Experimental Tests of the *Homo Economicus*

Implications of Research on Islamic Economics

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This article has multiple objectives. It seeks to identify those assumptions of neoclassical economics which are vindicated by experimental tests and those which fail such tests. The author tries to simultaneously expose the limitations of neoclassical economics and Islamic economics by pointing out that some assumptions of the rational choice model fail while others, often ignored by Islamic economists, are proven valid. The article also seeks to summarize the results of experimental testing about agent behavior under a controlled environment. The author hopes that this initiative will encourage Islamic economists to use experimental methods as a means for testing their theoretical assumptions. The author concludes that human agents are neither as self-regarding as the *homo economicus* model predicts nor are they as other-regarding as the model *homo Islamicus* predicts.

One of the most persistent debates in the social sciences has concerned the definition of man as either *homo economicus* (economic man) or *homo sociologicus* (social man). While the former is driven by rationality and outcome, the latter is guided by social norms. The former strives to maximize self-interests, whereas the latter's behavior is prescribed by a set of rules and standards. The former follows the norm only when it serves self-interests, and the latter uses rationality and self-interest maximization only when they are within the boundaries set by the norms.

Research in economics today is predominantly based on the neoclassical theory. The primary axioms of the neoclassical theory are those of the *homo*

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economicus; that is, individuals act so as to maximize utility, represented as a function of income, consumption, wealth, and leisure. In doing so, individuals make "rational" and "selfish" decisions. Economists have developed elaborate mathematical models using *homo economicus* to address a wide array of issues — from economic growth to monetary policy, firm behavior to consumer behavior, international trade to urban planning, and marriage to suicide. They even attempted to explain religious inclinations and practices with rationality and self-interest maximization (the utility function here obviously does not include the expected benefits in the hereafter).

A major issue for the study of Islamic economics is whether to utilize the existing rich models of neoclassical economics or build new models of economic behavior that captures "Islamic values." That is, should we simply examine how *homo economicus* would behave in an economy governed by Islamic rules or regulations, or should we also change the axioms of *homo economicus* and develop a *homo Islamicus*? Unfortunately, the majority of academic research in Islamic economics hitherto took a third, easier route. Instead of developing formal models of *homo Islamicus* or utilizing the existing formal models of *homo economicus*, they offered informal speculations of how the Islamic values of individuals would differentiate them from *homo economicus* and how this would ensure that various problems of the neoclassical model would not arise in an Islamic economy.[1]

Are the axioms of rationality and selfishness the driving forces of human behavior? The question has recently been debated by mainstream economists themselves. The debate was prompted by the results that were obtained in laboratory economics experiments where subjects were asked to make economic decisions. In the last three decades, these experiments have revealed that the axioms of rationality and self-interest maximization alone are not sufficient to explain subject behavior. In fact, in many cases these axioms are violated by the subjects in experiments. As a result, some economists have begun to modify the existing economic models in order to explain subject behavior in experiments.[2]

The purpose of this study is twofold: (a) to discuss recent experimental tests of the neoclassical theory and identify those behavioral assumptions of the theory that perform well and those that perform poorly in experiments; and (b) to discuss the implications of these experimental results for future research on Islamic economics. It is also hoped that this study will

encourage Islamic economists to consider the experimental approach as a method of testing their behavioral assumptions and theories.

It will be shown that the results of various experiments have seriously challenged some of the behavioral assumptions of neoclassical theory. Subjects in experiments often fail to take "rational" actions, and they care considerably about "fairness" and "equity" even when doing so is against their self-interests. Subjects also tend to be more "cooperative" than the theory predicts. These results are observed especially in experimental markets where there are a few players, such as in two-person bargaining games or public good games with few players. As we move to market experiments with a large number of participants, we observe less cooperative and more selfish behavior. The experimental results also show that monetary incentives play a crucial role in determining individual behavior. For any given environment, a change in incentives almost always leads to a change in behavior in the direction predicted by the theory. Unfortunately, this last point is often neglected or downplayed in studies on Islamic economics and in their policy recommendations. Players in the models of Islamic economics are somehow immune to any monetary temptations and strictly follow the "prescribed" strategy/behavior regardless of any incentives to follow a different behavior/strategy.

The main conclusion of this paper is that while some of the behavioral assumptions of neoclassical theory need to be modified, its assumptions regarding incentives should be taken more seriously by researchers in Islamic economics. It would be a mistake to assume that *homo Islamicus* (Islamic man) is immune to any temptations created by monetary incentives to break the norms or to act selfishly against the interests of the society. As we have witnessed with a number of norms/rulings in recent years, such as the rulings on interest-bearing mortgage loans, option trading, forward contracts, and insurance, monetary incentives induce Muslims to search for excuses, exemptions, or new interpretations of norms and rulings to justify their behavior. More importantly, the Qur'an and Sunnah specify a set of rules of conduct for social and economic interactions and call for the state to implement these rules and punish those who violate them. The state is even asked to enforce the zakah payments on each wealthy individual and to penalize those who evade them. Obviously, if norms were enough to ensure the desired behavior in an Islamic society, there would not be a need to prescribe any punishments, and zakah payments would be left to the individual's conscience.

The purpose of this article is not to offer a critique of the research on Islamic economics. Neither is it to evaluate how successful an Islamic economic system would be on such macro issues as inflation, unemployment, income distribution, or growth. Rather, the purpose is purely practical; it is to utilize the recent experimental studies to provide some guidance and evidence on human behavior, thus on the micro foundations of a tenable economic model.

The next section, "Experimental Methodology," briefly describes the experimental methodology and its advantages. The section "What Do Experiments Tell Us about Human Behavior?" reports some of the major findings of laboratory experiments that are relevant for researchers in Islamic economics. The section "A Discussion of the Results" discusses the implications of these experimental findings for future research.

Experimental Methodology

Brief Description

The purpose of economic theories is to explain the activities of individuals and markets. Economists have developed massive and mathematically sophisticated theoretical models of agents and markets, but the testing of these models has lagged behind the theory. Typically, the theory has been tested using field data, data from "natural" markets. The evaluation of a theory or policy by using laboratory experiments is a recent development.[3] Despite this late start, experimental methods have become increasingly widespread in the last twenty years.

The first step in testing a theory in an experimental lab is to construct the environment for the theory. Suppose we want to test if the competitive market price takes place at the intersection of supply and demand functions. We establish a market by dividing the subjects into two groups, buyers and sellers, and assigning a unit cost to each seller and a unit value to each buyer. The seller's earning from each unit sold will be the difference between the selling price and the seller's cost of the unit, while the buyer's earning from each unit purchased will be the difference between the buyer's value of the unit and the purchase price. Since we assign the cost and value figures to the sellers and buyers, we know exactly what the supply and demand in the market are. By allowing the buyers and sellers to trade with each other, we observe whether or not the transaction prices are at the intersection of the demand and supply. We can also test how transaction prices differ across

different trading rules, such as sealed-bid auctions, and double oral auctions.

Once the environment is carefully designed and theoretical predictions are ascertained, the experimenter recruits subjects for the experiment. It is important to conduct an unbiased recruitment of the subjects and make it clear to the subjects how their cash earnings will depend on the strategies they choose during the experiment. If an experiment does not offer the subjects performance-based rewards, then the subjects may not have any incentive to pay attention to their strategies, and the results of such an experiment will be questionable.

After the experiment is conducted, the data from the experiment is analyzed using the appropriate statistical techniques. If necessary, further sessions are run to replicate the data or to test the implications of a change in the market environment.

The next section discusses the advantages and limitations of laboratory experiments and why the experimental methodology has become so popular with researchers in economics and finance.

Advantages and Limitations of Experimental Methods

A primary advantage of laboratory experiments is that they allow the researcher to have control over the data. The researcher can manipulate laboratory conditions to induce changes in any of the variables while holding the other variables constant. This enables the researcher to evaluate and compare alternative theories and policies. If we want to test the implications of a change in the demand curve, for instance, we can run a new session where the buyers are assigned a new set of values for the traded good and compare the prices in the new session with the prices of the original session. Similarly, we can conduct sessions with a different number of sellers to investigate price formation under different market structures (monopoly, duopoly, oligopoly, etc.). With field data, on the other hand, we often observe only the transaction prices in the market without knowing the underlying demand and supply curves. Thus, it can become a challenge even to estimate the demand and supply curves.[4] Even if econometricians manage to clearly identify the effects of desired variables from the rest of the factors, they do not have the ability to control the environment in which the data was generated.

Another advantage of the experimental approach is that in cases where collection and verification of field data are expensive, it can serve as a less costly alternative to generating the desired data. The experimental method

also offers more reliable data, because the field data are usually collected not by the researcher for scientific purposes, but by businesses and/or government agents for their own purposes. The experimental data, on the other hand, are generated for a specific purpose using the desired set of variables.

The main advantage of experimental methodology, however, is that its data is replicable. Field data are generated from events that occurred at a specific time in a specific place. Due to the constantly changing nature of these settings, it is very difficult for other researchers to replicate a field data set, therefore making it difficult to verify the accuracy of the data and the accuracy of the findings. Since laboratory data is generated in controlled laboratory conditions, it is easier to reproduce the experiment and replicate the results.

In addition to the above advantages, laboratory methodology is sometimes the only feasible way to test a theory. This happens when data from existing markets cannot be collected, because it is impossible to find markets that match the assumptions of our theory, or the data is available but not in a form that would enable us to differentiate among alternative theories. This problem is particularly manifested in individual choice problems and game theoretical analysis. These models are either impossible or very difficult to evaluate with field data. Such problems, however, can be, and frequently have been, tested by laboratory experiments.

In spite of its advantages, some critics raise concerns about the experimental approach. One typical criticism is that experiments often use undergraduate or MBA students as subjects whereas relevant decision makers in the economy are more sophisticated players. This criticism was tested in some experiments where the same game was played by a set of undergraduate students and a set of decision makers such as corporate managers.[5] The behaviors of the two groups were not significantly different. Furthermore, even if this criticism were true, it is a criticism of the choice of subject pools in experiments, not the experimental approach itself.

Another common criticism of the experimental approach is that real-life economic environments are much more complex than laboratory environments. However, since the laboratory environment is designed to test a theory, this is a reservation about the theory, not the experimental approach. Furthermore, if the theory fails to work in a simple experimental environment, then it is less likely to work in a more complicated environment.

The major limitation of experiments is that some environments are technically very difficult to construct. Many macroeconomic policies, for

example, rely on intertemporal trade. How do we test if subjects recognize that government spending today may create inflation or increase taxes in the future, or how do we test if the subjects care about the welfare of future generations? Although numerous elegant approaches have been developed, we have not been quite successful at testing some of the economic issues in laboratory experiments.

What Do Experiments Tell Us about Human Behavior?

Experimental research has been applied to a large number of areas in economics in the past three decades. It is impossible to offer a detailed discussion of all the results obtained by the experimenters in this article. Instead, I will provide a brief summary of the major experimental results that are relevant to our purposes here.

1. Market Experiments. In experiments with a large number of traders, competitive market predictions have been observed in a rich variety of circumstances. Even with as few as 5 or 6 buyers and sellers, price converges to the competitive equilibrium level. An exception is the games where the buyers had to pay a search cost to learn the prices set by the sellers. It is common to have the prices in such games of costly information to differ from the prices predicted by the theory.[6]

2. Ultimatum Bargaining Experiments. There is a widespread violation of the theory in games/markets that involve a few players. A striking example is the ultimatum bargaining game. In this game, two players negotiate over the division of a pot of money. One player, say Player 1, proposes to the other player, say Player 2, a division of the pot. Player 2 then either accepts or rejects Player 1's offer, and the game ends. If Player 2 accepts Player 1's proposal, then they divide the pot according to the proposal. If Player 2 rejects Player 1's proposal, then each player receives zero. The two players play this game only once. This game has a unique equilibrium:[7] since a rejection by Player 2 gives zero amount to each player, Player 2 will accept any proposal by Player 1 as long as the proposal gives Player 2 a positive amount. Given this "rational" reaction by Player 2, the best strategy for Player 1 is to offer Player 2 the smallest possible amount (say a penny) and keep the rest of the pot to himself/herself.

The observed behavior in ultimatum game experiments, however, differs from the theoretical prediction profoundly. A typical outcome of such ultimatum game experiments is that Player 1 offers an equal split of the pot and

Player 2 accepts. Furthermore, some proposals (those that give Player 2 a small portion of the pot) are rejected by Player 2.[8]

3. Dictator Game Experiments. The results of the ultimatum game experiments took many economists by surprise. They began to question whether Player 1 was offering a significant portion of the pot to Player 2 because of a fear that Player 2 would penalize Player 1 by rejecting Player 1's proposal if it were not a "fair" proposal. To test this, a dictatorship game experiment was designed whereby Player 2 no longer had the choice of rejecting Player 1's proposal. Thus, the pot would be divided according to Player 1's proposal. The unique equilibrium is for Player 1 to keep all the pot to himself/herself and give nothing to Player 2. In experiments conducted by Forsythe et al., about 20 percent of the dictators took the whole pot, but the remaining 80 percent gave something to Player 2.[9] In fact, around 20 percent of dictators went as far as splitting the pot equally.

4. Prisoner's Dilemma Experiments. Consider the following prisoner's dilemma game where Player A and Player B choose simultaneously and independently between strategies Y and Z.

Figure 1. Prisoner's Dilemma Game

		Player B	
		Y	Z
Player A	Y	350,350	1000,0
	Z	0,1000	800,800

The first payoff in each cell in Figure 1 is Player A's payoff while the second payoff is Player B's payoff. For instance, if Player A chooses Y and Player B chooses Z, then Player A earns 1000 points/cents while Player B earns 0 points/cents. When players play this game only once (or a finite number of times), the unique equilibrium is for both players to choose Y. This is due to the fact that it is dominant strategy for each player to play Y; a player earns more by playing Y regardless of what he/she expects the other player to do. Note that both players would be better off if they both choose the strategy Z instead. However, this is not an equilibrium because it is better for a player to play Y even when he/she expects the other player to play Z.[10]

When Cooper et al.[11] ran an experiment with this exact game, however, they found a significant amount of cooperative play, i.e., strategy Z. The percentage of Z choices in their experiments ranged from 20 percent to 43

percent. Another common feature of prisoner's dilemma experiments is that once a cooperative pattern of behavior is established in early rounds, it tends to persist. Therefore, the initial rounds can become critical.

5. Public Good Experiments. Even though the provision of a public good (e.g., national defense, fire and police protection, or spraying of swamps near a town) is in everyone's interests, each individual has an incentive to "free-ride" on others' contributions. This leads to underprovision of public goods. To test for the free-rider hypothesis, consider the following experiment. There are 20 subjects, and each subject is given 10 "tokens" which he/she can allocate between a private fund and a group fund. Each token invested in the private fund earns the contributor $1 while each token invested in the group fund earns $0.25 to each member of the group, including the contributor.

If each player invests all of his/her 10 tokens in the group fund, then each player earns $50 (20 • 10 • $0.25). Note, however, that when everybody else contributes all of their tokens to the group fund, then a player can earn even more by switching all of his/her tokens to the private fund and free-ride on others' contributions to the group account. Such a strategy would earn him/her $57.50 (19 • 10 • $0.25 = $47.50 from the group fund plus 10 • $1 = $10 from the private fund). Since each player has such an incentive to free ride, the unique equilibrium of this game is where no tokens are contributed to the group fund, all tokens are invested in the private fund, and each player ends up earning $10 only.[12]

Numerous variations of the free-rider problem have been tested in experiments. Contrary to the theoretical prediction that players would contribute zero tokens to the group fund, almost every experiment found positive levels of contributions (even as high as 80 percent of the total tokens) to the group fund.[13]

6. Bilateral Trade and Coordination Experiments. In a recent experiment, Yavas, Miceli, and Sirmans[14] assigned each subject the role of buyer or seller and paired each buyer with a seller. The buyer and the seller in each pair then negotiated the price of a unit through computers. If the negotiations resulted in an agreement, then the seller's earning from each unit sold would be the difference between the negotiated price and his/her cost of the unit while the buyer's earning from each unit purchased would be the difference between his/her value of the unit and the negotiated price. If the two sides failed to reach an agreement, then they would each earn zero. The seller's cost of the unit and the buyer's value of the unit were randomly

drawn by the computer. Each seller knew his/her cost but did not know the buyer's value. Similarly, each buyer knew his/her value but did not know the seller's cost; however, all the subjects were informed that the seller's cost could be any integer between 601 and 700 and the buyer's value could be any integer between 751 and 850. That is, each subject's cost/value was private information drawn from a publicly known distribution. Note that since the lowest possible value for the buyer was greater than the highest possible cost for the seller, there was always a positive gain to reach an agreement.

Although an agreement was in the interests of both sides in each pair, we observed many disagreements. On average, 10 percent of negotiations failed to reach an agreement. The disagreement rate was as high as 50 percent in some of the sessions. Disagreements were due to the fact that each side tried to obtain a bigger part of the surplus. They could have split the surplus equally, but they did not know what the surplus was (because a buyer/seller did not know the exact cost/value of the seller/buyer that he/she was matched with) and they had no incentives to believe any attempts by the other player to reveal his/her value/cost.

The source of inefficiency (disagreement) in the above game is the asymmetric information that players have about their values and costs. Another potential source of inefficiency is the riskiness of the strategy leading to the efficient outcome. The following coordination game used in Cooper et al. and Sefton and Yavas[15] illustrates such a case.

Figure 2. Payoff Matrix for the Coordination Game

		Player B	
		Y	Z
Player A	Y	960,960	960,0
	Z	0,960	1200,1200

There are two equilibria in this game:[16] one where both players choose Y and the other where both players choose Z (see Figure 2). Obviously, the (Z,Z) equilibrium Pareto dominates the (Y,Y) equilibrium, i.e., (Z,Z) is preferred by both players. However, most subjects (as high as 100 percent of them in some experimental sessions) choose strategy Y. The reason is simple: Y is a safer strategy than Z. Playing Y ensures a payoff of 960 while the payoff from Z will be either 0 or 1200 depending on the choice of the other player.

A Discussion of the Results

As will be seen, factors other than rationality and self-interest maximization are important determinants of subjects' behavior in experiments.

1. Market experiments report that competitive market predictions are commonly observed. Prices generally take place around the intersection of supply and demand. It is also found that information structure plays a critical role. Players are less likely to play the predicted strategies when they have to incur a cost to obtain price information and process that information to update their expectations of price distribution in the market.

Market experiments involve interactions among many players (many buyers and sellers). *Competition among players in such settings yields the predicted equilibrium outcome.* However, when the number of players is reduced to two or three and the actions of a player have direct consequences for the other player(s), i.e., when things get "personal," then observed behavior diverges from the predicted behavior.[17] Below are some examples of such outcomes.

2. Two observations about the ultimatum games raise questions about the rationality and selfishness axioms: one is the fact that some of the Player 2 types were rejecting the offer they received from Player 1 types, and the other is the fact that many Player 1 types were offering half of the pot to Player 2 types. A rational Player 2 would never reject any positive offer, and given this, a rational Player 1 would offer the smallest possible amount to Player 2. A plausible explanation for the observed behavior is that *players care about the "fairness" of the outcome.* That is, Player 2 is penalizing Player 1 (and himself/herself) because he/she does not believe Player 1's proposal is fair. Similarly, Player 1 is offering more than he/she should because he/she is afraid of being rejected by Player 2 and/or he/she also wants to have a fair division of the pot.

The result that Player 1 proposes a smaller amount in the dictator game than in the ultimatum game indicates that the possibility of rejection by Player 2 increases Player 1's offer. In other words, *players become more "altruistic" when they have incentives to do so.* However, the fear of rejection is obviously not the whole story because most proposers in the dictatorship game gave a positive amount to the other players. This behavior points to the fact that *players can be altruistic and opt for an "equitable" distribution even when it is against their self-interests.*

Finally, a further dictator game by Hoffman et al[18] suggests that dictator's (Player 1's) altruism also depends on whether or not the dictator's offer

could be observed by the experimenter. Dictators were less generous when their offers could not be observed by the experimenter. In other words, players behave more selfishly when they can remain anonymous (this may explain, in part, why people living in smaller towns are more cooperative and helpful to others than people living in big cities). Thus, *the institutional setting and the social pressure have an influence on how altruistic players are.*

3. Prisoner's dilemma experiments show that *subjects tend to be cooperative even in circumstances where it is against their self-interests.* That is, subjects do not necessarily play the self-interest maximizing strategy.

Another observation in prisoner's dilemma games is reciprocity; subjects are kind/cooperative to those who have been kind/cooperative to them in earlier rounds of an experiment and strike back at those who have been selfish/uncooperative. As part of this observation, once a cooperative pattern of behavior is established in early rounds, it tends to persist in later rounds of the experiment. Therefore, the initial rounds can become critical. One question to raise here is what determines the level of cooperation in initial rounds. Could, for instance, the religious/ethical values or cultural background of the subjects be a deciding factor?

The rejection of "unfair" offers in the ultimatum games and the "reciprocity" in the prisoner's dilemma games point to the fact that we sometimes make choices with our emotions rather than with our reason. Both irrational anger and unselfish sympathy occur commonly across all cultures.

4. Free riding is observed. Public good experiments indicate that *players can act selfishly and prefer strategies that maximize their self-interests rather than the joint interests of the group.* This point needs to be stressed. Most Islamic economists would argue that a Muslim would not act against the interests of the society to serve his/her self-interests. I personally believe that in most cases the behavior of a Muslim would not be significantly different from that of a non-Muslim. In fact, I conducted this same public good experiment in a predominantly Muslim class at the International Black Sea University in Tbilisi, Georgia, in the spring of 1998 and obtained even a smaller amount of contribution to the group fund than the amounts reported in earlier public good experiments.[19]

5. Substantial numbers of disagreements in bilateral negotiation games indicate that *inefficient outcomes arise.* Inefficiencies are also observed in some coordination games where players opt for the safer strategy even

when there is an alternative (but risky) outcome that makes both of them better off.

6. *The assumption of "rational" behavior has been seriously challenged.* In experiments involving individual choices (i.e., experiments where the strategies of a player do not have any impact on other players' earnings, thereby making altruism, fairness, and equity issues irrelevant), subjects repeatedly make inconsistent choices.[20] A similar challenge to rationality was observed in experiments involving multiple-stage games. In such games, a subject makes a choice, then his/her opponent responds, then the subject responds to the opponent's response, and so on. The notion of subgame perfect equilibrium in such games requires that each subject figures out what the optimal chain of responses in later stages of the game will be to his/her initial strategy and accordingly chooses the optimal initial strategy. Various experiments have shown that subjects often fail to reason the optimal chain of responses, especially as the chain gets longer.[21]

7. There has been a very limited investigation of how subjects' religious, national, ethical, or cultural backgrounds affect their behavior. Roth et al.[22] conducted the same ultimatum bargaining and market experiments in Israel, Yugoslavia, USA, and Japan and did not find significant differences across these countries. Guttman,[23] on the other hand, found more cooperative play in prisoner's dilemma games among the Chinese students than among the Israeli and American students. Ben-Ner and Putterman[24] observed that subjects with more religious education gave more to the other player in dictatorship games. It has been argued by almost every study on Islamic economics that a Muslim consumer or firm would put the interests of the community above his/her individual interests.[25] Experimental methodology offers us a chance to test this and other hypotheses of Islamic economists.

Concluding Remarks

In addition to the behavior observed in laboratory experiments, there are numerous real life observations that shed doubts on the universality of selfishness and rationality postulates of neoclassical theory. We tip waiters in restaurants when we are out of town (restaurants that we do not expect to visit again in the future), we do not litter in the park even when there is nobody around to observe us, we spend the time and effort to vote in elections even though a single vote would not make a difference, and we donate to public radio and TV even though the provision of their programs do not

hinge on our individual donation. These acts are difficult to reconcile with selfishness.

Credit cards provide us with convenience in shopping. Yet, many people refuse to own any credit cards or they cancel their credit cards because they cannot refrain from overspending when they own a credit card. Why could they not follow the same spending pattern and enjoy the convenience of credit cards? Similarly, many people cancel their cable subscription because they cannot help watching too much TV when they have cable. Why could they not spend the same amount of time watching TV and enjoy the benefits of cable? It is a well-known mathematical result that unconstrained optimization yields a better result than a constrained optimization. However, the examples of credit cards and cable TV show that this rule is violated by (or perhaps it does not apply to) some people, making it difficult to reconcile such behavior with rationality. Another example of irrational behavior is the fact that millions of people start using addictive drugs even though it is common knowledge that it will most likely ruin their lives.[26]

Although the subjects in experiments are more cooperative than the theory predicts, selfish behavior is also commonly observed in various experiments. Selfish behavior was pervasive, for instance, in the public good experiments and in many of the coordination game experiments. Furthermore, the observation that subjects are not as selfish as *homo economicus* does not mean that norms alone will induce players to be unselfish and cooperative. This is true for Muslims as well as for non-Muslim players. If norms alone could be sufficient to generate the desired outcome, there would be no need for an Islamic criminal law or for the Islamic state to enforce the payment of zakah. The Qur'an and Sunnah recognize that incentives play a crucial role in our behavior and establish the incentives/penalties to encourage/discourage certain types of behavior. Unfortunately, many of the studies in Islamic economics fail to recognize the role of incentives and argue that norms and values would be sufficient to obtain the desired outcomes in an Islamic society.

To summarize, the results of economic experiments show us that human beings are neither as selfish and rational as *homo economicus* nor as cooperative and norm-oriented as *homo sociologicus* or *homo Islamicus*. Both norms and incentives are important determinants of our behavior.

Notes

1. A large number of recent studies in Islamic economics offer rigorous formal models of their arguments. A good example is M.A. Choudhury, *Contributions to Islamic Economic Theory* (New York: St. Martin's Press, 1986). For a criticism of the research in Islamic economics see T. Kuran, "Behavioral Norms in the Islamic Doctrine of Economics: A Critique," *Journal of Economic Behavior and Organization* 4 (1983): 353–379.

2. G.E. Bolton and A. Ockenfels, "A Theory of Equity, Reciprocity and Competition," Penn State University Working Paper (1997).

3. The first attempt is attributed to Edward Chamberlin in "An Experimental Imperfect Market," *Journal of Political Economy* 56 (1948): 95-108, who used his students as subjects in his experiment which simulated a market by inducing the demand and supply schedules and attempted to obtain equilibrium price and quantity. Other early attempts include A.W. Tucker in "A Two-Person Dilemma," working paper, Stanford University, published as "On Jargon: The Prisoner's Dilemma," *USMP Journal* 1980, no. 1 (1950): 101, and V. Smith "An Experimental Study of Competitive Market Behavior," *Journal of Political Economy* 70 (1962): 111–137.

4. The observed prices in equilibrium are points both on the demand curve and the supply curve. However, if prices are not taking place at the equilibrium points then we may fail to identify if an observed price is a point on the demand curve or on the supply curve.

5. D.V. DeJong, R. Forsythe, and W. C. Uecker, "A Note on the Use of Businessmen as Subjects in Sealed Offer Markets," *Journal of Economic Behavior and Organization* 9 (1988): 87–100.

6. For example, see E. Abrams, M. Sefton, and A. Yavas, "An Experimental Comparison of Two Search Models," Penn State University Working Paper (1998); and A.E. Roth, V. Prasnikar, M. Okuno-Fujiwara, and S. Zamir, "Bargaining and Market Behavior in Jerusalem, Ljubljana, Pittsburgh, and Tokyo: An Experimental Study," *American Economic Review* 81 (1991):1068–1095.

7. The notion of equilibrium used here is that of Subgame Perfect Nash equilibrium.

8. W. Guth, R. Schmitterberg, and B. Schwarze, "An Experimental Analysis of Ultimatum Bargaining," *Journal of Economic Behavior and Organization* 3 (1982): 367–388. Also see D. Kahneman, J. L. Knetsch, and R. Thaler, "Fairness and the Assumptions of Economics," *Journal of Business* 59 (1986): S285–S300.

9. R. Forsythe, J. L. Horowitz, N. E. Savin, and M. Sefton, "Fairness in Simple Bargaining Experiments," *Games and Economic Behavior* 6 (1994): 347–369.

10. When a player expects the other player to play Z, he/she earns 1000 by playing Y and only 800 by playing Z.

11. R. Cooper, D.V. DeJong, R. Forsythe, and T.W. Ross, "Cooperation without Reputation: Experimental Evidence from Prisoner's Dilemma Games," *Games and Economic Behavior* 12 (1996): 187–218.

12. Note that the free-rider problem is a variation of the prisoner's dilemma game. Both have an outcome that each player prefers, yet both give incentives to each player to follow a strategy that leads to an undesired outcome.

13. For example, see R.M. Isaac, J.M. Walker, and S.H. Thomas, "Divergent Evidence on Free Riding: An Experimental Examination of Possible Explanations," *Public Choice* 43 (1984): 113–149.

14. A. Yavas, T. Miceli, and C. F. Sirmans, "An Experimental Analysis of the Impact of Intermediaries on the Outcome of Bargaining Games," Penn State University Working Paper (1998).

15. R. Cooper, D.V. DeJong, R. Forsythe, and T.W. Ross, "Communication in Coordination Games," *Quarterly Journal of Economics* 107 (1992): 739–771. See also M. Sefton and A. Yavas, "Threat to Regulate and Coordination Failures: Experimental Evidence," *Journal of Real Estate Finance and Economics* 12 (1996): 97–115.

16. The two equilibira here are pure strategy Nash equilibria.

17. This is in some way parallel to Kuran's argument that norms become less effective as the size of the society grows. See T. Kuran, "Behavioral Norms in the Islamic Doctrine of Economics: A Critique," *Journal of Economic Behavior and Organization* 4 (1983): 353–379.
18. E. Hoffman, K. McCabe, K. Shachat, and V. Smith, "Preferences, Property Rights, and Anonymity in Bargaining Games," University of Arizona Working Paper (1991).
19. These were very "cooperating" students as well. (They resorted to numerous methods of "helping" each other during the exams!)
20. For a summary of these experiments see D.D. Davis, and C. A. Holt, *Experimental Economics* (Princeton, Princeton University Press, 1992).
21. M. Sefton and A. Yavas, "Abreu-Matsushima Mechanisms: Experimental Evidence," *Games and Economic Behavior* 16 (1996): 280–302.
22. A.E. Roth et al., "Bargaining and Market Behavior."
23. J.M. Guttman, "Ethnic Backround, Education, and the Propensity to Cooperate," Ber-Ilan University Working Paper (1997).
24. A. Ben-Ner and L. Putterman, "The Origins of Preferences: Theory and Experimental Evidence on Norms and Reciprocity," paper presented at the 1998 Meeting of the American Economic Association, Chicago, IL (1997).
25. B. Bendjilali and F.B. Taher, "A Zero Efficiency Loss Monopolist: An Islamic Perspective," *The American Journal of Islamic Social Sciences* 7 (1990): 219–232. Also, see M.A. Choudhury, "The Micro-Economics Foundations of Islamic Economics: A Study in Social Economics," *The American Journal of Islamic Social Sciences* 3 (1986): 231–245.
26. One can also argue that it is irrational for a person who believes in heaven and hell to commit any sins because the pleasure/benefit of the sin will be enjoyed for a finite period of time in this life while the punishment in the hereafter can be for an infinite period of time. Yet, believers in heaven and hell commit sins on a frequent basis.