

## A Macroeconomic Model of an Interest-free System

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A number of economic models have been designed to evaluate and analyse the Islamic banking system. However, less attention has been paid to macro model-building in an Islamic framework even though most of the Keynesian, Classical, and Neo-classical economic systems are compatible with the tenets of Islamic economics. In this paper an interest-free economic system is formulated in terms of the familiar Neo-classical macroeconomics models. Even though the rules of conduct for Muslims in an Islamic economic system are different from those in the non-Islamic economic systems, it is shown that the Islamic economic system does exhibit properties that are consistent, reasonable, and familiar. For example, under some reasonable simplifying assumptions, the model shows that savings and investment do not necessarily have to fall because of the institution of an Islamic economic system, as some economists suggest. These depend on the rate of return on *mudarabah* investment, just as they depend on the rate of return on investment (profits) in a credit-based economic system. These could be higher, lower, or remain the same relative to their levels in a credit-based economy under different conditions. The model also shows the impact of fiscal and monetary policies on the rate of inflation, the rate of return on *mudarabah*, and therefore on the investment demand. The model shows that, in general, an economic system based on Islamic principles is viable; it also provides unique solutions for income, employment, and prices.

### INTRODUCTION

Even though the notion of an interest-free system is shrouded in mystery, it is very simple and familiar. An interest-free economic system can be expressed in terms of the familiar neo-classical and Keynesian macroeconomic models that are usually used to examine the credit-based capitalist economies. Even though the rules of conduct for Muslims in an Islamic economic system are different [see Khan (1986); Zangeneh and Riely (1990)] from those of the non-Islamic economic systems, it can be shown that the Islamic economic system does exhibit properties that are consistent, reasonable, and familiar.

Even though there are many other models available, due to the centrality of interest-free banking, most of these models, such as the ones provided by Khan (1986); Khan and Mirakhor (1986); Khan (1984) and Khan (1986), are designed to analyse banking and central banking. Khan (1986) provides a "theoretical descrip-

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*Author's Note:* I would like to express my appreciation for the comments and suggestions made by the referee. They improved the quality and accuracy of the paper. However, I alone remain responsible for any remaining error or shortcoming.

tion of the Islamic banking system by formulating a relatively simple model that explicitly incorporates the constraints imposed by religion on the conduct of financial transactions" (p. 18). He finds that Islamic banking in an "Islamic system may well prove to be better suited to adjusting to shocks" because "shocks to asset positions are immediately absorbed by changes in the values of shares (deposits) held by the public in the bank. Therefore the real values of assets and liabilities of banks in such system would be equal at all points in time" (1986, p. 19); Mohsin Khan and Abass Mirakhor describe how a financial system with Islamic characteristics functions. Their analysis "indicates that there is apparently no fundamental change in the way the monetary policy affects economic variables in an Islamic system... While institutions and financial instruments may be quite different in an Islamic economy, the standard macroeconomic result, for example, that an expansionary monetary policy would reduce rates of return and increase output in the short run, carries through. What the authorities do lose in the process is the ability to set directly financial rates of return..." (1986, p. 8).

Shahrukh Rafi Khan analyses the consequences of supplanting interest with a profit-loss scheme on the loanable funds. He finds that "essentially the same market forces are operative... Risk assumes a much more critical role in a financial market which allows PLS as the only form of investment since the returns are variable... [L]enders will be less well off unconditionally if risk-free assets with positive return are eliminated... However, it was not possible to theoretically establish how the welfare of lenders would be affected ..." (1984, p. 122).

Khan (1986) develops a system to compare an Islamic framework with a traditional one. He finds that "under [a] certain set of assumptions, the Islamic financial scheme was superior to the traditional scheme because of the risk-spreading character of the former. But when ... the assumption of asymmetric information between lender and investor was relaxed, the debt contract emerged as the efficient type of contract because it minimises the monitoring costs associated with asymmetric informant." (p. 104).

There are others, such as the ones provided by ul Haque and Mirakhor (1986); and Kahf (1982), which are designed to deal with a segment of the Islamic economic system. Nadeem ul Haque and Abbas Mirakhor devise a model to analyse the "Islamic profit-sharing financial contracts and their implications ... for both [the] case of certainty and the case of uncertainty with and without complete information..." They find that for an investor within the context of a "principle-agent problem" in a certain world with full information, "the elimination of interest would have no consequences. When uncertainty is introduced, however, conditions are derived under which investment would increase or stay the same." [ul Haque and Mirakhor (1986), p. 141]. Monzer Kahf analyses the saving-consumption behaviour of Muslims under an Islamic economic system. He shows "that in an Islamic soci-

ety, a non-governmental, religiously motivated redistribution of income takes place. This results in increasing the aggregate consumption” [Kahf (1982), p. 107].

A pivotal principle of Islamic economics is the absence of a pre-determined fixed interest or interest rates in its financial operations. Therefore, obviously, any suggested micro or macro model, such as the one presented in this paper, must be devoid of any such consideration and economic decisions must be made to be equity-based rather than debt-based. The general framework used in this paper is a modified version of the interest-based aggregate macroeconomic models developed by Sargent (1979); Anwar (1981), and others. The usefulness of the model is that it can be used to show some of the properties of an interest-free system within an already familiar framework of neo-classical macroeconomics models. That is, as it has been proposed by others, this analysis shows that “standard economic concepts and methods can be fruitfully employed to analyse issues in Islamic economics” [Khan (1986), p. 18].

**Production Function**

Leaving the usually controversial problems of aggregation aside, one can express total output of the economy in terms of homogeneous capital and labour:

$$y = F(K, L) \quad F_k, F_l > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

$$(w/p) = F_l(K, L) \quad F_{ll} < 0, F_{lk} > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (1')$$

$F_l$ , the marginal product of labour, represents the demand for labour. Supply of labour follows a traditional formulation:

$$L = L(w/p) \quad L_{w/p} > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (1'')$$

**Investment Function**

$F_k$ , the marginal product of capital, represents the demand for investment. In an interest-free (equity-based) economy, investment takes place up to the point where the marginal product of capital is equal to the user cost of capital. The user cost of capital is equal to the depreciation rate of capital,  $\delta$ ; plus the profit rate of the capitalist (financiers),  $s_m m$ , [Note that total profits of the firm,  $m$ , are divided between the capitalist (financiers) and the entrepreneurs. Assuming that it is agreed that  $s_m$  is the share of the capitalist, then  $s_m m$  goes to the capitalist (financiers) and the remainder,  $(1 - s_m)m$ , goes to the entrepreneurs];<sup>1</sup> plus the tax rate;  $\tau$ , minus the

<sup>1</sup> $s_m$  is the same as lambda used by ul Haque and Mirakhor.

change in the value of capital due to inflation,  $\pi$ . It is important to note that even though there is an *ex ante* agreement between the capitalist and the entrepreneur on the level of  $s_m$ , since  $m$  is not known, there is no certain prior knowledge about the rate of return on capital. That is, even though  $s_m$  is fixed by contract,  $s_m m$  is not fixed ( $s_m m$  is the capitalist's or financier's share of the profits. One must remember that the capitalist's share is not a cost to the entrepreneurs. They share the profits according to the agreement over  $s_m$  which is assumed to be a prevalent "normal rate" in the market). Therefore, the fact that  $s_m$  is known in advance is not in violation of the *shari'ah*.

Now we can write an investment demand function which relates the accumulation of capital over time to the ratio of the gap between the marginal product of capital and the user cost of capital,  $F_k - (s_m m + \delta + \tau - \pi)$ , to the cost of capital,  $s_m m - \pi$ .

$$\frac{dk}{dt} = I = I\left(\frac{F_k - (s_m m + \delta + \tau - \pi)}{s_m m - \pi}\right) \quad I' > 0$$

Let:

$$q = \left(\frac{F_k - (s_m m + \delta + \tau - \pi)}{s_m m - \pi}\right) + 1 \quad \dots \quad \dots \quad \dots \quad \dots \quad (2)$$

or:

$$q = (K, L, s_m m - \pi, \delta, \tau) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2')$$

Now we can write:

$$I = I(q - 1) \quad I' > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (2'')$$

### Consumption Function

Suggestions have been made that consumption will increase (i.e., saving will decrease) as a result of the introduction of an Islamic banking system [Proyer (1985)]. This statement has been made based on the belief that the elimination of an explicit fixed rate of interest would encourage people to consume now rather than in the future. Also, it is argued that the introduction of an Islamic banking introduces a higher risk, which leads to a higher uncertainty for the public. This would lead to a higher consumption and lower saving. ul Haque and Mirakhor (1986) show the "increased uncertainty regarding the rate of return to saving [as leading] to reduced saving to be far from obvious, and the best that can be said, in the absence of strong

and restrictive assumption about risk aversion factor and/or utility index, is that the effect is indeterminate". Khan (1986) argues that the level of interest rates is determined by "the governments and hence it plays little if any role in determining the level of saving. In fact, saving decisions are strictly based on the level of income" (p. 87). These conclusions and observations have been reached without considering the religious belief of an individual Muslim against earning interest, which would, in any case, override the purely economic considerations inherent in the argument. If religious motive is taken into consideration, there is no reason to believe that saving will decrease due to the elimination of interest from the economic system. As it was argued by others, saving might even increase as Muslims choose a simpler life-style purported to be more in line with a pious tradition.

Another controversy is about the level of the Marginal Propensity to Consume (MPC) and, therefore, the Marginal Propensity to Save (MPS). There are those, such as [Arif (1982), p. 3] and Khan (1982), who believe that Muslims is expected to live a simple life and discharge their duties. In this world, they live a pious life and save for hereafter. If so, one could argue that the MPC for a Muslim economy would be significantly low. This argument, however, is based on the assumption that one could not conduct his/her obligations unless one lived a simple life, a point which is debatable. It is more of a value judgement than a religious requirement. The Qur'an does admonish the believers about wanton consumption. But the question of what is excessive is subjective and there are no hard demarcation lines in the Qur'an drawn between what is necessary and what is not necessary.

On the other hand, there are those who argue that if people behave as good Muslims, there is a good chance that income distribution and redistribution will provide more resources to those who have been less fortunate with worldly wealth. If so, the pent-up demand for goods would cause a significant increase in the MPC of a Muslim country—and, as a result, a lower MPS and lower investment. Evidently, this issue must be settled empirically.

Theoretically, the decisions to consume now or in the future (saving) are based on the assumption that the individual tries to maximise utility subject to a budget constraint. Let us assume that the underlying utility to be maximised is logarithmic. That is:

$$U(c) = \ln c \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3)$$

$$U' = 1/c \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3a)$$

$$U'' = -1/c^2 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (3b)$$

$U(c)$  has the usual properties associated with a utility function; i.e., marginal

utility,  $(1/c)$ , is positive; marginal utility is diminishing,  $(-1/c^2)$ ; each period of consumption is independent of consumption in all other periods (they are additively separable over time); we also assume that future consumption is discounted at the consumer rate of discount,  $\mu$ . Given these assumptions, we can write:

$$U = \text{inc}_0 + \frac{\text{inc}_1}{1 + \mu} + \frac{\text{inc}_2}{(1 + \mu)^2} + \frac{\text{inc}_T}{(1 + \mu)^T} \dots \dots \dots (4)$$

$$U = \sum_0^T \frac{\text{inc}_t}{(1 + \mu)^t} \dots \dots \dots (5)$$

Also the consumer faces a budget constraint, which is:

$$\sum_0^T \frac{c_t}{(1 + s_m m)^t} = \sum_0^T \frac{y_t}{(1 + s_m m)^t} \dots \dots \dots (6)$$

This inter-temporal budget constraint implies that the present value of total, lifetime consumption cannot, in the absence of bequests, exceed the present value of their total, lifetime income. The discount rate used is the rate of profit on *mudarabah* projects.

So the consumer's problem is to:

$$\text{Max } U = \sum_0^T \frac{\text{inc}_t}{(1 + \mu)^t} \dots \dots \dots (7)$$

$$\text{S. T. } \sum_0^T \frac{c_t}{(1 + s_m m)^t} = \sum_0^T \frac{y_t}{(1 + s_m m)^t} \dots \dots \dots (8)$$

The solution to this problem could be found by using the Lagrange multiplier method:

$$U = \sum_0^T \frac{\text{inc}_t}{(1 + \mu)^t} + \Omega \left[ \sum_0^T \frac{c_t}{(1 + s_m m)^t} - \sum_0^T \frac{y_t}{(1 + s_m m)^t} \right] \dots (9)$$

From this expression one can find the following first-order conditions:

$$\frac{\partial L}{\partial c_0} = \frac{1}{c_0} - \Omega = 0 \dots \dots \dots (10)$$

$$\frac{\partial L}{\partial c_t} = \left[ \frac{1}{(1 + \mu)^t} \right] \left[ \frac{1}{c_t} \right] - \left[ \frac{\Omega}{(1 + s_m m)^t} \right] = 0 \quad \dots \quad \dots \quad (11)$$

Using (9) and (10) one could derive an inter-temporal consumption relation:

$$\left[ \frac{1}{(1 + \mu)^t} \right] \left[ \frac{1}{c_t} \right] = \left[ \frac{1}{c_0} \right] \left[ \frac{1}{(1 + s_m m)^t} \right] = 0 \quad \dots \quad \dots \quad (12)$$

Or:

$$\frac{(1 + s_m m)^t}{(1 + \mu)^t} = \frac{c_t}{c_0}$$

Let  $t = 1$ , then:

Or

$$c_t = \frac{(1 + s_m m)^t}{(1 + \mu)^t} c_0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (13)$$

This inter-temporal consumption relationship implies that consumption expenditures will be postponed (higher saving will take place), kept at the current rate (same saving will take place), or decreased (lower saving will take place) if  $s_m m$  (return on *mudarabah* investment by an investor) is higher than  $\mu$ , equal to  $\mu$ , or less than  $\mu$ , the subjective discount rate of consumers. This implies that as long as  $s_m m$  is greater than  $\mu$ , it pays to postpone consumption to maximise utility. Therefore, whether or not saving will be higher, lower, or the same as before, the institution of an Islamic economic system depends on the rate of return on the *mudarabah* projects  $s_m m$  relative to  $\mu$ , the subjective discount rate of consumers. We can predict consumption at time  $t$ ,  $c_t$ , if we knew  $c_{t-1}$ ,  $s_m m$  and  $\mu$ . In other words,  $c_{t-1}$  contains all the information needed to predict future consumption.

From this maximisation we can write an operational consumption function using either the permanent income hypothesis or the life-cycle hypothesis. That is, by assuming that the present consumption depends on the present value of the future stream of income, one can write:

$$C_t = f_t(PV) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (14)$$

Multiplying the present value of future income by a rate of return,  $m$ , will result in permanent income:

$$y = m PV$$

So we can write:

$$C = yd = C(y - T, s_m m) \quad C_1 > 0, C_2 < 0 \quad \dots \quad \dots \quad \dots \quad (15)$$

The perceived real disposable income is the disposable income net of transfer payments; minus the depreciation of capital; minus the loss of financial assets due to inflation; plus net increase in equity from investment,  $(dK/dt = I)$ .

$$yd = y - (T - TR) - \delta K - [(M + \phi)/p] \pi + (q - 1) I \quad \dots \quad \dots \quad (16)$$

where:

$T$  = taxes;

$TR$  = transfer payments;

$p$  = average price level;

$\delta$  = rate of depreciation in capital stock;

$(M + \phi)/p$  = real value of money and *mudarabah* assets;

$y$  = real income;

$yd$  = disposable income;

$M$  = nominal money supply; and

$$q = \left( \frac{F_k - (s_m m + \delta + \tau - \pi)}{s_m m - \pi} \right) + 1$$

### Demand for Money

Households and firms hold money because it provides them with some utility—the convenience of using it as the medium of exchange, now and in the future. Households' demand for real money balances is a portfolio decision which depends on the households' real income,  $y$ , and the opportunity cost of holding money,  $s_m m$ . Households will increase their holding of real balances as their income increases while they will lower their holding of real balance as their opportunity cost of increases.

$$M^d = M^d(y, s_m m) \quad M_1 > 0, M_2 < 0 \quad \dots \quad \dots \quad \dots \quad (17)$$

### Model Solution

The following model comprises 7 equations and 7 unknowns ( $C, I, L, w/p, y,$



$p$ , and  $s_m$ ) to be solved in a classical system. In this case, the model exhibits dichotomy of the aggregate demand and aggregate supply.

$$y = F(K, L) \quad F_k, F_l > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (1)$$

$$(w/p) = F_l(K, L) \quad F_{ll} < 0, F_{lk} > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (1')$$

$$L = L(w/p) \quad L' > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (1'')$$

$$I = I(q - 1) \quad I' > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (2'')$$

$$C = C(y_d, s_m m - \pi) \quad C_1 > 0, C_2 < 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (15)$$

$$\frac{M}{p} = M(y, s_m m) \quad M_1 > 0, M_2 < 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad (17)$$

$$y = C + I + G \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (18)$$

Let  $s_m m - \pi = \sigma$  Linearising the system, we have:

$$dy = F_l dL + F_k dK \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (19)$$

$$d(w/p) = F_{lk} dK + F_{ll} dL \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (20)$$

$$dL = L' d(w/p) \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (21)$$

$$dI = I' [ql dL + qk dK + q\sigma (m ds_m + s_m dm - d\pi)] \dots \quad \dots \quad \dots \quad \dots \quad (22)$$

$$dC = C_1 dy_d + C_2 (m ds_m + s_m dm - d\pi) \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (23)$$

$$\left[\frac{dM}{p}\right] - \left[\frac{dp}{p}\right] \left[\frac{M}{p}\right] = M_1 dy + M_2 (m ds_m + s_m dm) \dots \quad \dots \quad \dots \quad (24)$$

$$dy = dC + dI + dG \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (25)$$

$$dy_d = dy - (dT - dTR) - \delta K - \delta dK$$

$$- ((M + \phi)/p)d\pi - \pi [(dM + d\phi)/p - ((M + \phi)/p) (dp/p)]$$

$$+ dI (q - 1) + I [qk dK + ql dL + q\sigma (m ds_m + s_m dm - d\pi)] \quad \dots \quad (26)$$

Since the system shows dichotomy, one can use Equations 19, 20, and 21 and solve for the real wages, employment, the real output.

$$d(w/p) = \frac{F_{lk}^+}{1 - L' F_{ll}^+} dK > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (27)$$

$$dL = L' \frac{F_{lk}^+}{1 - L' F_{ll}^+} dK > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (28)$$

$$dy = F_k \frac{+F_l L' F_{lk}^+}{1 - L' F_{ll}^+} dK > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (29)$$

Equations 27, 28, and 29 show, as expected in a classical framework, that change in real wages, employment, and the real output are the increasing function of the change in the real capital stock. There is no presence of a fiscal or a monetary parameter to influence the real wages, employment, or the real output. All are determined by the factors of production and the technology.

By totally differentiating Equation 2 we have:

$$dq = \frac{1}{s_m m - \pi} [F_{kk} dK + F_{kl} dL - q(s_m dm + m ds_m - d\pi)] \quad \dots \quad (30)$$

Using Equation 30 we could find the effects of  $L$ ,  $K$ , and  $s_m$  on  $q$  (i.e., on the gap between the marginal product of capital and the cost of capital).

$$ql = \frac{F_{kl}^+}{s_m m - \pi} > 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (30')$$

$$qk = \frac{F_{kk}^-}{s_m m - \pi} < 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (30'')$$

$$q\sigma = \frac{(-)q}{s_m m - \pi} < 0 \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (30''')$$

That is,  $q$  is an increasing function of employment,  $L$ , and a decreasing function of capital,  $K$ , and a decreasing function of the real share of profits paid to the capitalist,  $s_m m - \pi$ . This implies that an increase (decrease) in the bank's (capitalist's or financier's) share of the profits will decrease (increase)  $q$  and, therefore, also the investment and capital accumulation.

Using Equations 22, 23, 24, and 26 and assuming  $dK = dL = dy = dTR = d = 0$  for simplicity, one can write:

$$\begin{aligned}
 & - [C_1 ((M + \phi)/p) + \{C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I]\} d\pi \\
 & + m \{C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I]\} ds_m \\
 & + s_m \{C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I]\} dm + dG - C_1 dT \\
 & - C_1 \pi [(dM + d\phi)/p - ((M + \phi)/p) (dp/p)] = 0 \quad \dots \quad \dots \quad \dots \quad (31)
 \end{aligned}$$

Using Equation 31, we can write:

$$\frac{ds_m}{d\pi} = \frac{\begin{matrix} + & + & + & + & - & - & + & + & + & + & + & + \\ C_1 & ((M + \phi)/p) & + & \{C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I]\} & \end{matrix}}{\begin{matrix} - & - & + & + & + & + & + \\ C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I] \} dm & \end{matrix}} \quad \dots \quad (32)$$

Equation 32 shows the impact of the change in inflation rate on the share of the capitalist in the *mudarabah* investment. It may be positive or negative depending on the sign of the numerator. That is, it depends on whether  $|[C_1 ((M + \phi)/p)]|$  is greater or less than  $|C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I]|$ . This implies that an inflationary policy may have a positive or negative impact on the banks' share in *mudarabah* investments.

$$\frac{ds_m}{dG} = \frac{-1}{\begin{matrix} - & - & + & + & + & + & + \\ C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I] \} dm & \end{matrix}} > 0 \quad \dots \quad \dots \quad (33)$$

$$\frac{ds_m}{dT} = \frac{C_1}{\begin{matrix} - & - & + & + & + & + & + \\ C_2 + q\sigma [(C_1 (q - 1) + 1)I' + C_1 I] \} dm & \end{matrix}} < 0 \quad \dots \quad \dots \quad (34)$$

Equations 33 and 34 show the effects of fiscal policy on the banks' share of the *mudarabah* investment. An expansion of the government budget or a tax-cut would raise the banks' share of the *mudarabah* investment.

One could choose the following six equations and solve the model in a Keynesian tradition for  $y, L, C, I, s_m, p$ . In this framework, since there is one equation less, one could solve for six endogenous variables. Therefore, we must assume that the nominal wage rate is exogenous.

$$dy = F_l dL + F_k dK \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (35)$$

$$\left[\frac{dw}{w}\right] - \left[\frac{dp}{p}\right] = \frac{F_{ll}}{F_l} dL \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (36)$$

$$dI = I' [ql dL + qk dK + q\sigma (m ds_m + s_m dm - d\pi)] \dots \quad \dots \quad \dots \quad (37)$$

$$dC = C_1 dy_d + C_2 (m ds_m + s_m dm - d\pi) \quad \dots \quad \dots \quad \dots \quad \dots \quad (38)$$

$$\left[\frac{dM}{p}\right] - \left[\frac{dp}{p}\right] \left[\frac{M}{p}\right] = M_1 dy + M_2 (m ds_m + s_m dm) \quad \dots \quad \dots \quad (39)$$

$$dy = dC + dI + dG \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (40)$$

Solving for  $dL$  and substituting it in Equation 35, we can write:

$$dL = \frac{1}{F_l} dy \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (41)$$

$$\left[\frac{dp}{p}\right] = \left[\frac{dw}{w}\right] \left[\frac{F_{ll}}{F_l^2}\right] dy \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad \dots \quad (42)$$

By combining 37, 38, 40, 41, and 42 and assuming for simplicity that  $dK = dTR = d\delta = 0$ , one can write an equation for the "IS" curve as follows:

$$\begin{aligned} (1 - C_1 - I' ql \frac{1}{F_l}) dy &= dG - C_1 dT \\ + m(I' q\sigma + C_2) ds_m + s_m(I' q\sigma + C_2) dm &- [I' q\sigma + C_1((M + \phi)/p) + C_2] d\pi \\ - C_1 \pi((dM + d\phi)/p) - C_1 \pi((M + \phi)/p) (dp/p) &\dots \quad \dots \quad \dots \quad (43) \end{aligned}$$

In this framework, the fiscal and monetary policies will influence the real wages, employment, and real output. To see this, one can take derivative of 43 with respect to  $dG$  and  $dT$ .

$$\frac{dy}{dG} = \frac{1}{(1 - C_1 - I' ql \frac{1}{F_i})} \dots \dots \dots (44)$$

and

$$\frac{dy}{dT} = \frac{-C_1}{(1 - C_1 - I' ql \frac{1}{F_i})} \dots \dots \dots (45)$$

Signs of 44 and 45 are positive and negative respectively, if the marginal propensity to save,  $(1 - C_1)$ , is greater than the marginal propensity to invest out of income,  $I' ql (1/F_i)$ . Note that  $I = I(q)$ ;  $q = q(L)$ ; and  $y = y(L)$ , so we can write:

$$\frac{\partial I}{\partial y} = \frac{\partial I}{\partial q} = \frac{\partial q}{\partial L} = \frac{\partial L}{\partial y} I' ql (1/F_i) \dots \dots \dots (46)$$

which is the marginal propensity to invest out of income, a condition which is not unreasonable to assume.

**CONCLUSION**

In this paper a simple economic model was devised to explain a behavioural relationship, and to assess its properties, in an economy where an interest rate is replaced by a rate of return on equity. The exercise shows that an economic system based on the Islamic (interest-free) principle is viable and provides unique solutions for income, employment, and prices in a classical or a Keynesian framework. As it has been stated by others, one can *modify and use* the models that have been developed for the credit-based economies to show the properties of the Islamic welfare state. This paper demonstrates that the Islamic economic system does exhibit properties that are consistent, reasonable, and familiar.

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