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On the design and efficiency of a participating growth bill

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Abstract

A Participating Growth Bill (PGB) is an innovative hybrid financial vehicle employed by Western institutions and governments in lieu of short-term debt instruments. This study proposes PGB to be considered as an alternative way of raising funds for open market operations by the governments of Muslim countries constrained by religious regulations against fixed-interest debt (*ribawi*) financing. The security (PGB) is developed using partial equilibrium analysis under the assumption that the assets backing the financial package do not trade in a secondary market—a situation which invalidates the risk-neutral pricing of the well-known Black and Scholes (1973) model. The study finally demonstrates the efficiency of a PGB over a conventional (*ribawi*) debt vehicle thereby providing results contrary to assertions of the (i) Capital Structure Irrelevance Theorem (see Modigliani and Miller, 1958) and (ii) Capital Asset Pricing Model (CAPM) (see Sharpe, 1964).

JEL classification: D910 (Intertemporal consumer choice); G240 (Investment banking); H810 (Government loans and credits); P430 (Other economic system: Finance)

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1. Introduction

The recent innovations in financial engineering in the West have motivated many scholars in emerging Muslim nations to search for alternative and matching instruments that conform with their religious value system. Islam, an Abrahamic religion, encourages free markets,

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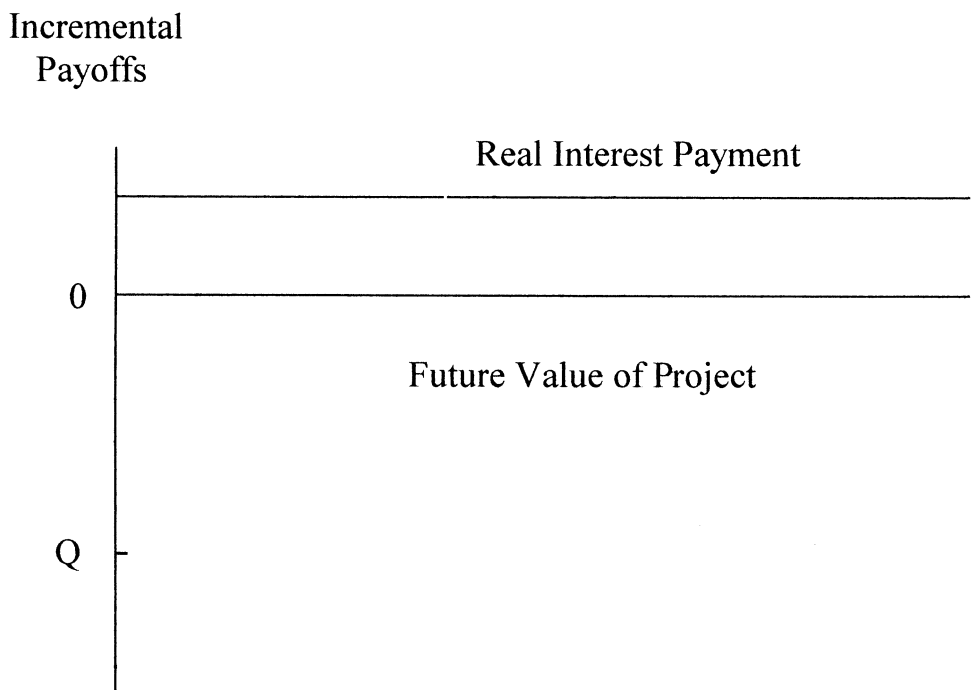

Fig. 1. *Riba Al-Nasi'ah* (conventional debt) contract

discourages price controls and forbids contracts based on *riba, gharar* and *maysir* (see Ibn Taymiya, n.d., and Islahi, 1988).

Riba is explicitly prohibited in the Quran in the following verse:

> "O you who believe, fear God and give up what remains due to you of *riba* if you are indeed believers. If you do not, then be warned of war (against you) by God and his Messenger. If you repent you shall have your capital. Do not wrong and you shall not be wronged." (Quran 2: 278–279)

It is interpreted by Islamic reformers like Ibn Qayyim al-Jawziyya (n.d.) to imply (i) any form of unfair trade, market manipulation or engaging a market participant to trade under duress (*riba-al-fadl*) and (ii) interest bearing debt contracts (*riba-al-nasi'ah*) (see also Chapra, 1986; Rahman, 1969, and Thomas, 1995).[1]

The element of *gharar* in a contract entails deception. Promoting it pre-empts *maysir* which is gambling (*qimar*).

In the contemporary complex financial environment, *riba-al-nasi'ah* can be expounded as a risk-free real return from an investment vehicle or from an investment strategy. Fig. 1 illustrates it graphically. For example, an investor may "go long," i.e., buy an index on a basket of stocks such as the Standard & Poors (S&P) 500 and simultaneously "sell short" a futures contract against it. This strategy results in a risk-free real return and therefore constitutes *riba-al-nasi'ah*. Ibn Qayyim al-Jawziyya (n.d.) rationalizes the prohibition of *riba* to be based on avoiding oppression on the poor. In lieu of loans bearing real interest, Islam encourages benevolent loans to the needy termed as *qardh hasan*. In terms of Fig. 1,

a *qardh hasan* facility would run along the X-axis instead of being parallel to it as in the case of *riba al-nasi'ah*.

Mainstream finance literature justifies *ribawi* debt contracts in the following cases:

1. Debt serves as a signal to convey future prospects of a firm, when there is *asymmetric information* between insiders (managers) of firms and outside investors (see Ross, 1977, and Myers and Majluf, 1984).
2. Debt reduces the conflict of interest (*agency cost*) between managers and shareholders of a firm (see Jensen and Meckling, 1976). Pre-committing the free cash flow of a debt contract reduces the chances of a manager misappropriating valuable funds for his frivolous activities.

However, one can present the following arguments contrary to conventional wisdom:

1. Society (or Governmental Agencies such as the Securities Exchange Commission-SEC in the USA) should make it obligatory for corporate insiders to convey information about the profitability and their stake in the firm on an ongoing basis. Markets (especially in the West) are so efficient that they are able to recognize the proprietary information of insiders from their actions.
2. The conflict of interest between managers and stock holders can be mitigated by giving managers performance incentives like stock options.

Conventional literature also discusses the detrimental effects of *ribawi* debt arising from the *agency issues* between equity holders and debt holders. In this instance, equity holders can jeopardize the assets of bondholders by adopting risky ventures which allow equity holders to appropriate most of the upside potential of the project (see Diamond, 1989). To alleviate this behavior of the equity holder or manager, it is recommended that debt contracts have participation clauses (see Green, 1984, and Haugen and Senbet, 1981, 1987). This conclusion is similar to that adopted by Muslim economists who advocate that equity participation (or profit-sharing) contracts are more efficient than those comprising *ribawi* debt (see Siddiqi, 1991, and Haque and Mirakhor, 1987).[2]

Public finance poses tremendous challenges to the Muslim economists as they have yet to provide solutions to the complex issues pertaining to both fiscal and monetary policies. There are nonetheless instances where practitioners have provided simple alternatives. These special situations are as follows:

1. Government spending on tangible goods (involving fiscal policy) is easily financed by the traditional Islamic instrument of *Murabahah* (Cost-plus, see Kahf, 1992).
2. Government spending on services (encompassing fiscal policy) or borrowing of funds (entailing monetary policy to restrict money supply) is feasible using the *qardh hasan* facility in combination with the Islamic principle of *hiba* (gifting). This mode of financing (termed as the Government Investment Certificate) is floated by Malaysia in the form of a Treasury Bill/ Note with maturity ranging from one to five years. Bank Negara (Malaysian Central Bank) does not promise ex-ante any payment in excess of principal. But at the end of the term of the loan it may do so at the discretion of a special committee from the Prime Minister's Department. The ex-post additional payment is denoted as a gift (*hiba*, see Idris, 1995). However, securitization of this

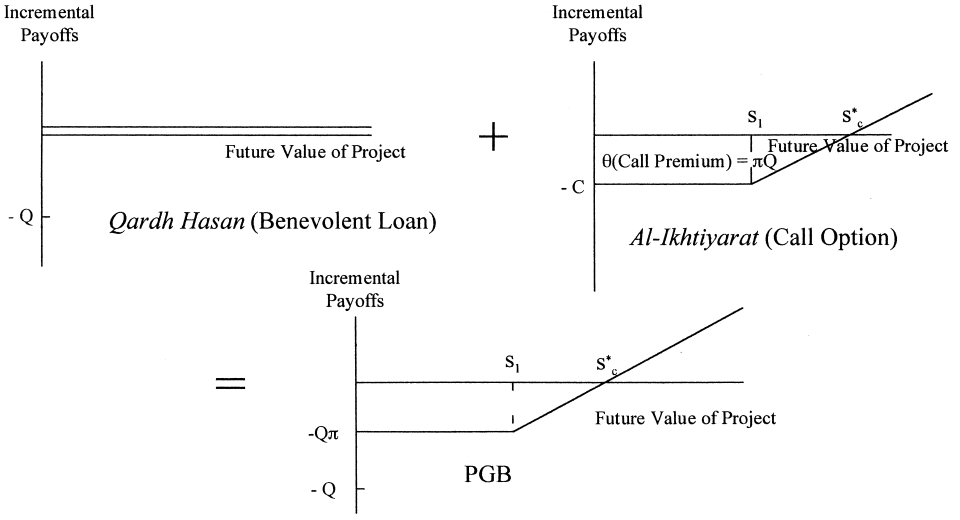

Fig. 2. Synthesizing a participating growth bill

facility for resale in a secondary market poses a problem as rates of return are not known ex-ante. Furthermore, any discounting of the facility (in the secondary market) from its par (face) value would eliminate its "Islamic" status as it would be construed to be a *ribawi* vehicle.

Thus there is an exigency to redesign short-term debt instruments especially to conduct Open Market operations in such a way that the vehicles structured conform with the *Shariah* (Islamic Law, see Mirakhor, 1988, and Dorph, 1990).[3] The prime focus of this paper is to design and demonstrate the efficiency of a hybrid security called Participating Growth Bill (PGB) which can be used by Muslim governments for short-term financing. A PGB is an innovation of Western institutions which conforms with the Islamic Law (*Shari'ah*). Fig. 2 synthesizes it as a combination of a *qardh hasan* facility and fractional shares of Call Options (on the equity of the government's project), in such a way that the Call premium offsets the inflation hedging property of *qardh hasan* thereby leading to the creation of a security where (i) only the principal (in nominal terms) is guaranteed and (ii) the lender participates in the appreciation of the businesses under the control of the government.[4] Thus, the only risk PGB investors are exposed to is inflation. That is, real returns to investors can be negative as depicted in Fig. 2 for all future states of the economy below the critical state S^*_c. Many governments have resorted to similar equity-indexed notes in the Western capital markets (see Finnerty, 1993). For example, the Republic of Austria has recently raised capital via Stock Index Growth Notes ("SIGNs") in the United States.[5] The governments of developing Muslim nations such as Malaysia, Qatar, Saudi Arabia, Sudan and United Arab Emirates (UAE) can control their money supply by trading a PGB which comprises sharing in the growth of specific state-owned assets/projects.

A PGB can revitalize the economy of a nation by offering the following benefits: (a) assist in completing the market, (b) transfer part of the risk of the state ventures to investor (in exchange for a higher potential return), (c) retain government control of the project and (d)

reduce agency costs which are inherent in any conventional *ribawi* debt contract between equity holders and debt holders. However, there is a fundamental difference between the synthetic debt instrument described in Finnerty (1993) and the one studied in this paper. This variance stems from the fact that the equity index securities in the West comprise stocks that are actively traded in the secondary markets, whereas the equity of the government-run enterprise in an emerging Muslim nation may not be traded on any exchange. In the first instance, the risk-neutral valuation argument of the Black-Scholes (1973) option pricing model holds true for synthetic financial instruments involving derivatives.[6] In the second situation, it may not be true. Therefore one has to adopt a partial equilibrium analysis to price synthetic financial vehicles embedding options.

The remainder of this paper is structured as follows: Section 2 provides a theoretical underpinning of a PGB. Section 3 investigates the efficiency of this hybrid security compared to the conventional *ribawi* facility. Finally, Section 4 concludes the study.

2. Modeling the participating debt certificate

To lay the underlying assumptions of our model of an equity-linked vehicle, we consider a two-period model where a representative agent is young in period $t = 0$ and old /retired in period $t = 1$ and beyond. The agent has endowments of w_0 and w_1 in periods 0 and 1, respectively. We assume that the endowment w_0 is perishable and cannot be saved for next period. There are only two assets in this economy: a risky debt and equity of state-owned project. However, the only option available to the agent is to invest in a risky debt certificate issued by the government. In the first period, the agent consumes part of w_0 and loans the remainder to the government. After investing the capital generated from loans, the government realizes a random liquidating value $\tilde{P}_1$ of its project in the second period.[7] The government then pays the agent the nominal (face) value of the loan plus a fixed agreed-upon percentage (Θ) of the realized appreciation of the project from its minimum liquidation value. The agent retires in period 1 and lives off endowment w_1 and the proceeds of the loan.

The analysis described below maximizes the expected utility of wealth of the agent, subject to the budget constraints. The First Order Necessary Conditions (FONCs) from the optimization in conjunction with the Market Clearing Conditions endogenously determine the unique asset pricing parameters of the PGB.

2.1 Modeling objective function of agent

The goal of the representative agent is to optimize the expected utility of wealth:

$$\underset{Q_0,c_0,c_1}{\text{Max.}}\ E_0\{U(c_0) + \gamma U(\tilde{c}_1)\} \tag{1}$$

Subject to the temporal budget constraints:

$$c_0 + Q_0 = w_0 \tag{2}$$

$$\tilde{c}_1 = w_1 + Q_0\left[1 + \Theta\left(\frac{\tilde{P}_1 - P_{10}}{P_{10}}\right)\right]$$

$$= w_1 + Q_0[1 + \Theta\tilde{\delta}] \tag{3}$$

where: $E_0\{\cdot\}$ is the expectation operator at time t.
$U(\cdot)$ is the utility function.
c_0 and $\tilde{c}1$ are the consumption of investor at times $t = 0$ and 1, respectively.
$\tilde{P}_1$ is the liquidating value of the state-owned project at $t = 1$.
P_{10} is the minimum liquidating value of the state-owned project at $t = 1$.
γ is the discount factor (incorporating inflationary expectations).
Q_0 is the amount of funds lent.
w_0 and w_1 are the endowments at times $t = 0$ and 1, respectively.
Θ is the appreciation-sharing parameter.[8]
$\tilde{\delta} = \left(\frac{\tilde{P}_1 - P_{10}}{P_{10}}\right)$ represents the appreciation of the project from that of its minimum liquidating value.[9]

The lagrangian L can be written as follows:

$$L = E_0\{[U(c_0) + \gamma U(\tilde{c}_1)] + \lambda_0[w_0 - Q_0 - c_0] + \lambda_1\gamma[w_1 + Q_0(1 + \Theta\tilde{\delta}) - \tilde{c}_1]\}$$

In the above equation, λ_0 and λ_1 are the lagrange multipliers. The FONCs are given by:

$$\frac{\delta L}{\delta c_0} = 0 \Rightarrow U'(c_0) = \lambda_0, \tag{4}$$

$$\frac{\delta L}{\delta c_1} = 0 \Rightarrow E_0U'(\tilde{c}_1) = \lambda_1, \tag{5}$$

$$\frac{\delta L}{\delta Q_0} = E_0\{\lambda_0(-1) + \lambda_1\gamma[1 + \Theta\tilde{\delta}]\} = 0$$

Using Equations (4) and (5), we get:

$$\frac{\delta L}{\delta Q_0} = E_0\{-U'(\tilde{c}_0) + \gamma U'(c_1)[1 + \Theta\tilde{\delta}]\} = 0,$$

$$\Rightarrow U'(c_0) = \gamma E_0\{U'(\tilde{c}_1)[1 + \Theta\tilde{\delta}]\} \tag{6}$$

The above equation embodies two unknown (Q_0 and θ) within a single equation. One way to solve it is to assume a certain level of risky debt via a market clearing condition given below. This makes it feasible to solve for θ endogenously. Finally, it should be noted that the deterministic budget constraint as depicted in Equation (2) must be satisfied, while the stochastic budget constraint as shown by Equation (3) must hold in every state of the economy in period 1.

2.2 The market clearing conditions

The following conditions are necessary for equilibrium:

(i) For the money market to be in equilibrium: $(Q_0)_{\text{Borrowed}} = (Q_0)_{\text{Lent}} = Q_0$ (7)

(ii) For government debt to be default free: $\Theta \geq 0$ (8)

(iii) For loan to be free of *riba-al-nasi'ah*: $(Q_0)_{\text{Lent}}$ = Funds guaranteed to be returned $= P_{10}$ (9)

(iv) For satisfying the government budget constraint: $\Theta\delta \geq r_s$, where r_s is the total return of state-owned project. (10)

2.3 The model solution for PGB[10,11]

In case of risk averse investor, Equation (6) implies that at the margin the cost of lending equals its associated benefit:

$$U'(c_0) = \gamma E_0\{U'(\tilde{c}_1)[1 + \Theta\tilde{\delta}]\} \quad (6)$$

Substituting the values of c_0 and $\widetilde{c_1}$ from the Budget Constraints and Market Clearing Condition (iii), i.e., Equations (2), (3) and (9), we have:

$$U'(w_0 - P_0) = \gamma E_0\{[U'(w_1 + P_{10}(1 + \Theta\tilde{\delta}))][1 + \Theta\tilde{\delta}]\} \quad (11)$$

Thus, given the exact form of utility function of agent, exogenous endowments and project return-risk distribution, one can iteratively solve for θ in the above equation.

The model solution is given by:

$$c_0 = w_0 - Q_0 = w_0 - P_{10} \quad (12)$$

$$\tilde{c}_1 = w_1 + Q_0[1 + \Theta\tilde{\delta}] = w_1 + P_{10}[1 + \Theta\tilde{\delta}], \text{ where } \Theta \text{ satisfies Equation (11)} \quad (13)$$

Thus, the synthetic debt presented in this paper provides a mechanism for investors to loan funds to the government of an developing Muslim nation without resorting to fixed-interest debt.

3. Efficiency of the participating growth bill

The comparative advantage of a PGB over a ribawi instrument is established first analytically. It is then ratified via a simulation model as follows.

Proposition:

In general a PGB is more efficient than the conventional *ribawi* debt contract.

Proof:

Assume the consumption patterns under the PGB (and the *ribawi* debt) as c_0, (c'_0), and $\tilde{c}_1$ (c'_1) respectively at periods $t = 0$ and 1.

We observe that:

Under the PGB:

$$\tilde{c}_1 = (\tilde{c}_{1i}) \geq w_1 + P_{10} \ \forall \text{ future state } i \text{ of the economy.}$$

Under the fixed-interest debt:

$$c'_1 = c'_{1i} = w_1 + P_{10} \forall \text{ future state } i \text{ of the economy.}$$

The above results emerge because in the worst state of the economy the consumption patterns at times $t = 1$ for the PGB (*ribawi*) security is at least (most) the minimum liquidation value of stock.

Thus $\tilde{c}_{1i} \geq c'_1 \forall$ future state i of the economy.

$$\Rightarrow E_0\{\gamma U(\tilde{c}_1)\} > \gamma U(c'_1)$$

$$\Rightarrow \gamma\{E_0[U(\tilde{c}_1)] - U(\tilde{c}_1)\} > 0 \tag{14}$$

Hence, the expected utility under the hybrid security is much higher than that under the *ribawi* debt. That is, the PGB dominates fixed-interest debt in the sense of First-Order Stochastic Dominance.

Now, assuming Q_0 (Q'_0) to be the price of synthetic (fixed-interest) debt, we have:

$$Q_0 = P_{10} > Q'_0 = \frac{P_{10}}{(1 + i)}$$

Even though $Q_0 > Q'_0$ the difference between the two loan prices is not that discernible. The reason for this is that in general the marginal rate of substitution (MRS) for a risky loan is lower than that of a *ribawi* loan. This results in

$$c_0 = (w_0 - Q_0) < c'_0 = (w_0 - Q'_0)$$

$$c_0 = (w_0 - P_{10}) < c'_0 = \left[w_0 - \frac{P_{10}}{(1 + i)}\right]$$

Here again the difference between c_0 and c'_0 is also not that substantial.

$$\Rightarrow U(c_0) < U(c'_0)$$

$$\Rightarrow [U(c'_0) - U(c_0)] > 0 \tag{15}$$

Now, the purpose of a savings facility is to assist individuals to shift consumption from early periods of abundant resources to later periods of scarce resources. This established the fact that c_0 (& c'_0) >> c_1 (& c'_1). From the property of diminishing marginal utility of consumption one can deduce that the discounted marginal gain in welfare in the final period between a PGB and *ribawi* vehicle exceeds the loss in the same for the initial period.

$$\Rightarrow \gamma\{E_0[U_1)]-U(c'_1)\} > [U(c'_0) - U(c_0)]$$

$$\Rightarrow E_0\{U(c_0) + \gamma U(\tilde{c}_1)\} > \{U(c'_0) + \gamma U(c'_1)\} \quad (16)$$

Thus, a PGB in general improves social welfare over that of a comparable *ribawi* debt instrument.

Verification of Proposition via Simulation:

The simulation methodology involved solving the model for risk-averse investors under the following assumptions:

1. Agents in the economy exhibit a Constant Relative Risk Aversion (CRRA) utility function. This presumption has some credence in the real world as demonstrated by Blume and Friend (1975) in their Federal Reserve Board survey.

   Thus, with a CRRA utility function of the form: $U(c_i) = \left(\frac{[c_i]^{1-\alpha}}{1-\alpha}\right)$.

   We have $U'(c_i) = \left(\frac{1}{[c_i]^{\alpha}}\right)$.

   The values of α selected were in the range [0.05, 0.7]. The reason for this is that for higher values, one either gets unrealistic values of θ, or solutions which are not feasible.
2. The state-owned project exhibits (i) a binomial distribution with the probabilities of the good (p) and bad state ($1-p$) to equal 0.5; (ii) the minimum liquidating value of the assets of the project (P_{10}) in the vicinity of $\left(\frac{w_0}{2}\right)$; (iii) the appreciation in the good state (δ) to equal 47.18% and the total return (r_s) to equal 154%. These values were inferred from the distribution of the ex-post returns of common stocks in the USA from 1929–1989 (see Ibbotson and Sinquefield, 1990).
3. The values of endowments are selected such that $w_0 >> w_1$ and the discount factor γ is selected in a range [0.9, 1.05].

One such simulation is exhibited in Fig. 3. Here $\alpha = 0.1$, $w_1 = 0.1$, $P_{10} = 1$ and $\gamma = 0.95$. The optimal parameters θ, i, Q'_0 and the sum of utilities are evaluated for both financing schemes using *Mathematica 2.2 Program* for different values of w_0 starting from an initial value of 2. It is found that as w_0 increases keeping w_1 constant at 0.1, consumption smoothening results in a declining value of θ and i. This induces a reduction in the difference between the utilities of the two financing modes (namely PGB and *ribawi* debt). This difference in utilities only becomes negative for unrealistic (negative) values of θ and i. The same pattern is observed if one keeps (i) w_0 constant and decreases w_1, or (ii) keeps w_0 and w_1 constant and increases γ. One can therefore deduce that in general a PGB is more proficient than a conventional *ribawi* vehicle.

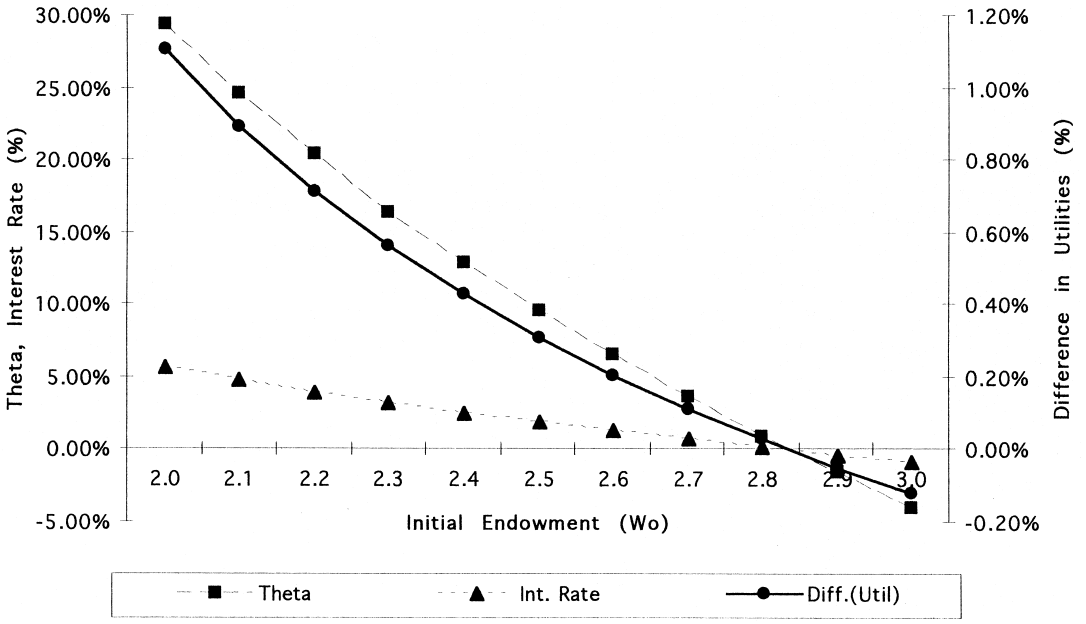

Fig. 3. Efficiency of participating growth bill over *Ribawi* debt

The results of this subsection has several implications listed as follows:

1. The efficiency of PGB over a *ribawi* vehicle illustrates that the mode of financing does matter. This conclusion is contrary to the result of the Capital Structure Irrelevance Theorem of Modigliani and Miller (MM, 1958). This distinct result stems from the fact that the current study optimizes the welfare of one stakeholder of the firm under risk aversion in contrast with MM (1958), who model both stakeholders (debt+equity) under risk neutrality.[12]
2. The above result is also different from the well know Capital Asset Pricing Model (CAPM see Sharpe, 1964), where the pricing of assets in the economy depend primarily on the covariance of the asset being studied with respect to the Market portfolio. Individuals (in CAPM setting) select a portfolio comprising a fraction of the following exogenously given assets: Risk-free (*ribawi*) debt and Risky equity (Market) portfolio depending on the degree of risk aversion. Highly risk averse individuals would opt for a portfolio comprising of only *ribawi* debt and vice versa. Contrary to the CAPM, the current model derives the pricing of risky (PGB) as well as risk-free assets endogenously and establishes the dominance of one over the other. The endogenous pricing variables are determined by the discount factor (γ), degree of risk-aversion (α), endowment level (w_0, w_1) and the return-risk distribution of the project ($p's$, P_{10}, $\tilde{g}$, $\tilde{r}_s$).
3. A PGB is *allocatively more efficient* than a *ribawi* debt security as the amount loaned is generally higher. This enhances the availability of funds for projects.

Table 1
Comparing hypothetical ex-post rates of return of a stock-index C.D.

Period	Inflation (%)	T. bills (%)	Citibank's stock index account (%)	S&P 500 total return (%)
1981–85	26.70	63.30	23.40	98.30
1982–86	17.60	51.10	83.70	147.60
1983–87	18.30	44.20	94.40	114.40
1984–88	18.90	40.90	77.00	103.90
1985–89	19.80	39.00	112.90	152.50
1986–90	22.40	39.10	74.90	85.70
1987–91	24.70	38.40	63.40	104.40
1988–92	23.00	38.60	79.40	109.00

Source: Ibbotson and Sinquefield (1990) and *Kiplinger's Personal Financial Magazine* (1993).

4. Conclusion

A participating-growth bill can be described as a combination of a *qardh hasan* security and fractional units of Call Option (on the equity of the government's project), in such a way that the inflationary shield (πQ_0) offsets the call premium (θC_0), yielding a security where only the principal is nominally guaranteed and the lender participates in the appreciation of the businesses under the control of the government. The paper modeled a PGB under the situation where the Black-Scholes (1973) risk-neutral valuation is not feasible. The hybrid security was found to be more efficient than a comparable *ribawi* debt vehicle. This result was contrary to the prediction of (i) the Capital Structure Irrelevance Theorem (see Modigliani and Miller, 1958) in the sense that the result demonstrated that *how you finance a project does matter;* and (ii) the Capital Asset Pricing Model (see Sharpe, 1964) in the sense that the result showed that *one cannot delineate clientele of securities purely based on the degree of risk aversion*.

Recently a number of sovereign governments as well as financial institutions have begun offering this instrument with minor variances (see Brennan, 1993; Finnerty, 1993; and Granito, 1993). Table 1 shows the hypothetical performance of one version of this security termed as a stock-index certificate of deposit offered by Citibank in the United States. It should be noted that total return on common stocks comprises both appreciation and dividends. This is the prime reason why some institutions like Citibank offer more than 100% of the appreciation of the stock index in the United States. The ex-post returns in general exceed that of the Treasury Bills except during the period 1981–85. This is due to the fact that the options embedded in Citibank's C.D. are Asian Options—where the appreciation is based on the average price of the option's life. A government of an emerging Muslim nation can float a similar security without privatization of the state-owned assets. The government of Malaysia, Qatar, Saudi Arabia, Sudan or that of UAE can borrow an amount equal to the minimum liquidating value of the government's stock, promising to pay it back without any fixed interest. The lender in return is entitled to a fraction of the appreciation of the venture. The government can enhance the appeal of these vehicles by

absorbing the cost of the call option in a manner similar to that of small companies in the United States, who induce clients to purchase their bonds packaged with free warrants. The government can further make this form of financing more attractive to the general public by not taxing the returns. In contrast, most governments fully tax the interest income from the conventional Treasury Bills.[13]

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Notes

1. Al-Qaradawi (1984) is of the view that *riba-al-nasi'ah* has been forbidden not only by the Quran, but also by the scriptures of the Prophets preceding Muhammad (PBUH) such as the Old Testament and the Gospel according to Luke.
2. Another related issue in the mainstream literature is that of the Equity-Premium Puzzle, where it has been difficult for financial economists to rationalize why the risk adjusted returns of common stocks exceed that of bonds (see Mehra and Prescott, 1985; and Siegel, 1992).
3. A suggestion made by some Islamic economists is to raise funds for short-term by selling stocks of government owned assets. This is not feasible for two reasons. Selling stocks (with voting rights) would imply losing control of the project (see Harris and Raviv, 1988). Investors also do not like to participate in equities for the short-term as the risk measured by standard deviation of stock returns is very high. This risk reduces as one increases the time horizon (holding period) of investment. This issue is termed as the time diversification of equity (see Loyd and Modani, 1983).
4. The controversy surrounding Options (*Al-Ikhtiyarat*) is extensively discussed by Kamali (1997). He refers to the research of contemporary scholars who have deemed it unacceptable in Islam. These include Ahmad Muhayyuddin Hasan, Shannat al-Jundi, Abu Sulayman and Ali 'Abd al-Qadir. Kamali refutes their arguments by comparing Options with the classical Islamic contingency instrument of *Bai'al-*

'Urban which is permissible in the Hanbali school (and by some contemporary scholars such as Yusuf al-Qaradawi and Mustafa al-Zarqa). He relies on the research of prominent Hanbali jurists such as Ibn Taymiyah, Ibn Qayyim al-Jawziyyah and Ibn Qudamah to conclude that it is permissible to trade Options for a premium (price) as they do not involve *riba* or *gharar*. This landmark opinion should pave the way for acceptance of Options (and PGB) in not only countries like Saudi Arabia, which follows the Hanbali school, but also in countries which have a more liberal interpretation of the *Shariah*. These would include Malaysia, Qatar, Sudan and UAE.

5. Inspite of the infancy of financial markets in the Muslim East, there are Jordanian banking groups using participation notes and income bonds to finance projects built by the country's Ministry of Islamic Endowment and Religious Affairs (see Khan, 1983). Participation Term Certificates are also used in Pakistan (see Qureshi, 1990). See also Kahf (1992) for further discussion.
6. If a Muslim government floats a hybrid security (comparable to a PGB) against assets continuously trading on a stock exchange, then it can be priced as synthesized in Figure 2.
   Initial loan amount $= Q_0$
   Maturity value of Loan $= Q_0 - \pi Q_0 \; \forall \; s < s_1$
   $= Q_0 - \pi Q_0 + \theta C_T \; \forall \; s \geq s_1$, where π is the expected inflation rate, C_T, C_0 are the maturity and initial value of all prices and θ is the profit sharing ratio given by the equation:

$$\theta = \frac{\pi Q_0}{C_0}.$$

7. It should be noted that the probability distribution of this variable $\tilde{P}_1$ is known e*x-ante* to both the government and the lenders.
8. θ signifies the percentage of appreciation of asset allocated to the investor.
9. In a truly stochastic environment $\exists \; \delta_j > 0$ for some state *j* in period 1. There is at least one state with $\delta_j = 0$. However, there are no states for which $\delta_j < 0$. Thus $E_0(\tilde{\delta}) > 0$.
10. The solution implicitly assumes that there are no initial capital constraints, i.e., $w_0 > Q_0 = P_{10}$.
11. The model solution for the conventional (*ribawi*) debt security is documented in the Appendix which is available upon request from the author.
12. The result would revert to that of MM(1958) Theorem only under risk neutrality (RN) of agents in the economy. This is because under RN (i) MRS equals one and (ii) the discounted marginal gain in utility between PGB and *ribawi* financing in the final period equals the loss of the same in the initial period.
13. Siegel (1992) reported negative after-tax real rate of returns of Treasury Bills in the United States of about −.3% over the period 1926–1990.

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