REMSES
Revue des Études Multidisciplinaires en Sciences Économiques et Sociales

ISSN : 2489-2068 Vol 5 – Numéro 3 (2020)

HOW TAKAFUL INSURANCE CAN REMEDIATE TO TECHNICAL DISEQUILIBRIUM OF INSURERS IN MORAL HAZARD SITUATION?

COMMENT L'ASSURANCE TAKAFUL PEUT-ELLE REMEDIER AU DESEQUILIBRE TECHNIQUE DES ASSUREURS EN SITUATION D'ALEA MORAL ?

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Abstract:

This contribution aims to explain some advantages of Takaful model in order to remediate to the dilemma of technical equilibrium of insurers.

The question of markets inefficiency has arisen again because of the phenomenon, which is, new and old in the same time; this phenomenon is due to the asymmetric information. This situation is described in finance as a moral hazard. We will interest in this paper to this situation that is recurrent in insurance contracts, we will refer, also, to the expected utility theory, V.Newman and O. Morgenstern (1944), Akerlof(1970) analysis, to explain how can Takaful insurance remediate to this disequilibrium.

The obtained results show that, when the two parties to the contract cooperate each other for a single purpose as enacted by the mutual insurance and Takaful model, the probability of extreme states will be minimized, average wealth will be unchanged, risk and variance premium will be lower, and utility will be higher.

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ISSN : 2489-2068 Vol 5 – Numéro 3 (2020)

Keywords: moral hazard, insurance companies, technical equilibrium, Takaful insurance
Jel Codes : D41, D8, D9, G22

Résumé :
Cette contribution a pour objet d'expliquer certains avantages du modèle Takaful afin de remédier au dilemme de l'équilibre technique des assureurs. La question de l'inefficacité des marchés s'est posée à nouveau en raison du phénomène, à la fois récent et ancien, qui est dû à l'asymétrie de l'information. Cette situation est décrite dans la finance comme un aléa moral. Nous nous intéresserons dans cet article à cette situation qui est récurrente dans les contrats d'assurance, nous nous référerons, également, à la théorie de l'utilité espérée de V.Newman et O. Morgenstern (1944) et l'analyse d'Akerlof(1970), pour expliquer comment l'assurance Takaful peut remédier à ce déséquilibre. Les résultats obtenus montrent que, lorsque les deux parties au contrat coopèrent dans un seul but, comme le prévoient le modèle d'assurance mutuelle et le modèle Takaful, la probabilité d'états extrêmes sera minimisée, la richesse moyenne restera inchangée, la prime de risque et de variance sera plus faible et l'utilité plus élevée.
Mots clés : Aléa moral, compagnies d'assurance, équilibre technique, assurance Takaful
Classification Jel : D41, D8, D9, G22

Introduction:

The purpose of this paper is to discuss the issue of an insurance contract that guarantees insurers, as well as insureds, a level of satisfaction according to their expectations. Starting from an assumption of two parties to the contract with two binding objectives; from an economic point of view (maximization of the expected utility), and from a technical point of view (risk sharing), an insurance contract can arise in a situation of under- or over-insurance. This situation seems to be an outcome in the case of informational asymmetry or moral hazard, thus calling into question optimality in the sense of Pareto.

We will try to demonstrate, through this work, in which situation the optimum can be reached, and how to remedy this very frequent problem, which can even affect the technical balance of an insurance company. In our analysis, we rely on the Takaful insurance system to remedy this

failure. We plan to proceed in our theoretical approach from : the foundations of the theory of uncertainty from the new risk theory of D.Bernoulli(1738), to the contributions of J.V.Newmann and O.Morgenstern (1944), Akerlof (1970), Samuelson(1977), Machina(1987), Eeckhoudt *et al*(2005) in the analysis of the economic behavior of individuals. We will then proceed, in the technical part of the analysis, to determine the optimal situation by referring to the measurement of an optimal risk premium using the Arrow and Pratt (1964) model.

1. Takaful Insurance *Versus* Traditional Insurance

Coping with adversity and reducing risk is an instinctive human behavior. This attitude is not opposed to the precepts of Islam. However, certain methods and techniques used in traditional insurance, also known as conventional insurance, constitute major contradictions, calling into question an entire system with a noble purpose. The elements of Riba (usurious interest rates), el Maysir (gambling and speculation), el Gharar (too much uncertainty), often appear in insurance contracts. As a result, the last two decades have revealed, in a global way, some failures of the current financial system.

Indeed, in a context of financial crisis and moral rejection of capitalist excesses, a renewed interest from the part of investors and national and international bodies in search for ethical values has already been observed, particularly for the insurance system.

Mainly developed in Muslim countries in the Middle East and South East Asia, the Takaful industry is still an emerging and poorly regulated industry. However, major international brands are beginning to take a position in these markets. From this point of view, it becomes essential to clarify certain features in order to understand the context in which this new model is imposed.

The payment or collection of interest, which is commonly known as el Riba among Muslims, corresponding to an increase in the amount lent, is not advocated in Islam. This practice was condemned by the various religions* long before it was condemned in the various verses and Suras of the Holy Koran (Sura II, V 275,276, Sura III, V 130). However, in the personal insurance branch, for example, and from a technical point of view, insurers use a capitalization system, because it is impossible to rely on a distribution system, given the characteristics of the insured risk. This technique, which is, in reality, just an interest-bearing savings technique, reduces uncertainty in the calculation of premiums, claims and profits.

* The technique of lending to the big adventure, for example, was condemned by Pope Gregory IX in 1234, because of the usurious interest rate.

In verse 90, Sura 5 of the Qur'an, God forbids any practice of gambling (el Maysir), calling this act an abomination and the work of the Devil. However, in some insurance contracts the terms of the contract are unclear, which makes its practice subject to the different rules of gambling. In some contracts, the amount paid as an insurance premium will not be returned to the client at maturity once the risk has not occurred.

In addition, L.Milliot clearly explains, in the following quotation, the reason why el Gharar was banned, "el Gharar's prohibition is based on the immortality of gain that does not justify work, (...), on the danger of speculation on certain basic necessities with a view to monopolizing them, in a country whose population is still on the verge of famine. ».

Hazard and uncertainty are the main characteristics of insurance as it is currently practiced. Both parties to the contract are increasingly less informed. The insurer who forecasts his technical balance on the basis of the laws of statistics cannot predict the future behavior of his clients with regard to the insured risk. On the other hand, the insured is generally not sufficiently trained or predisposed to master the laws of statistics, to understand the details of an underwritten contract. Moreover, the same pricing is applied whether or not the insured makes an effort to protect himself or herself, which is unfair, because the cost of self-protection is often not taken into account. In other words, insureds are assumed to be identical, and the assumption of insured heterogeneity is not taken into account in pricing (Sirey, 1953).

This information, escaping the contractors, increases uncertainty and uncertainty, which is detrimental to the entire insurance system. This situation is not appreciated in Islam, as it leads to injustice and prejudice. Thus, in 1985, the Great Council of Muslim Ulemas (Majmaa el ficqh) ruled on the insurance contract, as it is currently conceived, considering it to be full of uncertainty, which makes it insufficient, and it therefore becomes prohibited.

By conforming to the precepts of Islam, Takaful insurance departs from the main contradictions of traditional insurance. This new model of insurance takes into account first of all ethics and moral values based on religion, with man at the center of the reflection. Thus, mutual assistance and the voluntary contribution of the insured, the separation of the shareholders' fund from that of the insured, the redistribution of technical profits and the conformity of assets with the Sharia are the main features.

As mentioned above, by giving participants a share of the technical benefits*, the contradiction

* Since the Takaful model considers policyholders as participants, there is no distinction between policyholders and insurers.

arising from el Gharar is put to an end (Graig R Nethercott, Davis M Eisenberg (2012). Moreover, the principle of no enrichment at the expense of insurance would be respected, insofar as one can depart from any speculation or unjust enrichment (el Maysir). Investment that is too risky is also considered illegal (Haram), since the Takaful operator does not own the capital invested in its entirety, insuredss are also considered as participants in the different models (Musharaka, Murabaha...etc).

Insurance premiums are no longer regarded as remuneration paid to insurers in return for a service rendered, but rather as contributions or donations intended for the solidarity and mutual interest of the participants, Kassim, Z. (2005). As a result, the payment or collection of usurious interest (el Riba) will be meaningless. Thus, Takaful insurance, with its structures and different models inspired by Sharia and some principles of mutual insurance, can constitute an alternative to the current system, while meeting the expectations and ethics of Muslim law.

In fine, from this brief description of the main contradictions of traditional insurance, justifying the growing interest in the Takaful model, we can see that all the failures of the current system are related to uncertainty, randomness and informational asymmetry, from which arises what is called el Gharar. As a result, several other contradictions result, calling into question an entire insurance model.

In what follows, we will show how these failures can alter the equilibrium of an insurance market in the microeconomic theory of uncertainty.

2. Problem of moral hazard in the insurance market

Generally, it is assumed in economic theory that both parties to the contract (insured and insurer) have all the information. However, this assumption has become utopian and unrealistic since the work of Akerlof (1970).

Let's take the case of a client who goes to an insurance company for health insurance. Only the client himself has all the information concerning his state of health. On the other hand, the insurance company is the sole owner of the information concerning the calculation of premiums and the market situation (conditions of competition), unlike the customer, who is less informed about these details, especially in the case of low-income economies where the insurance service is still a luxury.

In most cases, this situation leads to a difficulty related to the fair pricing of risks A.Raviv (1979), due to an informational asymmetry. Consequently, adverse selection (*ex ante* or *ex post*)

and moral hazard will be the main features of an insurance contract, hence the difficulty of achieving technical equilibrium and optimum in the sense of Pareto.

In a situation of moral hazard, Pareto's optimum is difficult to achieve (J.J.Laffont, 1998, P136). One of the contractors may take advantage of the situation by setting prices in his favor, which will certainly lead to not respecting the golden rule ($\frac{\sum primes}{\sum sinistres} \approx 1$) ; technical surplus (of technical profits), or technical deficit (insufficient pricing).

Several research studies have been carried out in this regard, the most widespread being Akerlof (1970), Rothschild & Stiglitz (1976) and Winter (1992)), which have made it possible to distinguish between the different stages leading to the appearance of moral hazard in a market.

2.1. Information asymmetry:

Asymmetric information generally leads to two situations: the first is a situation where the market is disrupted by the fact that one party is better informed about the subject matter of the transaction being exchanged at the time the contract is signed, known as anti-selection, or adverse selection. The other situation is moral hazard, which is a situation in which one of the parties cannot control the action of the other party or does not have the means to assess its appropriateness.

2.1.1 Adverse selection (anti-selection): Anti-selection results from the asymmetry of information that is declared at the time the contract is signed (*ex-ante*). When buyers imperfectly observe the quality of goods/services they wish to acquire, sellers have an interest in overestimating the quality of their products in order to sell them at the highest possible price. Buyers can therefore neither trust the sellers' statements nor infer that a high price means good quality. In such a framework, sellers of good quality goods, which are indeed worth a high price, may be unable to sell their product at their true price because buyers doubt its quality.

The prize can no longer play its informative role. Under these conditions the competitive market can no longer function effectively. The agent who suffers from a lack of information risks selecting a product that does not correspond to the posted price, or asks for a price so low that the right products are withdrawn from the market.

Akerlof demonstrated in 1970 in his publication "The market for lemons: Quality uncertainty and the market mechanisms" that price is not necessarily synonymous with quality, good or bad depending on how it evolves. He assumes, in a situation of informational asymmetry, that by proposing a single price, which could be an average price, the market only allows the sale of poor quality models. At this price, the owners of good quality models withdraw from the market,

as the average market price is too low. The asymmetry of information therefore excludes good quality products from the market in favor of lower quality products. This is known as adverse selection. "The bad products chase the good ones away"...Thus letting it happen can have disastrous consequences: elimination of the good products, or even no exchange at all.

In this context, regulations ensuring the disclosure of all or part of the information, or instituting effective appeal procedures against the sale of poor quality products (legal guarantee against hidden defects), help improve the functioning of markets.

Insurance companies often find themselves in the same situation, and so do insured persons. If the companies set an insurance premium, calculated on the basis of a mathematical expectation (the average value) that applies to the entire population, it in turn exposes itself to an obvious risk. Since insurance is not compulsory, it is reasonable to assume that "low-risk" people, finding the average premium too high, will not take out insurance, depriving the company of the expected revenue needed to balance its finances. Conversely, the expenses incurred by those who have decided to insure themselves (the "high risks") are much greater in volume and value than those assumed for the medium risk. Such a choice therefore leads to a technical imbalance. In this analysis anti-selection appears in the impossibility of insuring a large number of potential clients who consider the insurance premium too high in relation to the risk incurred.

One solution is to encourage insured persons to disclose their risks by setting up a system of deductibles or co-insurance. The insurance company offers contracts with fairly low insurance premiums but a fairly high deductible and other contracts with, on the contrary, fairly high premiums and a low deductible. Low-risk agents will rationally opt for the former and high-risk agents will opt for the latter. The problem of adverse selection finds in this situation an obvious solution: pay according to the risk incurred. This discrimination, in fact, makes it possible to keep the right customers.

2.1.2 Moral hazard:

As explained above, anti-selection is a phenomenon or issue related to situations where information asymmetry occurs *ex-ante,* at the time of negotiating a transaction, it concerns the nature and quality of goods/services offered on the market but it is difficult to anticipate the behavior of the buyer after buying (*ex-post*). In the case of moral hazard, the behavior of both parties to the contract cannot be predicted, it is somehow ignored. This lack of perfect knowledge of post-purchase behavior leads to a situation where the market cannot be treated in a global way. Each case becomes an individual case.

In insurance, we can give the example of coverage against fire and theft. The question that arises in the name of **"moral hazard"** is whether the insured will take as many precautions after making sure as he did before to avoid theft and/or fire. Is the incentive to protect oneself not reduced by the fact of being insured? Generally speaking, too much insurance encourages the loss of precautions. Obviously, the existence of hidden behavior changes the nature of the balance compared to that observed where behavior is rational and predictable.

Moral risk appears in situations where certain actions of agents, which have a consequence on the risk of damage, are unobservable by insurers. But the development of the information economy has led to a more general definition of moral risk. Two types of situations can be distinguished. In the first case, the insurer can observe the effort made by his client to protect himself, and in the second case, he cannot observe his behavior.

Thus, M.M.Boyer (1999) describes a situation of moral hazard, as a problem related to the incentive of the agent who has private information to make an optimal decision in relation to the less informed individual. However, in the previous case of anti-selection, the less informed individual must select a good partner or a good product. The way to solve the problem of moral hazard is therefore to find an incentive procedure, while the way to solve the problem of anti-selection is to find a procedure to obtain information about an intrinsic quality of a product or individual. As Boyer suggests, the problems related to moral hazard can be solved by imposing certain rules such as payment according to a result, the adoption of techniques of direct control of the action of agents, contracts that establish competition on results or collaboration for a long period with the same agents or partners.

2.2 Technical balance with the presence of moral hazard

In studies on the equilibrium of insurance markets, it is assumed, in a global way, that the information is symmetrical. Nevertheless, in recent years we have been interested in cases where moral hazard and anti-selection can be observed. A first category of models assumes that the anti-selection relates to agents' risk aversion: Jullien, Salanié *and al* (2006), while the second category of models assumes that the anti-selection relates to the effort made for self-protection: Stewart (1994), Chassagnon and Chiappori (1996). In this study, our analysis will approach both approaches.

In our analysis, we consider agents with an initial wealth *W0,* having the same utility function as described by VNM.

In the presence of moral hazard, information is not symmetrical. As a result, agents can

influence the probability of the risk occurring (see illustration in the Appendix). In this case, there will be two categories of agents, the first one being able to increase the probability of risk occurrence, and the other one making an effort to reduce this probability. On the other hand, the insurer may or may not observe the heterogeneous behavior of the two categories of agents.

Now suppose that the probability of risk occurrence is influenced by a variable characterizing the self-protection effort (*x*), so we will have a probability dependent on (*x)* given by *π(x)*. The insurer is thus confronted with two categories of agents (insured), consequently the identical pricing cannot be right, because the probabilities of claim will be different.

Taking the logic a little further, and assuming that the probability (π1) is the probability of the loss for agents who make a self-protection effort, and (π2) is the probability of the loss for agents who make no self-protection effort.

Knowing that *π2 > π1,* VNM utility function can take the following form:

U(w) = πiU(W0-Pw-S +I)+ (1-πi)(W0-Pw) , Such as:

- *W0: the initial wealth*
- *Pw: the insurance premium*
- *S: is the sinister*
- *I: Compensation*

If $Pw = \gamma \alpha S$, $I = \alpha S$; γ being the premium rate and α being the coverage rate. The optimization constraint requires the first-order condition (see Laffont, 1998) :

$$\frac{du(w)}{d\alpha} = 0 \Leftrightarrow \pi_i U'(w_2)(-\gamma S + S) + (1-\pi_i)U'(w_1)(-\gamma S) = 0$$
$$\Rightarrow \pi_i U'(w_2)(-\gamma + 1) + (1-\pi_i)U'(w_1)(-\gamma) = 0$$

From the equation above, we can deduce the following equality:

$$\frac{U'(w_2)}{U'(w_1)} = \left(\frac{(1-\pi)\gamma}{\pi}\right) \times \left(\frac{1}{1-\gamma}\right)$$

And also: $\frac{(1-\pi_1)}{\pi_1} \rangle \frac{(1-\pi_2)}{\pi_2}$

Thus, coverage rates differ; agents with a high probability of loss and a lower self-protection effort will prefer to insure more, more than other agents who will influence the probability of risk occurrence ($\alpha_2 \rangle \alpha_1$) downwards, this situation is considered optimal. With this logic, we can draw two indifference curves corresponding to every agent as follows:

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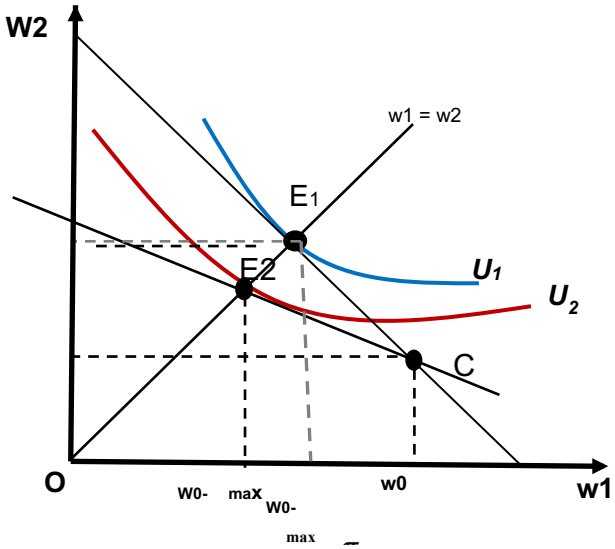
Figure 1: Insurance choices of two economic agents (with and without self-Protection)



Source: Realized by the authors

From this Figure, we can clearly see that the tangents of the two curves correspond respectively to $\frac{(1-\pi_1)}{\pi_1}$, and $\frac{(1-\pi_2)}{\pi_2}$, knowing that $\frac{(1-\pi_1)}{\pi_1} \rangle \frac{(1-\pi_2)}{\pi_2}$.

This means that agents with a self-protection effort will accept an optimal contract at point (E1), while other agents with a high probability of claim will accept at most a premium and an optimal contract at point (E2). Given that it has been found that, from the point of view of the insured (agent) and with only one category of agents, the optimization condition will only be verified when the insurance premium is determined according to its actuarial value, which corresponds to zero profits for the insurer (see JJ Laffont 1998).

Suppose that the insurer imposes an insurance contract at point E1 for all. Agents with a low probability of loss will accept this contract as well as agents with a high probability of loss. The latter will be very happy as long as the utility is greater.

Now, what about the insurer, his technical balance will be achieved but with intense fragility. In fact, agents with a high probability of claim will be more numerous than those who have made an effort at self-protection, which will lead to an average probability biased to that of agents with a high probability of claim. The compensation rate will be higher than expected, leading to a technical deficit. Otherwise, if the insurer offers a contract at point E2, it will only have the agents with a high probability of loss. Of course there is adverse selection, this is exactly the example similar to the bad second-hand cars in Akerlof's model, which amounts to the same observation; agents with a low probability of claim will not accept a high insurance premium (at point E2), as the utility level is lower than at point E1.

Thus, in order to transcend this situation, the insurer can propose contracts where the insurance premium is determined proportionally to the coverage rate, and each category of agent will choose a contract according to its needs. In other words, insurers have to comply with Akerlof's signal theory in order to identify bad and good risks.

Offering two different contracts (blending contracts) will allow the insurer to achieve technical balance, as the premiums collected will be exactly sufficient to compensate all claimants. Agents with a high probability of claim will choose a contract at point E2 and will have full insurance. On the other hand, the other category of agents will choose a partial insurance (complementary to their self-protection), in return for a lower insurance premium, it can be the point c' (see the following figure).

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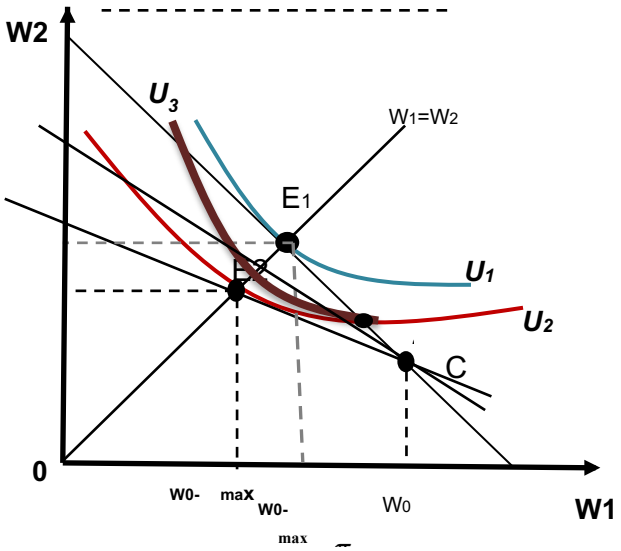
Figure 2: Balance of insurance with contingent contracts



Source: Realized by the authors

3. The Takaful mechanism to the rescue of insurance companies

We resume the previous analysis by introducing another parameter that characterizes behavior in accordance with the precepts of Islam.

In a Takaful insurance system, it is advocated, to respect the rule of mutuality falling under the precepts of Islam. This insurance model stipulates that both parties to the contract must cooperate to reduce the risk. Thus, any new information must be declared at the appropriate time, Laguere, D. (2011). The terms of a contract must be clear and do not constitute what is commonly referred to as al Gharar*. Any other manipulation or cheating is prohibited. This is embodied in Takaful insurance in different contracts such as: La Mucharaka, Murabaha, Mudharaba...etc.

Indeed, all Takaful insurance models prioritize strict adherence to the precepts of Islam so as not to harm the other party. We assume in this work that this behavior must be worthy of an act that reduces the probability of a given risk occurring, and that any new information will be fully incorporated into the process of determining and calculating premiums (since the terms of the

* Confusion in the terms of a contract.

contract will be so clear, surpluses and underwriting profits will be fairly distributed). As a result, the Pareto optimum and technical equilibrium will be quickly achieved, as long as the risks are priced at their fair value.

In such a model, mutuality is respected, the policyholder is also considered as a participant in most cases, and when the policyholder is aware of the importance of his or her behavior for the correct outcome of an insurance contract, mutual honesty of all participants' results.

Let us take the case of two individuals participating in an insurance operation, they help each other, according to the rules described above, to face adversity, three different situations can be foreseen:

- A no-loss situation and the wealth of the two participants becomes identical, i.e. $Wfi = W0$, with a probability equal to $(1 - \pi)^2$
- In another situation where one of the participants is at risk, each of them must

Therefore pay half of the claim, i.e. $Wfi = W0 - (L/3)$

With probability equal to $2 \times \pi(1-\pi)$

- The other situation is that of two claims, with both participants bearing the risk.

The final wealth of each becomes: : $Wfi = W0 - 2(L/2)$, with a probability = $(\pi)^2$

Thus, we can generalize this analysis to a multi-participant insurance system, the final wealth will be given by $Wfi = (W0 - L)$, and the probability of occurrence of the risk = $(\pi)^n$

To better understand, we will refer to the following example, where two identical agents wish to help each other to face a given risk, the utility function is identical

and checks the criteria of VNM, it is given by $U(W) = w^{1/2}$, the initial wealth $W0 = 100000\ DA$, the probability that the risk occurs and completely destroys this wealth is given by $\pi = .3/4$.

If, for example, an agent faces this risk alone: his average wealth:

$\overline{w} = E(\tilde{w}_f) = 25000DA$

The optimal maximum insurance premium can be deducted as follows:

$P(w, \tilde{x}) = E(\tilde{w}_0) - w^* = 25000 - 79.05 = 24920{,}95DA,$

as w^* The certain equivalent

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Let's take the previous example again with a possibility to help each other with another well-informed participant, our calculations become :

$$\overline{w} = E(\widetilde{w}_f) = 100000 - (100000 \times 0.5625) - (50000 \times 0.375) + (0 \times 0.0625) = 25000DA$$

$w^* = 103.61$.

It gives an optimal maximum insurance premium equivalent to 24896.39 DA.

A simple comparison indicates that when the two parties to the contract help each other for a single purpose as enacted by the mutual insurance and Takaful model, the probability of extreme states will be minimized, average wealth will be unchanged, risk and variance premium will be lower, and utility will be higher.

Consequently, and with this logic of analysis, it becomes clear that any failure, resulting from an informational asymmetry, that would allow the contractors to harm each other will not be possible, because of the desire to help and compensate each other.

Conclusion:

By way of conclusion, it can be said that the rational behavior of economic agents is a *sine qua non* condition for remedying certain failures and excesses of moral hazard situations resulting from neo-capitalism system.

Putting people at the center of the reflection constitutes the core of the analysis, which is why a renewed interest in Islamic finance has been observed in recent years. Most financial models are indexed to the principles of Islamic finance (such as the case of Japan, which sets interest rates at very low levels, even tending towards zero). This contribution allowed us to briefly explain how a Takaful insurance model will help insurance companies (having recently played a more important role like banks in the mobilization of savings and investment), to transcend the problem of moral hazard, which is a new phenomenon that undermines the technical equilibrium of insurers.

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ISSN : 2489-2068 Vol 5 – Numéro 3 (2020)

Appendix:

Illustration of a technical deficit resulting from moral hazard:
Portfolio of automobile insurance contracts (amounts are expressed in DA):

Contract No.	Pricing code	Capital insured	Term of insurance	Pure premium	Total premium
01	00/100	700000	1 year	9784,12	12433,9
02	00/102	850000	1 year	18648,12	23079,03
03	00/114	1650000	1 year	53276,87	64623,79
04	03/120	130000	1 year	2421,01	3445,99
05	00/110	600000	1 year	2114,34	3076,48
06	02/102	160000	1 year	7115,07	9200,25
07	00/123	1200000	1 year	27275,86	33448,32
08	00/133	1400000	1 year	32233,86	39428,86
09	14/104	1800000	1 year	105769,81	127189,12
10	03/122	160000	1 year	3304,343	4536,273
11	00/103	1500000	1 year	33018,6	40331,88
12	02/123	200000	1 year	5176,5	6847,27
13	00/112	750000	1 year	2535,414	3586,92
14	00/104	1300000	1 year	29432,58	36037,93
15	00/125	1450000	1 year	31940,84	39030,24
16	03/102	140000	1 year	4551,83	6062,2
17	02/121	150000	1 year	4756,79	6313,54
18	00/122	800000	1 year	25989,33	31895.73
19	02/104	180000	1 year	6197,01	8094.68
20	00/130	650000	1 year	21375,01	26115.26
Total				399641,447	/

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Compensation (DA) :

Contract No.	Amount of the claim (after expertise)	Franchise	Compensation
03	75000	500	74500
06	60000	0	60000
09	220500	1000	219500
14	37000	500	36500
17	28000	0	28000
Total			418500

Based on the two tables, a technical deficit of **18858,553 DA** can be noted.

If the probability of occurrence of the risk is determined as follows:

$\pi = \frac{\sum x_i}{n_i} = 0.25$, and a premium rate $\gamma = (1 + \Lambda) \times \pi$ such as $\Lambda = 0.3$,it gives a premium rate of γ =0,325.

We can now calculate the pure premium to be paid by the insured who have suffered the risk:

Contract No.	Compensation	The premium rate (γ)	Corresponding pure premium
03	75000	0.325	24375
06	60000	0.325	19500
09	220500	0.325	71662.5
14	37000	0.325	12025
17	28000	0.325	9100
Total			24375

Thus, it will be possible to easily deduce the probability calculated by the insurer($\pi = 0.23$), and that was actually found $(\pi' = 0.25)$. The results obtained indicate the presence of moral hazard, which led to a technical deficit of the insurer.