ISLAMIC APPROACH TO RISK*

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I

Risk in Islamic Economics

More than 670 years ago, Ibn Taymiah (728H – 1328G) wrote:

> Risk falls into two categories: commercial risk, where one would buy a commodity in order to sell it for profit, and rely on Allah for that. This risk is necessary for merchants, and although one might occasionally lose, but this is the nature of commerce. The other type of risk is that of gambling, which implies eating wealth for nothing (أكل المال بالباطل). This is what Allah and his Messenger (peace be upon him) have prohibited. ([2]; pp. 700-701.)

This phrase shows that Muslim scholars were aware of the dual forms of risk. Although there might be cases where it is difficult to distinguish between the two, the overall framework nonetheless is clear. The above statement shows that there are two types of risk:

1. Risk associated with normal economic transactions, i.e. value-adding and wealth-creating activities.
2. Risk associated with "eating wealth for nothing", or zero-sum activities, where no net additional wealth is created.

Economic Risk

If we define risk as possibility of loss, then it becomes clear from an Islamic perspective that risk as such is not desirable. Islamic principles clearly call for the preservation and development of wealth. Exposing wealth to loss cannot be a goal in itself. In fact, al-Qarafi clearly states that i.e. protection of wealth, is desirable for rational agents (cited in al-Suwailem [10]).

This is the same position towards hardship (مشقة). Although many Islamic deeds involve hardship of some sort, such hardship is not desirable in itself. According to Ibn Taymiah ([4]; pp. 10:620-622):

> Reward of deeds is based on their usefulness, not their hardness. A good deed might be hard, but its goodness is for a reason other than being hard. Reward may be larger if involved hardship is larger, not because hardship is the objective of the deed, but because the deed implies hardship.

In other words, hardship is secondary in determining the value of the deed. The primary factor is its usefulness. Accordingly, value would reflect its hardness, but only to the extent that it is useful.

The same reasoning applies to risk, as it is a form of hardship. Risk as such is not desirable, although it is intrinsic to virtually all economic activities. However, the value of an economic decision is not determined primarily because of risks it involves; rather, it is determined according to wealth it creates and value it adds. Risk is reflected in value accordingly, but not that risk in its own determines the value.

Whenever taking risk is praised it is because of the added value and created wealth that follows, not that risk as such is desirable. This represents a vital difference between legitimate and undesirable risk: Risk is legitimate when it is necessary for value creating. But when no value is added, it is a form of gambling.

Hedging

Hedging is used generally to denote neutralizing and minimizing risk. In this respect, it naturally belongs to Islamic economic objectives. As such, this is not an issue and should not raise any concerns. The issue, however, is how to reach this goal, and what means is used to meat this end. If the means involves pure speculation and gambling-like activities, it would be illegitimate, even if the objective is. Ends do not justify means (Ibn al-Qayyim [6]), and thus noble ends necessitate noble means. Obaidullah (2005) rightly notes, "the provision of hedging facility is hardly an adequate rationale for tolerating *qimar* and *maysir*. The Shari'ah does not disapprove of hedging, since it brings in some It is the zero-sum nature of the game that the Shari'ah finds objectionable, as in it lie the roots of social disharmony and discord." (p. 176.)

To achieve legitimate hedging without *maysir* therefore is a challenge that both Islamic and conventional finance are facing. The objective of this paper is to explore and highlight milestones of the Islamic approach through which legitimate means can be developed to reach this essential goal.

Tolerable Risk

Muslim scholars discussed the conditions under which risk can be tolerated, and those under which it is not. Generally, they point that risk is tolerable if it satisfies the following conditions:

1. It is inevitable.
2. It is insignificant.
3. It is unintentional.

(See al-Dharir [12], pp. 587-612, and Hassan [7], pp. 464-469).

The first condition implies that the same level of added value of the concerned activity cannot be achieved without assuming risk of loss or failure.

The second condition concerns the degree of this risk. It states that likelihood of failure shall be sufficiently small. Scholars were clear that likelihood of failure should be

less than that of success in order for involved risk to be acceptable (al-Dharir, op. cit.). We shall see later how this condition distinguishes the Islamic approach from conventional, Neoclassical approach.

The third condition follows from the first two. The objective of a normal economic activity is the value it creates, not the risk it necessitates. This risk therefore cannot be the intended part of the transaction.

Inevitability of Risk

The condition that risk shall be inevitable implies that risk is inseparable from real, value-adding transactions. As discussed in the last section, separating risk from real transactions creates even more risks and makes the economy highly unstable.

From Shari'ah point of view, exchange of pure liability for a given price (معاوضة على الضمان) is unanimously prohibited (al-Suwailem, 1999). This is consistent with the general trend of Islamic finance to be always linked to real transactions. Since derivatives by construction separate risk from ownership and thus from real activities, they appear in direct opposition to Shari'ah principles. Not surprisingly, several Fiqh councils ruled that options and futures are unacceptable from Shari'ah point of view (e.g. OIC Fiqh Council [14]).

From an economic point of view, risk is necessary for economic progress and wealth creation. According to Alan Greenspan:

> The willingness to take risk is essential to the growth of a free market economy. If all savers and their financial intermediaries invested only in risk-free assets, the potential for business growth would never be realized. (cited in Bernstein, 1996, p. 328.)

President of IMF, Horst Köhler (2004), reiterates this meaning: "Indeed, it is the willingness to take risk and tackle uncertainty that drives innovation and technical progress—and helps create jobs and build prosperity."

Thus risk by nature is inseparable from economic activities. Islamic requirements that risk may not be severed from real transactions therefore are only natural and conform to economic reality. Artificially severing risk will not make it disappear; rather, it will come back in even more dangerous forms, as discussed earlier.

Likelihood of Failure

It is clear from classical sources of fiqh that for risk to be tolerable the likelihood of failure shall be less than that of success. This is true regardless of the magnitude of the outcomes of the decision.

This is in sharp contrast to expected utility rule (and many competing rules for this matter), where decision is based on expected terms, i.e. the product of probability of the outcome times its magnitude. The difference between the two can be seen most clearly in lotteries.

In a lottery, an agent has an extremely small probability of wining the prize. Probability of losing the ticket's price is substantially large. From an Islamic point of view, this cannot be acceptable since it is almost certain that loss will materialize. Expected utility rule, in contrast, is based on the expected value regardless of which state is more likely to prevail. This is true even if probability of loss exceeds 99%, as long as the prize is sufficiently large. This rule leads to a kind of "wishful behavior," where an agent behaves according to his preferences or wishes more than to objective reality.

This kind of behavior is rightly described as deception and delusion, or gharar. The decision maker is deceived by the size of the prize such that he behaves as if it is more likely to obtain, when in fact it is more likely not.

Causality

The condition of dominant likelihood of success is equivalent to saying that the action shall lead or "cause" the successful outcome to materialize. A cause need not lead to the final outcome with certainty. It is sufficient that it does so more often than not (al-Suwailem, 2002).

From an Islamic perspective, uncertainty requires the decision maker to take proper causes to achieve desirable results, and entrust Allah to avoid possible but less likely failures. Taking proper causes is viewed as mandatory and not merely preferable. Entrusting Allah thus compliments rational decision-making and never substitutes for it. Taking an action that is more likely to lead to failure is a violation of Islamic teachings.

This clearly shows that playing a lottery is not acceptable since it is almost certain that the player will not win the prize and thus will lose the price. This is also true for any economic decision for which likelihood of failure dominates that of success.

Investment vs. Gambling

The causality rule can clearly distinguish investment from gambling. The key difference between the two is confidence of success. An entrepreneur starts a project because he is confident that the project would succeed. A gambler knows in advance that he is more likely to lose than to win. However, the size of the prize deceives him to engage into such a losing project.

This difference is consistent with the concept of causality according to Islamic principles. An action that leads to failure more frequently than success cannot be considered as a cause of success. It is a cause of failure.

Expected utility rule in contrast does not differentiate between a cause and a non-cause. It mixes the likelihood of the outcome with its magnitude, and decision is based on the final product. No attention is given to how the outcome is reached, whether systematically or by blind luck. This is not the way agents normally evaluate their decisions. According to Ben-Ner and Putterman (1998):

> Individuals care about the manner in which they themselves and others behave, including the ways in which they attain outcomes

> of interest. ... Uncommon is the individual who is indifferent about whether he has achieved his income through honest work or blind luck, whether he has cheated others or treated them fairly. (p. 20)

Choice under Uncertainty

Conventional theories of choice, most obviously expected utility, cannot distinguish investment from gambling. Rather, decision under uncertainty is viewed simply as a choice among lotteries (e.g. Varian, 1992). Not only this is inconsistent with the Islamic view, it is also inconsistent with real decision making in business environments.

Studies by MacCrimmon and Wehrung (1986) and Shapira (1995) show that business managers rarely take risk as given. They consistently attempt to adjust risks such that they are confident of the successful outcome. According to Shapira: "Managers see themselves as taking risks, but only after modifying and working on the dangers so that they can be confident of success" (p. 74; emphasis added). In this context, risk taking "is an endeavor where a manager can use his judgment, exert control, and utilize skills". This is absent from gambling (p. 48). Shapira concludes that the "gambling metaphor appears as an inadequate description of managerial risk taking" (p. 120). James March, decision scientist at Stanford University, writes:

> Although theories of choice tend to treat gambling as a prototypic situation of decision making under risk, decision makers distinguish between "risk taking" and gambling, saying that while they should take risks, they should never gamble. They react to variability more by trying actively to avoid it or control it than by treating it as a tradeoff with expected value in making a choice. (1994, p. 54)

These results point to the fundamental difference between risk taking associated with real business activities, and gambling where likelihood of failure is dominant, but the size of the outcome deceptively makes the choice acceptable.

A Causal Decision Rule

If we want to amend the expected utility rule in the light of the above discussion, one way to do so is to impose a constraint on the likelihood of success. Suppose that an action a would lead to outcome $x_i \geq 0$ in state i, $i = 1, \ldots, n$, with probability p_i. Probabilities could be objective or subjective, as long as they satisfy axioms of probability. Let $v(x_i)$ be the payoff (utility) function of the decision maker in state i, and let $c(a)$ be the cost of action a. Expected utility requires an action a is admissible as long as:

$$[1] \qquad U(a) = \sum_{i=1}^{n} p_i v(x_i) - c \geq 0 .$$

For example, the action could be to purchase a lottery ticket for which the prize is, say, one million, and c = 1 is the price of the ticket. Then the outcomes are either to win the prize, whereby $x_1 = 1{,}000{,}000$, or not, whereby $x_2 = 0$. The action is admissible as long as the expected payoff is non-negative. If the probability of winning is one in million, and the payoff function is linear, then we have:

$$v_1 = 1{,}000{,}000 \text{ with } p_1 = \tfrac{1}{1{,}000{,}000}, \text{ and } v_2 = 0 \text{ with } p_2 = \tfrac{999{,}999}{1{,}000{,}000} .$$

Consequently, $U(a) = 0$. Thus, purchasing the ticket would be admissible. To exclude this sort of behavior, we have to impose a restriction on admissible probabilities. This can be achieved by subjecting [1] to the constraint that probabilities of success are larger than those of failure. Let S be the set of outcomes for which $v(x_i) - c \geq 0$, and let S' be its compliment, i.e. for which $v(x_i) - c < 0$. The set S represents the set of successful outcomes, while S' represents unsuccessful ones. Then action a is admissible as long as:

$$[2] \qquad U(a) = \sum_{i=1}^{n} p_i v(x_i) - c \geq 0 , \text{ and } [3] \quad \sum_{i \in S} p_i > \sum_{i \in S'} p_i .$$

The constraint [3] requires that total probability of success exceeds that of failure. Since total probability of all outcomes equals one, then condition [3] is equivalent to requiring that $\sum p_i > 0.5$ for $i \in S$. This condition therefore excludes outcomes with low probabilities that might be chosen merely because of the associated large payoffs, i.e. gambling.

Statistical Measure

A more direct representation of the causal rule can be obtained by invoking statistical measures of probability distribution. The expected utility rule is equivalent to the *mean* of the payoffs distribution. The mean is a measure of the central tendency of the distribution, defined as the sum of the values of the random variable weighted by their respective probabilities.

An alternative measure is the *median*. The median is commonly defined as the point that divides total distribution into two equal parts, each with probability of 50%. A more general definition, suitable for both discrete as well as continuous distributions, is provided by DeGroot (1986, p. 207). The median is defined as a value m of a random variable $\tilde{x}$ such that:

[4] $prob(\tilde{x} \leq m) \geq 0.5$ and $prob(\tilde{x} \geq m) \geq 0.5$.

That is, the probability distribution on either side of the median is *at least* 0.5. The two sides therefore need not be equal. For the outcomes of a given action *a*, the median payoff $\hat{v}$ is defined as:

[5] $prob(\tilde{x} \leq \hat{v}) \geq 0.5$ and $prob(\tilde{x} \geq \hat{v}) \geq 0.5$

A decision rule based on the median would require that an action *a* is admissible if the median payoff is non-negative, i.e.:

[6] $U(a) = \hat{v} - c \geq 0$.

To apply this rule to the lottery example, recall that there are two payoffs (assuming linearity of v):

$v_1 = 1{,}000{,}000$ with $p_1 = \frac{1}{1{,}000{,}000}$, and $v_2 = 0$ with $p_2 = \frac{999{,}999}{1{,}000{,}000}$.

The median of this distribution is v_2, since it satisfies the conditions in [5]. To see this, note that $prob(v(\tilde{x}) \leq v_2) = p_2$. That is, probability to get at most a zero-payoff (which is the smallest payoff) is greater than 0.5. Next, $prob(v(\tilde{x}) \geq v_2) = 1$. That is, a player is certain to get zero or more. (The reader may want to verify that v_1 violates [5] and thus cannot be a median.) Since the median is zero, the utility of purchasing a lottery ticket becomes negative, and therefore the decision is not admissible.

Note that this result is obtained regardless of the shape of the utility function. This makes the median rule robust with respect to the specification of risk preferences of the decision maker. Statistically, it is well known that the median is more stable than the mean, and represents the central tendency of the distribution more accurately (DeGroot, 1986, pp. 208-209).

It is somewhat surprising that while the median is more robust than the mean, it is also more consistent with Islamic and moral principles regarding wagering and gambling. The rule succeeds, at least to some extent, in distinguishing acceptable risk taking from gambling, a problem that puzzled lawmakers and economists alike. The median rule is consistent with results of evolutionary game theory, which point that "nature abhors low probability events" (Gintis, 2000, p. 117). From an evolutionary point of view, low probability events add little to agents' fitness, and thus are evolutionarily unimportant. Since few studies examine the median as a decision rule under uncertainty, further investigation is needed to explore and better understand its implications.

Derivatives

As discussed in Al-Suwailem(2006), trading derivatives, such as futures and options, results in losses more than 70% of the time. Since likelihood of failure exceeds that of success, such instruments are considered as factors of loss, not of gain, which violates condition [3] above. Further, using the median rule in [6], the decision to trade derivatives becomes inadmissible. Only in expected terms might they appear profitable.

But the expected utility rule is questionable, both from an Islamic perspective as well as real business decision-making, as explained earlier.

From the above discussion, none of the requirements of tolerable risks are satisfied by derivatives. This raises deep questions about Islamic legitimacy of these instruments.

The fact that derivatives by design are zero-sum games is another dimension of the subject that will be treated in the following section.

II

Theory of *Gharar*

The word *gharar* in Arabic language means risk. It also has the meaning of deception and delusion (al-Dharir [12]). The two meanings coincide most clearly in prospects with low probability but large magnitude, as in lotteries and all forms of gambling. The size of the payoff entices the agent to engage into an almost losing game. This is the essence of gambling that conventional choice rules fail to exclude, as discussed earlier.

While the previous section focused on individual decision-making, this section focuses on bilateral or interactive decisions. In such interactions *gharar* takes a definitive structure. It becomes equivalent to a zero-sum game with uncertain payoffs (al-Suwailem, 1999). This structure is consistent with Shari'ah measures of *gharar*. The measure can be used as a basis for evaluating as well as developing risk management instruments consistent with Shari'ah, as will be discussed below.

Types of Games

The term "game" is used for a variety of settings and arrangements. Here it is used to denote a for-profit exchange among two or more agents, whereby agents' payoffs are uncertain at the beginning of the game.

Games can be classified according to the sum of players' payoffs into three categories: positive-sum, zero-sum, or mixed-sum games.

1. Positive-sum games are games in which players have common interests, and thus they gain together or lose together (see Figure 7). Since agents are assumed to be rational, the losing outcome will not be their objective of the game. The positive outcome therefore is the objective of the game, and for this reason it is described as a positive-sum game.

In Figure 7, (A , B) denotes players of the game. The right branch denotes the positive payoffs for each (the first is the payoff of A while the second is that for B). The left branch denotes negative payoffs. At the start of the game, it is not known which branch they will arrive at. However, each player is assumed to seek the positive outcome rather than the negative one, and thus the objective of the game becomes mutual gain. If agents follow the median rule discussed earlier, then the positive outcome will be more likely to materialize. This makes the game Pareto-optimal, since both players are likely to be better off playing the game compared to not playing it.

An example of a positive-sum game is partnership or Since each partner contributes capital and labor, both would gain if the project succeeds, and both would lose if it fails.

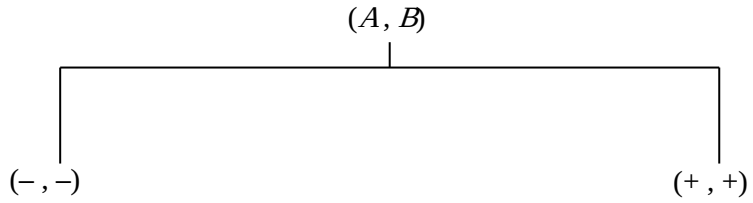

Figure 1: Positive-sum Games

Note that the size of the payoffs need not be equal for the two parties. But the sign must be identical; that is, they gain together and lose together, although the contribution of each might not be equal.

2. Zero-sum games are games in which one party gains and the other loses (Figure 8). Gambling is the most obvious example: Two players put, say, 1000 each, and a coin is thrown. If it comes head, A wins 2000, otherwise B wins.

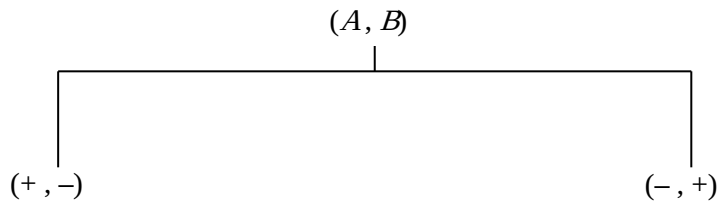

Figure 2: Zero-sum Games

Obviously, there is no possibility that the two could both win. One player wins only at the expense of the other. Again, the magnitudes of gain and loss need not be equal. The term "zero-sum" indicates that the interests of players are in direct opposition. As textbooks on game theory show, such games can always be reformulated so that the payoffs add to zero (Friedman, 1990, pp. 79-80; Binmore, 1994, pp. 276-277). We shall use the term "zero-sum game" to indicate games of direct opposition, regardless of the size of payoffs. Zero-sum games are Pareto-inferior, since they do not allow mutual gain of players. Agents are better off not playing the game (al-Suwailem, 1999).

3. Mixed games are games that include both sorts of outcomes: the zero-sum outcome as well as the positive-sum outcome (Figure 9).

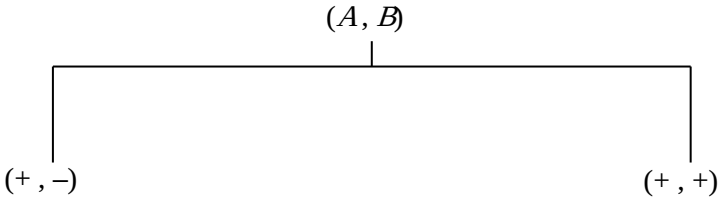

Figure 3: Mixed Games

These games allow for mutual gain, but also imply the possibility of conflict of interest. Examples of mixed-games include sharecropping or and (see al-Suwailem, 1999). In

fact, most economic activities are mixed or non-zero-sum games, as Schelling (1980) points out. Life therefore is not a gamble, as many writers claim. It is a mixed game that could end up in conflict or in cooperation. Wright (2000) argues that evolution, both social and biological, progresses towards non-zero-sum interactions. We shall see later how the structure of mixed games can be useful in developing Islamic hedge instruments.

Measure of Gharar

In a zero-sum game, one party gains at the expense of the other. It is a pure transfer of wealth for no counter-value. Since each party is seeking profits not donations, it becomes therefore a sort of "eating wealth for nothing," strictly condemned in the Qur'ān. Further, a zero-sum game is a game with direct conflict of interests, which represents the source of enmity that accounts for the prohibition of *maysir* or gambling in the Qur'ān: "Satan only wants to plant enmity and hatred among you through wine and *maysir*" (6:91).

On the other hand, gambling represents the purist form of *gharar* (al-Dharir [12], p. 622). Since gambling is obviously a zero-sum game, it follows that *gharar* must be unacceptable to the extent that it possesses the zero-sum structure. Accordingly, the circle of *gharar* is wider than that of gambling. For this reason, some transactions might contain *gharar* (i.e. a zero-sum outcome) but they are still acceptable if it the zero-sum component is dominated by the positive component, as in sharecropping and

From Sharīah point of view, generally speaking, the acceptability of such mixed games depends on the likelihood of the cooperative, positive-sum, outcome. If this outcome is dominant, the game generally is acceptable. In this case, the zero-sum outcome is considered as "minor *gharar*." If the zero-sum outcome is dominant, it becomes "excessive *gharar*" and thus not acceptable.

Technical formulation of this measure, as well as detailed discussion of several examples and applications, is provided in al-Suwailem (1999).

Characteristics of Zero-sum Games

Although it might appear fuzzy, the zero-sum property, in its basic form, is quite clear: Whatever one party gains is what the other loses. The following points help clarify how this structure applies to different forms of transactions.

1. First, note that in any zero-sum game, uncertainty at the time of contract is an essential condition. If it were known upfront, the game would not have been played. For example, if it were known on which side the coin will land, there is no point of betting. This is not the case in games with mutual gain. In a normal sale, where relevant variables are known upfront, the sale takes place with full information. Even if all future information were known at the beginning, the sale will still be performed if it satisfies the needs of the two parties.

2. It should be noted also that gains and losses in a zero-sum game are determined bilaterally, i.e. between the two parties of the contract. That is, an actual net transfer of wealth takes place at maturity from one party to the other, with no counter-value in exchange. If one buys a good on spot basis, and its price subsequently falls, this loss is not a direct gain to the first seller, except as foregone losses. But contractually, no counter party has these losses credited to his account as gains, and thus no net transfer of wealth takes place. Although trading of shares or commodities might at times appear as a zero-sum game, it is only at the system level. Individually, however, spot trading, with predetermined prices and parameters, cannot be a zero-sum game since the relationship between the two parties ends the moment the trade is concluded. Only in presence of uncertainty during the contract that a zero-sum exchange might, but not necessarily, arise.

3. Derivatives are clear examples of zero-sum games. They are obligations to exchange certain amounts of money in a future date. The difference between prices at the time of contract and at maturity is debited from one party and credited to the other, and that is why they are called contracts for differences. With mark-to-market system, this is done on daily basis. Even if the derivative is traded in a secondary market, the obligation as such survives throughout the life of the contract, and whoever becomes party to it has to settle these differences.

4. Financial markets as a whole might appear at times as zero-sum systems. Pyramid schemes are also zero-sum systems. But this applies to the system as a whole, not to individual contracts as such. Zero-sum systems arise because of misuse of normal, non-zero-sum contracts. However, with zero-sum contracts, the system by design will have a zero-sum structure. That is, systems of zero-sum contracts are zero-sum overall, but systems of non-zero-sum contracts may or may not be zero-sum overall.

For this reason the Prophet, peace be upon him, has put further conditions on normal sale, e.g. not to sell before possession or to sell what one doesn't have. These conditions help make the system overall positive-sum and prevent what Shiller (2000) calls "naturally occurring Ponzi processes" (pp. 64-67). During speculative bubbles, the market as a whole behaves as a Ponzi scheme: early investors get returns from newcomers, and newcomers profit from those joining afterwards, and so on, but latecomers eventually bear the cost when the market crashes. While financial markets in principle are useful and provide important economic functions, they need to be regulated in order to minimize such Ponzi processes from taking over. For example, James Tobin (1978) and Lawrence and Victoria Summers (1989) propose a transaction tax to reduce frequent trading and thus to curb speculation. Allais (1993) calls for abandoning continuous quotation of prices, and having a single quotation per day. He also insists that margins on forwards should be considerably increased to avoid harmful speculation (p. 36). Recall that in Islamic forwards, i.e. salam, the full price must be paid in advance, which points to the economic rationale for this condition. Detailed discussion of financial markets reform is beyond the scope of this paper, but the point should be clear: non-zero-sum contracts might lead to Ponzi, zero-sum systems if not properly regulated.

The above discussion hopefully clarifies the difference between zero-sum contracts and zero-sum systems. The former implies the latter, but the opposite is not necessarily true.

Expected vs. Actual Measures

The zero-sum measure is based on actual, realized outcomes of the transaction. Derivatives and all forms of gambling are zero-sum games in this respect. In expected terms, however, they might be considered as mutual gain deals. In other words, they might be win-win games ex ante, but win-lose ex post. The two measures are clearly incompatible, and thus a choice must be made between the two.

Economic success obviously is based on, and measured in terms of, actual and realized performance. In expected terms, LTCM might have been a profitable investment. In early 1998, the fund's value-at-risk (VAR), which measures the maximum daily loss in any single day with 95% confidence, was less than 1% of its capital. The probability that the fund would lose all its capital within a year was . That is, it would take several multiples of the lifetime of the universe for this event to occur (Lowenstein, 2000, p. 159; Partnoy, 2003, p. 257). Few months later, the fund collapsed when losses wiped out most of its capital. In other words, failure also is measured in ex post terms. Bankruptcy is decided according to actual, not expected, results. Similarly, profits and losses of derivatives are calculated daily through marking to market, not based on the overall, expected, value of the contract. Consequently, whenever expected and actual measures are in conflict, the latter obviously will have the precedence.

This is supported by the nature of uncertainty. Uncertainty reflects our ignorance of the reality. It therefore exists only in human minds. In reality, things either exist or do not exist. Nothing in the outside universe is random or undetermined. "God does not play dice," as Albert Einstein famously affirmed (Pais, 1982). The Qur'an clearly states: "Verily all things We created in (precise) amount" (54:49), "And every single thing is before Him in (due) proportion" (13:8). Uncertainty and risk therefore cannot exist outside human mind.

Accordingly, risk per se is not in fact traded, as it cannot exist in reality. What is actually traded is money for money. Kenneth Arrow (1971) points to this fact with respect to commercial insurance. He describes it as an "exchange of money for money, not money for something which directly meets needs." (p. 134.) Since this exchange is

contingent on a certain event, the contract ends up in payment in one direction only. If the event occurs the insurer pays to the insured more than the latter has paid, and thus the net-payment becomes money for nothing. The opposite is true if the event does not occur. In either state one party pays something for nothing. Only in expected terms that there is a mutual exchange. Ex post, however, no mutual exchange takes place, and it becomes a sort of eating wealth for nothing.

This clearly reflects the discrepancy between actual and expected measures in case of zero-sum games. This discrepancy is closely related to that between the mean and the median discussed earlier. The discrepancy arises in case of "outliers," i.e. outcomes with low likelihood but large magnitude. It is such cases where gambling arises, and the need for careful discrimination of types of risk is called for. The zero-sum measure provides an important landmark in achieving this objective.

Risk and Zero-sum Structure

There are several reasons why a zero-sum market is more risky than a normal market:

1. Earlier we argued that a zero-sum market does not create additional wealth to balance the additional risks created through interaction of agents. This is particularly true when the market is highly leveraged, as it is the case with respect to derivatives.

2. A zero-sum structure by design is relative: The payoff of one agent is the negative of the other. Relative payoff makes agents' behavior highly sensitive to each other. Consequently, a feedback loop is created as changes in an agent's behavior feeds back to itself through the behavior of others. The positive feedback loop and recursiveness of the system makes it increasingly nonlinear and thus prone to chaotic episodes, as several writers have pointed out (Sornette, 2003; Tumpel-Gugerell, 2003; Mandelbrot and Hudson, 2004; Bennett, 2004).

3. A derivative by design is derived from an underlying asset or variable. Movements in this variable would register profits for one party and equal losses to the other. In a zero-sum market, where all transactions are zero-sum games, any change in

relevant economic variables will necessarily create losses to some parties. The market has no room for mutual gain and common reward. Since risk is defined in terms of exposure to loss, a zero-sum market almost by definition becomes more risky than a normal one.

For example, in a futures market of a certain commodity, any change in the price of the commodity registers profits to one party and equal losses to the other. In a salam contract, in contrast, the price is paid in full in advance. The advanced payment provides the seller the possibility to utilize it in a manner that could compensate for moderate price increases of the commodity. On the other hand, since delivery is destined to a future date, the paid price is lower than the spot price. This discount provides a cushion for the buyer against moderate price declines. Therefore, the advanced payment provides a "safety margin" for both parties against moderate price fluctuations. This is in contrast to leveraged futures, where any price fluctuations presents a gain to one party and a loss to the other (al-Suwailem, 1999, pp. 84-85).

As another example, consider companies that provide their employees options to buy shares of the company at a predetermined price. Rise in the share's price above that given to employees is a gain to the employee and a cost to the company. However, this cost is utilized as an incentive to employees, so the final result of the contract is a win-win outcome (notwithstanding possible misuses of stock options). That is, wealth created through employee's effort compensates for the loss arising from the increase in the share's price. In contrast, in a call option, any changes in the price of the underlying will register gains to one party and losses to the other.

Derivatives deliberately sever wealth-creating activities from risk management, making them by construction zero-sum games. A derivative contract does not require the creation of wealth that balance the losses involved. The argument that risk trading promotes value-creating activities, if true, reinforces the Islamic position, since integrating the two will not be harmful. The integration would produce effectively the same result, but provides better incentives to do so.

4. In a zero-sum market all players are in direct conflict. This results in players taking advantage of each other when economic variables move unfavorably to some.

Thus the likelihood of failure of inflicted players will rise beyond that determined by exogenous economic forces. This apparently what happened to LTCM, when investors became aware of the losses the fund suffered after the crisis of Russian bonds and other emerging markets in 1998. Traders started betting against LTCM, causing further losses to the fund. In the words of Partnoy (2003, p. 260): "Other traders smelled blood at LTCM, and began betting against the hedge fund, trying to weaken its positions." LTCM was acting as "bank of volatility," and thus suffered "a classic run." According to Lowenstein (2000): "It made no difference whether banks were consciously trying to profit at Long-Term's expense or merely protecting themselves … Either motivation would have produced the same behavior" (p. 174, emphasis original). The fact that investors while protecting themselves necessarily attacked LTCM is a characteristic feature of zero-sum games. Since interests were in direct opposition, the benefit of one party necessarily implies the harm of the other.

Together with moral hazard, this shows that incentives react to the payoff structure in a manner that might distort behavior and thus create additional layers of risk to the system.

Since the zero-sum structure creates unnecessary risks, it becomes consistent with a widely held view that gambling is characterized by involving artificial risks (e.g. Borna and Lowery, 1987; Raines and Leathers, 1994). The zero-sum structure therefore is a sufficient condition to consider a certain transaction as gambling regardless of the tools used to implement it.

Two Measures of Gharar

In the last section we argued that taking risk would be acceptable, in a real transaction, if success was more likely than failure. A deal that is more likely to fail is more of a gamble than an investment. It is therefore a form of gharar. Here we argued that gharar is a predominantly zero-sum game. That is, we have two measures of gharar:

1. The likelihood measure.
2. The zero-sum measure.

The first is related to individual decisions, while the second is related to interactive decisions. But how these two measures are related to each other?

First, note that in a zero-sum game, there is no way that both players could win with probability greater than 0.5. Suppose that one player is likely to win with probability 70%. Since it is a zero-sum game, then if one party wins the other must lose. This means that the other player must lose with probability 70%. That is, a zero-sum game does not allow success to be more likely for both players. Thus the zero-sum measure implies the likelihood measure.

Next, the likelihood measure in principle is more general the zero-sum measure. To see this, consider an investment decision that has negligible chances to payoff. For example, a speculator decides to build a shopping mall in uninhabited area. Although the contract with the construction agent is a legitimate transaction, in terms of its final objectives it is a gamble on the side of the speculator. Thus, a legitimate, real transaction could be used for illegitimate purposes. This shows that the likelihood measure is broader than the zero-sum measure.

However, in a competitive economy, such highly risky decisions would eventually be transformed into zero-sum games. If an investor is willing to spend money for a highly risky project, then another agent would step in and offer to take less money in exchange for a higher return but with low likelihood. Ex ante, both parties are better off, and thus highly risky projects cannot continue for a long time. Accordingly, the likelihood measure, while pertain to individual decision-making, naturally leads to the zero-sum measure.

The two types of gharar might help clarify two widely used, but still ambiguous, terms: speculation and gambling. We might describe the first type of gharar as "speculation," and the second type as "gambling." Speculation thus is to use a legitimate contract for highly risky purposes. It describes a mixed game where the zero-sum outcome is more likely to obtain. Gambling, on the other hand, implies a stronger connotation, as both parties are involved in direct conflict or a strictly zero-sum game. From the above discussion, speculation eventually transforms into gambling. Further,

speculation, in this context, transforms a market of non-zero-sum contracts to a zero-sum system, like Ponzi or pyramid schemes.

Value of Risk Management

As point out earlier, hedging is valuable and consistent with Islamic economic objectives. However, conventional instruments, mainly derivatives, cannot separate hedging from speculation. They are used indistinguishably for both purposes, but mostly, 97%, for speculation. How can we realize the value of hedging and risk management without incurring the increasing costs of speculation?

From an Islamic perspective, the answer may not be very difficult. Islamic rules of exchange, being revealed from Allah (s.w.t) and thus entail His perfect wisdom and knowledge, provide the right framework for achieving this challenging objective. The general principle, which is a matter of consensus, is that risk cannot be severed and separated from real transactions. This will make risk transfer a zero-sum game and thus a form of eating wealth for nothing, which is strictly and explicitly prohibited by the Qur'an (e.g. 2:188, 3:29).

To achieve desirable risk transfer, therefore, we have to utilize structures that allow for mutual gain, i.e. nonzero-sum games. Such games, while imply the possibility of a zero-sum outcome, permit a positive-sum outcome, and thus provide a room for mutual benefits. This is the general strategy for developing risk management tools that are consistent with Islamic principles.

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