Proceedings of the Second Harvard University Forum on Islamic Finance: Islamic Finance into the 21st Century
Cambridge, Massachusetts. Center for Middle Eastern Studies, Harvard University. 1999. pp.63-75

The Survival of Islamic Banking

A Micro-evolutionary Perspective

Mahmoud A. El-Gamal·

ABSTRACT

Many economists have studied the macroeconomic properties of interest-free banking in the framework of an isolated and ideal Islamic economy. In this age of integrated global financial markets, it is important to consider an alternative model where interest-based and interest-free banking co-exist. An evolutionary game-theoretic model in which strictly Muslim agents (who use profit- and loss-sharing), regular interest-based banks, and hybrid-system Muslims/banks (e.g. banks with Islamic windows) interact is presented. In this model, a society where all agents and institutions are purely Islamic would be the most prosperous, even financially. However, in the face of competition with interest-based institutions, a critical initial mass of the hybrid type is necessary for the survival of the strictly Islamic agents in a heterogeneous environment. Moreover, their survival is predicated on the hybrid agents' acting among themselves in an Islamic way. When the hybrid agents act this way, their existence is both necessary and sufficient for Islamic banking to survive.

I. INTRODUCTION

The twentieth century has witnessed resurgence in the observance of fundamental Islamic practices around the world. The Islamization of the financial sectors of many Muslim countries was a natural consequence of this resurgence, and the degree of Islamization varied dramatically across countries with Muslim populations. The Islamic Republic of Iran and Pakistan are at one extreme, where the entire financial sector has been made officially "Islamic."[i] Malaysia, Saudi Arabia, and many Arab countries have developed a hybrid financial system where Islamic banks coexist with regular financial institutions, and the monetary authorities of those countries to varying degrees regulate both types of financial institutions.[ii]

This increase in the practice of Islamic banking transformed "Islamic economics" from a sub-field of *fiqh* (Islamic jurisprudence) and comparative systems into one which interacts positively with mainstream economic theory.[iii] The large ensuing literature since the mid-1970s (significantly assisted by the inception of a number of journals devoted to the subject) has helped dispelling a number of the myths that surrounded the field in earlier decades. In particular, it is no longer held that by abolishing interest, Islam denies the legitimacy of time preference and/or rates of return for capital (see, for instance the papers in M.F. Khan (1995) on this issue).

Moreover, M. S. Khan (1986) has noted that the abolition of interest-based transactions is not a subject alien to "western" economic thought. For instance, Fisher (1945), Simons (1948), Friedman (1969), and others have argued that the current (one-sided liability) interest-based financial system is fundamentally unstable. This view was made more popular in recent years due to the epidemic of Savings and Loans bankruptcies in the U.S., as well as the financial crises in Latin America, and - more recently - in Asia (instigated by the ambiguity of the financial positions held by banks seeking higher interest rates on foreign currency denominated bonds). Zarqa (1983), Khan (1986), and a number of papers that followed have illustrated the macroeconomic stability of a profit- and loss-sharing (henceforth PLS) system, which would replace interest-based transactions in an Islamic economy.

This paper attempts to add to the existing literature in two directions. First, I consider the stability of the institution of Islamic banking from a micro-economic point of view, where the survival of this institution depends on its ability to maintain sound financial positions for its customers (devout Muslims, and others). Second, I do not limit my attention to an idealistic Islamic economy which is isolated from the rest of the world; i.e. where all interest-based transactions are impossible, (e.g. Naqvi (1982) and others). Instead, I present an evolutionary game-theoretic model of the dynamics of Islamic banking in the existence of other interest-based financial institutions. This model is a closer representation of the current situation, where Islamic banks operate in most countries (Islamic and non-Islamic) side-by-side with traditional banking institutions.[iv]

· El-Gamal is Professor (Chair) of Islamic Economics, Finance and Management, Professor of Economics, and Professor of Statistics at Rice University in Houston, Tex. This paper was previously published as El-Gamal, M. "The Survival of Islamic Banking: A Micro-evolutionary Perspective." *Islamic Economic Studies*, 5(1 & 2): 1-19, 1997 & 1998.

At the micro-level, I replace the assumption of a population of homogeneous Homo Islamicus (Haneef (1995)) agents in the economy, with one comprised of three types of agents: (1) strictly Islamic agents, who never engage in interest-based transactions; (2) traditional banks and economic agents, who lend and borrow with interest; and (3) economic agents who deal symmetrically with both the strictly Islamic agents (in which case they engage in PLS transactions), as well as regular economic agents (in which case they have interest-based transactions). This last type will be labeled hybrid agents (e.g. banks with "Islamic windows," or "dual system"). Perhaps the strongest condemnation in the literature of those hybrid agents is that in Ahmad (1992):[v]

> "The sad reality is that though every one concedes that Islam prohibits interest, there is not a single Muslim country which running its financial institutions without resorting to interest. The fact is that no one knows how to do it, and when political pressure mounts, they can only resort to some kind of subterfuge" (p. 16)

Later, Ahmad (1992) criticizes Islamic banks engaging in such activities under subsections titled "And we claim, we have abolished interest!" and "Current posture of Islamic Economics."

> "It is not clear whom we are cheating..." (p. 47)

> "The worst part of the story is that Islamic economists, as a body in their International Monetary and Fiscal Conference held in Islamabad in 1981, gave their unreserved approval to this arrangement. So far this is the best that Islamic economics has to offer, viz., change the name of interest and you have abolished interest." (p. 48)

In the model I shall present, it will be shown, rather surprisingly, that it is exactly this type of economic agents that are needed in the interim to ensure the economic survival of pious Muslim agents. Religious and theoretical considerations, as well as some empirical evidence will motivate the assumptions of the model. Though highly stylized, this dynamic microeconomic approach may serve as a seed for further theoretical and empirical investigations of the necessary transition from interest-based to PLS systems. Section 2 reviews some of the general theoretical assumptions of the model presented in this paper. The religious, theoretical, and empirical findings motivate the assumptions of the model. Section 3 presents the model and the analysis of its dynamics, and Section 4 concludes the paper.

II. ASSUMPTIONS OF THE MODEL

We take as fundamental the fact that interest rates payment and receipt are forbidden for all Muslims. Moreover, we recognize that the economy contains pious Muslims who never engage in any transactions involving interest payments, as well as regular economic agents and institutions, which routinely pay and receive interest. This hybrid economic system is likely to continue for some time, and it would be idle philosophy to contemplate how a purely Muslim economy would perform without knowing whether such a system can be sustainable in the presence of interest paying and receiving agents and institutions.[vi]

A recently conducted survey of depositors of an Islamic bank (Abdel-Kader (1995)) showed that in addition to agents who never deal in interest and those who always do, there is a large contingency of agents who participate in both systems. In particular, the study found that for the depositors of BIMB in 1991, 64% of depositors had accounts with other (interest paying) banks. Moreover, the transactions of Islamic banks are themselves not purely Islamic. Whereas demand deposits do not pay any interest, savings deposits which remain with the bank for a significant period (e.g. 12 months) are rewarded with a "gift", which typically has a high correlation with market interest rates, although they tend to be lower than the market rates (BIMB (1994), Bank Negara Malaysia (1994)).

Most *mudaraba* arrangements carry in their contracts a clause that if the rate of return to the bank or investor is less than some percentage (usually written in the contract as an absolute monetary value of the "profit share"), the bank or investor has the right to audit the entrepreneur's operations. To avoid such an audit, entrepreneurs typically pay that threshold rate regardless of the actual profit or loss, which makes that rate functionally equivalent to an interest rate (Khan (1983)).

This empirical reality motivates our assumption that there are three types of economic agents in our evolutionary game model:

1. Strictly Islamic agents (denoted P^* for always using PLS financial instruments instead of interest-rate based instruments).

2. Regular banks and economic agents (denoted I*, for always choosing the interest-based instrument).
3. Hybrid agents (denoted W, who interact symmetrically with all agents; i.e. when making a transaction with a P* agent, they follow PLS rules; and when making a transaction with an I^* agent, they use the market interest rates). In addition to individuals who participate in both banking systems, those hypothetical *W* agents also represent the current practice of "banks with an Islamic window," and "Islamic" banks which offer interest-like.

Our model is an evolutionary game wherein the three types of agents are pairwise randomly matched in each period to play a two-person, two-move game (interpreted as an economic transaction). The two moves available to each agent are P (do not use interest rates), and I (use interest rates). Strictly Islamic agents—due to the religious prohibition—never choose I, and hence their lifetime strategy is P^*. Traditional economic agents are accustomed to interest rates, and believe that it is always better due to their risk aversion (it is argued below, based on the "equity premium puzzle", that this belief is empirically unjustified). Therefore, they always choose I, taking the borrower or lender side depending on which is more advantageous at the given interest rate.

We shall construct the normal form of the stage game as a prisoner's dilemma:

	P	*I*
P	*(a,a)*	*(0,b)*
I	*(b,0)*	*(c,c)*

where we shall assume that $b>a>c>0$. This makes the standard banking practice (*I,I*) the unique Nash equilibrium for the stage game, but it is Pareto inferior to the Islamic outcome (*P,P*).

The fact that (P,P) is not a Nash equilibrium (i.e. b>a) follows immediately from the impossibility of finding a profit-sharing rule which, for a generic profile of risk aversion in the population and distribution of potential profits, will make the certainty equivalent of the profit share greater than or equal to the interest rate times principal. Moreover, if an I^* agent is matched with a P^* agent, since the I^* type is always willing to take either the borrower or the lender side, and since the P^* agent has the option of holding their money and paying 2.5% *zakat* al-Mal or giving an interest free loan,[vii] the outcome is an interest free loan from the P^* agent to the I^* agent. We normalize the service fees or other nominal fixed return to the lender in such a transaction at zero, and the I^* agent can then invest the funds, or collect unshared interest on them, hence justifying b>a.

The fact that the unique Nash equilibrium (I,I) is Pareto inferior to the Islamic outcome (P,P) (i.e. a>c) is justified on theoretical as well as empirical grounds. On the theoretical side, one may name: (i) the stability of an Islamic financial sector in the face of macroeconomic shocks (Simons (1948), Zarqa (1983), Khan (1986)); (ii) the more efficient allocation of resources, up to a lower marginal productivity of investment (Iqbal and Mirakhor (1987)); (iii) the reduction of "effort aversion" which would cause poorer choice of investment projects (Khan (1995)); (iv) the potential undertaking of riskier projects with a higher expected profit; and, above all (v) obedience to God; which is believed to lead to success in this life and the next. Those theoretical considerations support the assumption that a>c.

On the empirical side, an argument that a>c, even allowing for risk aversion, can easily be formulated based on the famous "Equity-Premium Puzzle" (Mehra and Prescott (1985)). Mehra and Prescott noted that the premium of the return on the S&P over the riskless rate (commercial paper) for the period 1889-1984 had a mean of 6% and a standard deviation of 18%. This large "premium" can only be explained by extreme rates of risk aversion in the economy. However, Weil (1989) has shown that if such a rate of risk aversion is assumed, we get a reverse puzzle, "the risk-free rate puzzle." Namely, if we assume a rate of risk-aversion, which justifies the equity-premium, then the rate of time preference that justifies the risk-free rate must be negative. Since a negative rate of time preference defeats some of the most fundamental justifications for interest rates, it would seem that risk aversion cannot explain why PLS (equity-based) systems yield returns so much higher than riskless rates. A number of other unsuccessful explanations have been proposed in recent years, but the "puzzle" remains an unexplained empirical regularity which justifies our assumption that a>c.

III. THE MODEL

We study the stage game discussed in the previous section, which shows that whenever any two agents are matched at any point in time, they play a prisoner's dilemma:

	P	*I*
P	*(a,a)*	*(0,b)*
I	*(b,0)*	*(c,c)*

with $b>a>c>0$. We further assume, following the discussion and motivation in the previous section, that there are three types of strategies agents use in the repeated game: P^* (always choose *P*), I^* (always choose *I*), and *W* (choose *P* if matched with a P^*-type, and choose *I* if matched with I^*). The only remaining degree of freedom is how *W* acts when matched with another *W*. The assumption we make for such encounters is crucial for the analysis to follow. We shall consider the two extreme cases:

1. [Case I: WW=PP] where the hybrid types mimic the pious types when they interact amongst themselves.
2. [Case II: WW=II] where the hybrid types mimic the interest-using types amongst themselves.

Time is assumed discrete. In each period, all the agents (in a very large, but finite, population) are matched pairwise, and they get to play the game for this period. The appropriately normalized payoffs in any period of the repeated game given the three strategies is:

	*P**	*I**	*W*
*P**	*(a,a)*	*(0,b)*	*(a,a)*
*I**	*(b,0)*	*(c,c)*	*(c,c)*
W	*(a,a)*	*(c,c)*	*(d,d)*

where $(d,d)=(a,a)$ in CASE I, and $(d,d)=(b,b)$ in CASE II.

It directly follows that the expected payoffs for each type at any given period are a simple function of the proportion of agents using P^* (we call that proportion x_t), and the proportion using I^* (we call that proportion y_t, and - trivially - the proportion using W is $(1-x_t-y_t)$). Those expected payoffs are:

$$\pi(P^*; x_t, y_t) = a - ay_t,$$

$$\pi(I^*; x_t, y_t) = c + (b-c)x_t,$$

$$\pi(W; x_t, y_t) = \begin{cases} a + (c-a)y_t & Case I \quad (WW = PP) \\ c + (a-c)x_t & Case II \quad (WW = II) \end{cases}$$

Which results in a population-wide payoff at time *t* of:

$$\pi(x_t, y_t) = x_t\pi(P^*; x_t, y_t) + y_t\pi(I^*; x_t, y_t) + (1 - x_t - y_t)\pi(W; x_t, y_t)$$

Now, we assume that the agents making more money will have a stronger presence in the market in the following period, and vice versa. This can be interpreted as the rich having more progeny/followers, or simply as being larger economic entities which subdivide into more "agents," whereas those getting poorer get smaller and fewer. The particular dynamic model chosen here is the famous "replicator dynamics" model which is borrowed from Biology. This model has become the main paradigm for evolutionary game theory:[viii]

$$x_{t+1} = \frac{x_t \times \pi(P^*; x_t, y_t)}{\pi(x_t, y_t)}$$

$$y_{t+1} = \frac{y_t \times \pi(I^*; x_t, y_t)}{\pi(x_t, y_t)}$$

The dynamics of this model are strikingly different for CASE I and CASE II. A schematic sketch of the phase diagrams for the model with b>a>c>0 in CASE I and CASE II are shown in Figure 1 and 2, respectively. In Figures 1 and 2, lines and points in boldface represent fixed points, and arrows in the interior represent the dynamic trajectories. Figures 3 and 4 show the phase diagram and 400 numerical trajectories each for the case b=3, a=2, c=1, however, the phase diagram is qualitatively the same for any b>a>c>0, although the exact turning points depend on the numerical values of those parameters. Notice that P^*'s average payoff is monotonically decreasing in y_t, and that I^*'s payoff is monotonically increasing in x_t; i.e. the I^* types are predators and the P^* are prey. The interaction of those two types with W in cases I and II produces interesting dynamics.

It is straightforward to verify the main analytical properties of our phase diagrams:

- [In CASE I] *WW=PP*:
  1. All the points on the x-axis (y_t=0) are fixed points, where the P^*'s survive forever, and the *W*'s survive forever acting like P^*'s.
  2. There is an isolated fixed point at y_t=1.
  3. All the points with (1-x_t-y_t)=0 (i.e., the diagonal, with no *W*'s), converge to the isolated fixed point, where all the P^*'s vanish.
  4. In a neighborhood of the diagonal defined by 1-x_t-y_t < ε(*a,b,c*), we get monotonic decline of x_t to zero, followed by a monotonic decline of y_t to zero. In the limit, only *W*'s survive, and they act in CASE I like P^*'s.
  5. With sufficient *W* types, 1-x_t-y_t > ε(*a,b,c*), the P^* types survive forever, with $\lim_{t\to\infty} y_t = 0$, and the *W*'s in the limit act like P^*'s.
  6. There is no scenario in which both $\lim_{t\to\infty} x_t$ and $\lim_{t\to\infty} y_t$ are positive. In other words, the pious and the interest-using cannot co-exist forever.
  7. In order for Islamic banking to survive in a heterogeneous environment, it is necessary that *WW=PP* (see CASE II below), and that there is some mass of *W* types (the larger the mass, the higher the chance of P^*'s surviving, and the faster that interest-based dealings perish).

- [In CASE II] *WW=II*:
  1. The only manifold on which any Islamic banking can survive is defined by the x-axis y_t=0. All of the points on that axis converge to the isolated fixed point at x_t=1, i.e. where at time *t*=0 only P^*-types exist.
  2. All points with x_t=0 (on the y-axis) are fixed points, where the interest-using agents survive forever, and the *W* types mimic them and survive as interest-users.
  3. Starting from any other point with y_t>0 (i.e., with the slightest deviation from an idealistic, isolated, Islamic economy), $\lim_{t\to\infty} x_t$ =0.
  4. There is no scenario in which both $\lim_{t\to\infty} x_t$ and $\lim_{t\to\infty} y_t$ are positive. In other words, the pious and the interest-using cannot co-exist forever. This is true in both cases I and II.

Of course, if we take intermediate cases where the W types sometimes use PP and sometimes use II when dealing amongst themselves, we may still get the survival of Islamic banking provided that the proportion of W's is above a critical level, and that they use PP amongst themselves sufficiently often. Figures 5 and 6 illustrate two of the more interesting scenarios under Cases II and I, respectively. Figure 5 shows that if WW=II, we may get a short period of increase in P^*, but such a resurgence of Islamic banking will be short-lived, and eventually self-defeating. Indeed, as we know from the above analysis of the phase diagram, the only scenario under CASE II in which Islamic banking (the P strategy) survives (is used in the limit), is for all agents to use P at time 0. This corresponds to the traditional view of Islamic economists that all interest must be abolished instantly, otherwise the Islamic practice cannot be sustained. Indeed, in both cases I and II, this point x_t=1 is trivially a fixed point, and this justifies the statement that if the economy were to convert to Islamic practice all at once, such practice can survive regardless of the environment.

However, this intuition is not useful in a complex world where interest-using agents coexist with—and strive to exploit—Islamic practice. In this environment (y_t > 0), it is not true that a sufficiently large x_0 (contingency

of pious agents), can guarantee the survival of Islamic banking. This is obvious in CASE II, where all pious agents will perish if faced with a heterogeneous population. It is interesting to see in Figure 6 a scenario under CASE I where x_0 is large at the expense of $(1-x_0-y_0)$; i.e. there are not enough W type agents in the economy. In this case, the P^* types will still be easy prey for the I^*, and will be doomed to extinction. After all the P^* types have vanished ($x_t=0$), the W agents continue to outperform the interest-taking types, and eventually become the only survivors ($\lim_{t\uparrow\infty}(1-x_t-y_t)=1$). This limiting result has Islamic banking surviving in the limit, but for economic rather than religious reasons, since the truly pious types are the first to perish. Indeed, the hybrid agents are the strongest economically. In both cases I and II, they can survive in the face of the interest-users. In CASE I, they can play an additional role (provided there are enough of them) of helping the pious agents survive in the long run.

Interpreting the W agents as the modern Islamic banks with some Islamic dealings and some transactions that either mimic interest, or are explicitly interest based, our results suggest that the severe criticism of those institutions in the literature may be misguided. It would be ideal to instantaneously obtain universal Islamic behavior $x_t=1$. However, since this is not a likely scenario, the "dual system banks" type seems necessary to ensure the survival of Islamic economic practice in a heterogeneous economy of Islamic and interest-using agents. If we further accept the limiting result $(1-x_t-y_t)=1$ as a form of Islamic banking survival (despite the fact that the truly pious agents would have perished), then the existence of W agents has been shown to be sufficient for Islamic banking to dominate the economy in the limit. Moreover, the larger the contingency of W agents, the faster an economy can rid itself of the interest-using types, provided that we are in CASE I, where the W types behave among themselves in the Islamic manner.

IV. CONCLUSION

Islamic economists and Muslims in general, diverge in their view of the modern phenomenon of hybrid Islamic/traditional banking. Some view the practices of those Islamic banks which mimic interest as practical short-run alternatives, and hope that they will gradually be replaced with practices that agree with the spirit as well as the letter of the Islamic law (Khan (1995)). Others are angered with what they view as an outrageous form of religious hypocrisy, and wish to transform the economy instantaneously to be in accordance with Islamic law (Ahmad (1992)).

In the highly stylized model presented in this paper, it has been shown that each of these divergent views is correct in a special case. The determining factor in this model is the manner in which Islamic banks deal among themselves. It is shown that the necessary and sufficient condition for Islamic banking to survive in the long run is the existence of agents who are willing to interact symmetrically with the Islamic and the interest-based parts of the economy, and that those agents deal amongst themselves in an Islamic manner. It is interesting to note that the Malaysian Islamic banking system (which is the most advanced hybrid financial system where Islamic and regular banks coexist) has recently adopted an Islamic check-clearing system which would facilitate the Islamic interaction amongst the Islamic banks (Bank Negara Malaysia (1994)). This suggests that our model can serve as a seed for future empirical, theoretical, and policy research on transition from regular interest-based banking to Islamic banking.

REFERENCES

Abdel-Kader, R. "BIM: Market Implications." *Leading Issues in Islamic Banking and Finance* (Pelanduk, Malaysia, 1995).

Ahmad, K. *Economics of Islam: A Comparative Study*. (Lahore: Sh. Muhammad Ashraf, 1952).

Ahmad, S. *Toward Interest-Free Banking* (New Delhi: International Islamic Publishers, 1992).

Al-Jozayri, A. *Al-Fiqh 'ala Al-mathahib Al-'arba`ah* (Cairo: Dar 'Ihya' Al-torath Al-qarabi, 1986).

Bank Islam Malaysia Berhad. *Bank Islam Malaysia Berhad Annual Report* (Kuala Lumpur, 1994).

Bank Markazi Jomhouri Islami Iran. *The Law of Usury(Interest)-Free Banking* (Tehran: Central Islamic Republican Bank of Iran, 1983).

Bank Negara Malaysia. *Money and Banking in Malaysia* (Kuala Lumpur: Bank Negara Malaysia, 1994).

El-Gamal, M. "Government Papers Acceptable to Islamic Banks." *Central Bank of Kuwait and IMF seminar on Islamic Financial Instrument Design and Regulation, October 1997* (Central Bank of Kuwait, 1997).

Fisher, I. *100% Money* (New Haven: City Printing, 1945).

Friedman, M. "The Monetary Theory and Policy of Henry Simons." *The Optimum Quantity of Money and Other Essays*. M. Friedman (Chicago: Aldine 1969).

Haneef, M. *Temporary Islamic Economic Thought: A Selected Comparative Analysis* (Kuala Lumpur: Ikraq, 1995).

Iqbal, Z. and Mirakhor, A. "Islamic Banking." *IMF Occasional Paper #49*: 1987.

Khan, M. "Islamic Banking as Practiced Now in the World." *Money and Banking in Islam. Ed.* Z. Ahmad, M. Iqbal, and M. Khan (Islamabad: Institute for Policy Studies, 1983).

Khan, M.S. "Islamic Interest Free Banking: A Theoretical Analysis." *Staff Papers of the IMF*, 33: 1986.

Khan, M.F. *Essays in Islamic Economics* (Leicester, UK: The Islamic Foundation, 1995).

Mehra, R. and Prescott, E. "The Equity Premium: A Puzzle." *Journal of Monetary Economics*, 15: 1985.

Mirakhor, A. and Ul-Haque, N. "The Design of Instruments for Government Finance in an Islamic Economy." *Central Bank if Kuwait and IMF seminar on Islamic Financial Instrument Design and Regulation, October 1997* (Central Bank of Kuwait, 1997) [Also, *IMF working paper WP/98/54*.]

Naqvi, S. *On Replacing the Institution of Interest in A Dynamic Islamic Economy* (Islamabad: Institute of Development Economics, 1982).

State Bank of Pakistan. *Elimination of Interest from the Banking System in Pakistan* (Karachi: State Bank of Pakistan, 1984).

Van-Redondo, F. *Evolution, Games, and Economic Behavior* (New York: Oxford University Press, 1996).

Weil, P. "The Equity Premium Puzzle and the Risk-free Rate Puzzle." *Journal of Monetary Economics*, 23: 1989.

Zarqa, M. "Stability in an Interest-Free Islamic Economy: A Note." *Pakistan Journal of Applied Economics*, 2: 1983.

[i] See Bank Markazi Jomhouri Islami Iran (1983) and State Bank of Pakistan (1984).

[ii] The issue of Islamic bank regulation is a currently active area of research; see Mirakhor and Ul-Haque (1997), and El-Gamal (1997).

[iii] The earliest well-known source on Islamic economics is Ahmad (1952). For a recent survey of the major figures in the field of Islamic economics, see Haneef (1995).

[iv] Some referees and audience members where this paper was presented have mistakenly read it to say that the hybrid model is superior to the purely Islamic one. As will be seen later in the paper, this is incorrect. The model I present assumes that a purely Islamic financial sector will be more prosperous than the hybrid society. Unfortunately, such a system cannot be brought into existence without incurring monumental costs by severing all ties with the international monetary system. The question asked in this paper is whether the hybrid systems that currently exist in every Muslim society can evolve into a purely Islamic one, and under what conditions.

[v] Again, referees and audiences were quick to echo the sentiments in those comments, by immediately associating the hybrid agents with hypocrites (in the jurisprudential sense). We all know many good-willing, devout Muslims with banking businesses who are working hard to bring about the Islamization of our financial sectors. The dual agents in this paper are sufficiently abstract that their intentions cannot be inferred from their actions. They sometimes have to resort to Islamically acceptable transactions (e.g. *murabaha*) which are very similar to traditional banking practices, and other times may not be able to convert their institutions instantly to Islamic banks. However, no assumption about their intentions would be appropriate based on the fact that they have a hybrid portfolio of transactions at any point in time.

[vi] Some readers seemed to jump to the conclusion that I am thus arguing that the hybrid system I am studying is assumed to be superior to a purely Islamic one. Again, this is completely contrary to what the model says. I am simply arguing that a hybrid system exists in reality, and therefore should be our focus of study.

[vii] Any funds that remain unused for a year are subject to this form of wealth tax of 2.5% per annum. Interpreting the time period in our model as a year, the *P* agent would – from a purely financial point of view – rather lend the money with no interest than hoard it and pay 2.5% of its total sum.

[viii] For a recent treatment and survey of the literature in Evolutionary Game Theory, see Vega-Redondo (1996).