with more than one external financial institution and with more than one project. The objective function of the Muslim country can also be generalized to be a utility index function. In addition, time can be introduced to give a dynamic dimension to the problem.

V
APPENDICES

APPENDICES

APPENDIX 1

Let us consider the following maximization problem :

$$\text{Max } E(C) = \left(1 - \frac{\lambda B}{K}\right) \pi p + W_2 \quad \ldots\ldots (1)$$

subject to

$$(\pi p - K) \geq iK.$$

If the constraint is binding, that is, when $\pi p = (1 + i) K$, problem (1) becomes

$$\text{Max } E(C) = \left(1 - \frac{\lambda B}{K}\right) (1 + i) K + W_2 \quad \ldots\ldots (2)$$

Equation (2) can be written as

$$\text{Max } E(C) = (1 + i) (K - \lambda B) + W_2.$$

Since $K \neq 0$, the necessary condition for optimality must satisfy

$$\frac{dE(C)}{dK} = \frac{d}{dK} [(1 + i) (K - \lambda B) + W_2] = 0 \quad \ldots\ldots (3)$$

i.e.,

$$(1 + i) (1 - \lambda - B\lambda') = 0 ,$$

which reduces to the first order differential equation in λ.

$$B\lambda' + \lambda - 1 = 0 . \quad \ldots\ldots (4)$$

To get the solution of equation (4), we go back to equation (3). By looking at equation (3), in order to have the change with respect to K of

the quantity between brackets equal to zero, we need that quantity to be constant (to remain unchanged) as K (or B) changes by a small amount. In other words, we need that quantity between brackets to remain independent of K (or B). Hence, we have

$$(1 + i)(K - \lambda b) + W_2 = C , \quad \text{..... (5)}$$

where C does not depend on K or B.

$$K - \lambda B = C_1 ,$$

where $C_1 = \frac{C - W_2}{1 + i}$ is also a quantity independent of K or B.

$$\lambda = \frac{K - C_1}{B} = \frac{W_1 + B}{B} - \frac{C_1}{B}$$

$$\lambda = 1 - \frac{C_1 - W_1}{B} = 1 - \frac{C - W_2 - W_1 (1 + i)}{B(1 + i)}$$

$$\lambda = 1 - \frac{C_2}{B} \quad \text{..... (6)}$$

where C_2 is the numerator of the second term which is a constant independent of the quantity B.

At B = 0, the expected consumption is equal to $E(C)_{B=0} = W_1 (1 + i) + W_2$. Equation (6) then becomes equal to

$$\lambda = 1 - \frac{C - E(C)_{B=0}}{B} \quad \text{..... (7)}$$

APPENDIX 2

Proposition 1 :

The slope of the domestic marginal gain curve is negative.

$$\frac{dG}{dK_{DMG}} > 0.$$

Proof :

Let us consider equation (22):

$$G = \frac{A}{\sqrt{K}} + p - i^{*}_{B}\sqrt{K} \qquad \text{.....(22)}$$

Differentiating equation (22) with respect to K, we get

$$\frac{dG}{dK} = \frac{-A}{2K} - i^{*}_{B}\frac{1}{2\sqrt{K}} = \left[\frac{A}{2K} + i^{*}_{B}\frac{1}{2\sqrt{K}}\right],$$

which is negative. Q.E.D.

Proposition 2 :

The slope of the foreign marginal gain curve (FMG) is positive, i.e.,

$$\frac{dG}{dK_{FMG}} > 0.$$

Proof :

Let us consider equation (24):

$$\lambda_1 (\pi p - W_1 - B) + i_B (W_1 + B - K) = iB \qquad \text{.....(24)}$$

where $i_B = i\frac{B}{W_1 + B}$

After some simple algebraic manipulation, we get

$$\lambda_1 \pi p - \lambda_1 (W_1 + B) = i \frac{B}{W_1 + B} K$$

Which becomes

$$\lambda_1 p \left[\pi - \frac{W_1 + B}{P} \right] = i_B K.$$

Using the definition of G, we get

$$G\pi^* = i_B K,$$

where $\pi^* = \pi - \frac{W_1 + B}{P}$ and where i_B has already been defined.

Hence,

$$G = i_B \frac{K}{\pi^*} \qquad \text{.....(25)}$$

The slope of equation (25) that gives the change in G with respect to K is equal to

$$\frac{dG}{dK} = i_B \frac{\pi^* - K\pi^{*\prime}}{\pi^{*2}}$$

which can be written as

$$\frac{dG}{dK} = \frac{i_B K}{\pi^{*2}} \left(\frac{\pi^*}{K} - \pi^{*\prime} \right) > 0$$

which is positive as long as the gain-capital ratio $\left(\frac{\pi^*}{K}\right)$ is greater than the marginal gain $\pi^{*\prime}$.

APPENDIX 3

Proposition 1 :

For the domestic marginal gain curve, the change in G given the change in the foreign country's capital contribution (B) is positive. $\frac{dG}{dB_{DMG}} > 0$

Proof :

Concerning the domestic country, in order to analyze in what direction the DMG curve shifts given any change in B, we look at equation (22):

$$G = \frac{A}{\sqrt{K}} + p - i^*_B\sqrt{K} \quad \text{.....(22)}$$

The change in G given a small change in B is equal to

$$\frac{dG}{dB} = -\sqrt{K}.\ \frac{di^*_B}{dB},$$

where $$\frac{di^*_B}{dB} = \frac{d}{dB}\left(\frac{i^*W_1}{W_1 + B}\right) = -\frac{i^*W_1}{(W_1 + B)^2} = \frac{i^*W_1}{(W_1 + B)^2}$$

Thus,

$$\frac{dG}{dB_{DMG}} = i^*\sqrt{K}\,\frac{W_1}{(W_1 + B)^2} > 0 \quad \text{.....(25)}^1$$

It is clear from equation $(25)^1$ that any change in B will shift upward the domestic marginal gain curve.

Proposition 2 :

For the foreign marginal gain curve, any change in B affects positively its profit-sharing ratio, that is, $\frac{dG}{dB_{DMG}} > 0.$

Proof :

From equation (25), we can derive the change in G given any change in the foreign capital contribution (B).

Let

$$G = i_B \frac{K}{\pi^*} \qquad \ldots\ldots (25)$$

$$\frac{dG}{dB}_{FMG} = \frac{\pi^* K \frac{di_B}{dB} - K i_B \frac{d\pi^*}{dB}}{\pi^{*2}} \qquad \ldots\ldots (25)_1$$

$$\text{where } \frac{d\pi^*}{dB} = -\frac{1}{p} \qquad \ldots\ldots (25)_2$$

$$\frac{di_B}{dB} = \frac{W_1}{(W_1 + B)^2} \qquad \ldots\ldots (25)_3$$

Thus, by plugging equation $(25)_2$ and $(25)_3$ into equation $(25)_1$, we get

$$\frac{dG}{dB_{FMG}} = \frac{\pi^* K \frac{W_1}{(W_1 + B)^2} + \frac{K}{p} i_B}{\pi^{*2}} > 0 .$$

Equation (29) also shows that any increase in B shifts the foreign marginal gain curve upward.

APPENDIX 4

Proposition 1 :

The set of pairs (K, capital invested in the project, and G, the foreign country's profit-sharing ratio) which maximizes the expected second period consumption for the Muslim country is governed by a first order differential equation of the form

$$\pi G' + \pi G' = \pi p' - \frac{1}{(1 - \gamma\beta)} i^*_B$$

Proof :

The necessary condition for maximization of E(C) is $\frac{dE(C)}{dK} = 0$,

(which implies that

$$\frac{d}{dK} \{ (1-\lambda_1) (1-\gamma\beta) \pi p \} = i^*_B \quad \ldots\ldots (27)$$

The right hand side can, therefore, be rewritten as

$$(1 - \lambda_1) \pi' p - \pi p \lambda_1 = \frac{i^*_B}{(1 - \gamma\beta)}$$

$$\pi' p - \lambda_1 \pi' p - \pi p \lambda'_1 = \frac{1}{(1 - \gamma\beta)} i^*_B$$

Taking into consideration the variable G, the previous equation can be written

$$\pi' p - \lambda' G - \pi G' = \frac{1}{(1 - \gamma\beta)} i^*_B$$

Rearranging terms, we get

$$\pi G' + \pi' G = \pi' p - \frac{1}{1 - \gamma\beta} i'_B \quad \text{.....(28)}$$

Proposition 2 :

In the presence of political risk and the diversion of funds, the foreign marginal gain curve takes the form

$$G = i_B \frac{K}{\hat{\pi}} \quad \text{.....(29)}$$

where $\hat{\pi} = (1 - \gamma\beta)\,\pi - \frac{W_1 + B}{p}$

Proof :

From equation (32), page 32

$$\lambda_1 (\pi p - W_1 - B) + i_B(W_1 + B - K) + \gamma\beta\pi p\,(1 - \lambda_1) = iB \quad \text{.....(32)}$$

Replacing G in equation (32), we get

$$\pi G - G\,\frac{(W_1 + B)}{P} + i_B\,(W_1 + B - K) - \gamma\beta\pi G + \gamma\beta\pi p = iB$$

$$\left[\pi - \frac{W_1 + B}{P} - \gamma\,\beta\,\pi\,\right] G = iB\,(W_1 + B - K)$$

$$G\left[\pi\,(1-\gamma\,\beta) - \frac{W_1 + B}{P}\right] = i_B\,K.$$

By letting

$$\hat{\pi} = \pi\,(1 - \gamma\beta) - \frac{W_1 + B}{p}$$

we get

$$G = i_B \frac{K}{\hat{\pi}} \quad \text{.....(33)}$$

Proposition 3 :

The slope of the foreign marginal gain curve is positive as long as $\hat{\pi}/K$ is greater than $\hat{\pi}'$. Moreover, any increase in B will shift upward the FMG curve.

Proof: The slope of equation (29) is equal to

$$\frac{dG}{dK} = i_B \frac{\pi - K\hat{\pi}'}{\hat{\pi}^2} = i_B K \frac{(\hat{\pi}/K - \hat{\pi}')}{\hat{\pi}^2} > 0,$$

which is positive as long as the expected net gain per capita $(\frac{\hat{\pi}}{K})$ is greater than the marginal expected net gain $(\hat{\pi}')$.

On the other hand, by totally differentiating equation (29), we get

$$\frac{dG}{dB}\hat{\pi} - \frac{G}{P} = K\frac{di_B}{dB},$$

where $$\frac{di_B}{dB} = i\frac{W_1}{(W_1 + B)^2}$$

and, thus,

$$\hat{\pi}\frac{dG}{dB} = \frac{G}{P} + iK\frac{W_1}{(W_1 + B)^2}$$

$$\frac{dG}{dB} = \frac{1}{\hat{\pi}}\left[\frac{G}{P} + iK\frac{W_1}{(W_1 + B)^2}\right] > 0.$$

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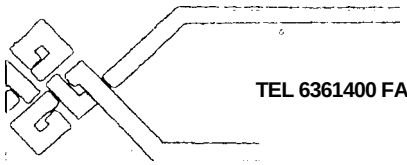

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