A Binding Model of Insurance to Restrict the Marine Pollution

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***Abstract*- Among commodity products in the world, oil is the mostly transported. Most of the oil flowing in the world is carried on specific ships, tankers. They can easily deliver large quantities of -either crude or refined -oil to places where they are needed, often following the same routes. The shipping of these products is done under conditions of strict security provided by the oil companies, ship-owners who have the ships and the states that register them.**

Oil tankers can have very different sizes. They are classified according to their transport capacity measured in tones of crude. Thus, in response to a constantly increasing demand, the oil freight (transportation of crude but also fuel, fuel or basic products for the petrochemical industry) continues to grow.

Energy consumption by shipping is the source of many pollutants. Environmental risks associated with exporting and shipping of oil in particular can be very important. The resulting effects are diverse and often complex. For some of them (impacts on the built environment, visibility, vegetation: wildlife, health) it is however possible to give some quantification in physical terms. The monetary value of these effects can refer to their economic cost or to a "contingent valuation", and it raises some methodological difficulties. Today the risk is financial, social, physical, environmental and human. The shipping company must manage after identifying risks and knowing how to transfer them to insurers, sovereign states, take offs to the maritime adventure, as the sea still remains a wild world.

Worldwide, operators require the highest levels ever of environmental and social performance of industry.

***Keywords*- Oil pollution; tanker; externality; market failure; performance; risk; regulation; freenegotiation; insurance**

I. INTRODUCTION

The shipping company operates in an open global competitive context, said free rivalry. The sea trade uses important means of transport (ships increasingly gigantic) but every year many ships perished accidentally and despite the technical and human resources in place, new risks emerge (pollution, insecurity) or reappear (risk of war), new international conventions follow these events by trying to govern together and unify the world through free trade. Maritime transport, which reports to the Maritime Law is all about «sea risk, which requires solidarity - (not legal in the sense of the word) -between participants in the maritime shipping and a risk division , particularly since more goods that carried risks have been expensive ".... In origin, the Maritime Law has a new and original character (positive law) remarkable implementing institutions such as the general average, insurance, and Bottomry loan (in-existing nowadays) The shipping company has always tried to protect its interests in its relationship with shippers, Brussels Convention and the Protocols are amended so as to limit its cargo liability . Major maritime disasters have led States to react through international conventions: The Titanic disaster will lead to the SOLAS (Safety, ship classification and marine salvage), disasters lead to closer agreements on marine pollution, the introduction of the ISM Code and STCW regulations providing complementary constraints to the shipping.

II. RISK ASSESSMENT OF OIL MARITIME TRANSPORTATION

Risk is an important concept particularly in the fields of industry, environment (industrial risks, major risks), finance, law, health, and of course insurance.
Compared to other energies, the success of the petroleum energy is particularly related to the ease of transportation.
Dealing with the maritime transportation of crude oil and petroleum products has become a problem of major international concern due to the potential of environmental pollution created by oil spill incidents. Maritime transportation accidents are relatively common occurrences compared to more frequently analyzed contributors to public risk. Yet research on maritime safety and pollution incidents has not been

guided by a systematic, risk-based approach. Maritime shipping accidents can be analyzed using event trees to group the accidents into "bins," or groups, of similar characteristics such as type of goods, location of accident (e.g., port, inland channel), kind of accident (e.g., fire, collision, grounding), and size of release. The importance of specific types of events to each accident bin can be quantified. Then the overall importance of accident events to risk can be estimated by weighting the events' individual bin importance measures by the risk associated with each accident bin

Managing risks associated with the energy industry is becoming increasingly complicated due to factors such as government regulations, public policy, financial concerns, and energy resource scarcity.

Parallel to the decision-making, risk management involves the assessment and anticipation of risks.

An energy risk management assessment typically involves several steps. The first step requires identifying all possible energy threats. Once potential energy threats have been identified, the risks associated with these threats are usually quantified and prioritized. The final step in an energy risk management assessment usually entails finding ways to address the risk. Solutions may include reducing the energy risks, monitoring. and systematic collection of data to trigger alerts.

III. HOW THE FIRM COULD MANAGE ITS ENVIRONMENT?

How the firm can manage its environmental impacts is a good determinant of how it manages its business overall. The experience has shown that the good environmental management not only yields financial savings but also leads to efficient business practice.

In our economies which are subject to globalization, the firm relies on a strong sense of network interconnection. The exchanges with its environment (physical, technical, legal, economic, social, media ...) are irregular, and the dependencies are unavoidable (suppliers, economic and political conjuncture, public opinion, bad weather ...).

The firm must introduce a number of measures to reduce the environmental impact of its
office operations.

This environment in which various actors involved in different logical as well as the chance is unstable by definition, not entirely predictable. The firm needs to know to make an ally. It will be all the stronger as soon as it will come into harmony with its environment, taming, anticipating his movements, adapting to draw from knowing the opportunities to create value required in a hyper competitive economy, for its survival.

In this context where risk-taking generates value and where the risks can simultaneously weaken or even destroy a business, risk management becomes essential.

IV. OIL POLLUTION AND MARINE ENVIRONMENTAL LAW

How is the environment integrated in our market economy? The traditional approach, consisting of regulating the most possible, has shown its inability to solve environmental problems. A new approach, which is more flexible and more efficient in combining regulatory and economic instruments, should lead to improve both economic and ecological results to fight against pollution.

In the early 1970s, governments began to intervene in the field of environmental protection by using a regulatory arsenal and direct controls. Parallel to this legislative process, a new—economic—approach appeared. It came out from the theory of externalities, by which the phenomena of pollution and environmental degradation are due to the lack of an adequate pricing of environmental resources: if we give a full price for these assets, their users (especially polluters) will take the necessary measures to limit their consumption and deterioration, rather than wasting them when they are “free”.

V. POLLUTION IS A TRUE MODE OF EXTERNALITY

The externality characterises a situation where the economic action of an agent provides advantages (positive externalities) or disadvantages (negative externalities) to one or many other agents, such interdependence finds no adjustment on the market.

When a tanker empties its tanks in the international waters or when toxic smokes degrade the air quality,

officials embarrass fishermen and inhabitants without spontaneously setting any price for such nuisances.

In case of externalities the price system ceases to carry on its function of information and incitement, it does not guide the agents towards more socially optimal decisions which may lead to various forms of inefficiency in the organization \ activities of production and consumption.

The exploration and production of oil and gas and the energical infrastructure projects associated with it are increasingly taking place in the world, they influence the diversity of environmental parameters and socio-economic from the Arctic 'to tropical and humid regions. The activities of the energy sector are by their nature complex and risky. They affect a variety of biodiversity, health and safety which should open a social debate about the factors of geological, political and economic risks.

Worldwide, operators require the highest levels ever of environmental and social performance of industry.

Consequently, oil and gas companies are being exposed to a steady proliferation of policies, laws, guidelines and other standards relevant to their activities.

VI. EXTERNALITIES AND THE REGULATORY APPROACH

An important solution to the problem of environmental pollution is based on a conception of the kingly state. It advocates to the use of administrative regulations of activities causing externalities through taxation permissions

We shall introduce here the concept of Pigouvian taxes, named after the British economist Arthur C. Pigou (1877-1959) who first, proposed to tax externalities in the environmental field. It aims to internalise the external costs or damages that the firm imposes on society and -the environment. With this tax, beard in mind, is not a tax but a price, the producer takes into account not only its individual costs of production but also its social costs (externalities) caused by its operations. The problem of course is to quantify the damage in monetary units. This estimate is very difficult in practice and the Pigouvian tax, optimal theoretical tool, can not be applied in this form. The concept, however, provided a theoretical basis for economic instruments increasingly used in OECD countries, such as taxes, fees, deposit systems, the financial markets or the creation of a "permit to issue "(" rights to pollute "). All these instruments have the advantage of giving a price to the pollution and thus lead to a better allocation of resources.

However there are two opposite views here, on the one hand, economists in favour of active intervention of the state (tax or regulatory approaches) and on the other hand, economists advocating free negotiation between polluters and the polluted (Contractual approach, and mechanism of pollution rights).

- If there is uncertainty about the future effects of a suspicious activity, the precautionary principle is applicable only to avoid irreversible catastrophy. This principle is to take protective measures without waiting for scientific certainty (to the greenhouse effect, immediate ban on CFCs, for example).

-A lower overall cost of fighting against pollution in relation to the establishment of pollution norms: tax is individually applied to the activity level of each firm, while the norms are uniformly applied, without taking into consideration the marginal costs of each firm.

Compared to the standard, the tax is a permanent incentive to reduce emissions. So when the state imposes an emission standard, the polluter-friendly law has any ambition to achieve this standard. In this case, the polluter has no incentive to do better than the standard (except for matters of commercial images).

In contrast, the tax provides a double permanent incentive struggle against pollution and technological innovation in this field. On the one hand, the tax induces a further reduction of emissions so that technical progress no longer benefits as a single polluter, but the community too. On the other hand, in the presence of tax, technical progress allows the polluter to perform a dual economy. (Cost-saving treatment and tax saving):

VII. THE FREE NEGOTIATION BETWEEN THE AGENTS

Ronald Coase, demonstrating that government intervention is not automatically required; he also highlights the true foundation of such an intervention. The state action is justified when the high number of partners and / or complexity of externalities involve entail transaction costs so that no mutually beneficial agreement and establishing the optimal allocation of resources can not be spontaneously negotiated.

The Coase Theory also is read as follows. If property rights are fully defined, if transaction costs are zero and if the information concerned is perfect agents, negotiation among these agents enables a situation of Pareto-optimal. In addition, if the distribution of property rights does not generate income effect, the optimum obtained will be the same, whatever the structure of property rights is.

The invalidity of the income effect related to the allocation of property rights: suppose that the Stationery initially owns a River. If this right is removed to be attributed to the water treatment plant, it sees its economic situation improve (increase in its "income" in the broadest sense). Say that the income effect is zero; this change has no effect on its marginal willingness to pay for a less important pollution. Under these conditions, bargaining between the two firms will lead to the same result (Pareto optimal) as Stationery has the right to pollute the river or the treatment plant has the right for a clean river. Coasian solution to the problem of externalities is a “market" procedure of the internalization of externalities-, which means that a market of externality rights has to be created. This procedure relieves the state to intervene, apart from ensuring respect for property rights.

So as this bargaining can take place, it is necessary that the rights of agents are clearly defined. In the case of the factory that pollutes a river, it is about who owns the rights to the river water. Do they belong to river users, who are then entitled to a clean river? Or do they belong to the company, which then has the right to pollute the river? If property rights are well

VIII. INTERNATIONAL MARITIME ORFANIZATION RESPONSIBILITY

The irresponsible practices of the maritime world and the race for the benefit of multinationals that are charged against; two main components are included here:

- The dilution framework of responsibilities and the lack of transparency that characterize the financial rules of the sea under the International Maritime Organization (IMO)
- The players of the global economy as some Oil Companies, in order to maximize profitability, are always basing their activities towards the lower social and environmental responsibility.

It has always been recognized that the best way of improving safety at sea is by developing international regulations that are followed by all shipping nations.

In terms of risk prevention, including the risk of maritime safety, the most important international conventions is that of the Safety of Life at Sea, known as SOLAS, adopted in 1960 and 1974. Its objective is to establish minimum standards for construction, equipment and operation of ships. States flag vessels have the responsibility to ensure that vessels flying their flag comply with the provisions of the Convention. The Contracting Government may inspect vessels of other Contracting States if there is a reason to believe that the ship does not comply with the provisions of the Convention.

The risk of pollution is taken into account by several conventions. The Torrey Canyon accident in 1967 and its media have been critical. It was the first major oil accident, after which the International Maritime Organization, affiliated to the UN, has been initiated by the adoption of several international conventions.

The first is the MARPOL Convention of 1973/1978, which establishes rules designed to prevent and minimize pollution caused by ships, whether accidental or due to routine operations. Beyond these agreements, we must also recognize the voluntary efforts of industry, either the ship-owners or oil companies.

IX. THE SCOPE OF MARINE INSURANCE AGAINST POLLUTION

The concept of risk premium is useful to characterize the extent of risk aversion. Indeed if $U(C)$ is the utility function wher C is the amount of

compensation in case of a loss we have; $U(E(C)$ *is the utility of expectancy of the chosen model.*

$E(U(C))$ *is the expectancy of the utility of the chosen model* U *is the utility function.*

a) *If* $U\big(E(C)\big) < E(U(C))$ *the agent is an amateur of risk*
b) *If* $U\big(E(C)\big) = E(U(C))$ *the agent is neutral to risk*
c) *If* $U\big(E(C)\big) > E(U(C))$ *the agent is dislikes risk.*

And $E_o(C) \leq E(C)$ *with* $E(C)$ *compensation expectancy* C.
The difference $\sigma(C) = E(C) - E_o(C)$ *is the risk premium associated with:* C *it is the amount which the agent is ready to withdraw (in terms of compensation expectancy) to remove any risk.*

$$U[E(C) - \sigma(C)] = E(U(C)$$

Suppose that the value of petroleum product transported by sea is w

And an insurance agency dealing with oil sea freight offers its clients who are carriers a choice model *between two possibilities Compensation* $(w + \theta$ *with probability 12 or compensation* $w-\theta$ *with the same probability (is a small sum compared to). The expected utility of such compensation shall be:*

$$EU(C) = \frac{1}{2}U(w+\theta) + \frac{1}{2}U(w-\theta)$$

Assuming that U *is a double differentiable function and very small for* w*, the Taylor expansion to order 2 gives us*

$$U(w+\theta) = U(w) + \theta U'(w) + \frac{\theta^2}{2}U''(w)$$

And

$$U(w-\theta) = U(w) - \theta U'(w) + \frac{\theta^2}{2}U''(w)$$

therefore is

$$EU(C) = U(w) + \frac{\theta^2}{2}U''(w)$$

The risk premium

$$U[w - \sigma(C)] = U(w) + \frac{\theta^2}{2}U''(w)$$

If θ *is small,* $\sigma(C)$ *will also be: So* $U[(w - \sigma(C)] = U(w) - \sigma(C)U'(w)$

and

$$\sigma(C) = \frac{U'''(w)}{U'(w)} \times \frac{\theta^2}{2}$$

θ^2 *is nothing as variance of compensation. So for small risks, the risk premium is proportional to the variance of compensation,*
This example obviously shows that the bad carriers of pollutants by sea who do not respect international safety standards will be barred from the sphere of insurance.

X. PROPOSED SOLUTIONS

The anti-selection is the issue of insurance which consists of, in exchange of a perception of quote-part or premium, providing a predefined financial service to an individual, an association or a company during a risk period. Thus, the main part-the insurer-will propose a maritime contract. For his contract he fixes a unique price p, because he cannot know the quality of his customers (good or bad carriers). In other words, let's simplify it as the cost of the median oil ship accidents.
From the point of view of a potential customer, this contract is even more interesting than is a bad carrier (the cost of the accidents becomes higher than the price of insurance).
Among all customers, the insurer will ensure all failing carriers; those whose accidents cost more than p, and only part of the goods which can bear the cost of their infrequent accidents instead of paying insurance). So the contract selects customers whom the insurer would not want to (they make him lose money), and does not like those who make him lose. Therefore this asymmetry of information is the origin of the marine insurance's higher costs and it

results in hazardous moral problem which is an "unwanted effect" i.e. a non desired result and a tiresome regulatory system or a contract with a major legal flaw which opens wide possibilities of abuse, or even fraud, to those who want to take advantage of the regulation/the contract by diverting its spirit. The hazardous moral is the voluntary ability for someone to strategically take advantage of an unpredictable situation ignored by the system designers.

To resolve this issue, we believe that the insurer can include typically, in such contracts a bonus and a franchise. Under such conditions, it is possible to firstly suggest a strong premium and a low franchise contract which is chosen by the failing carriers, and a low premium and strong franchise contract, chosen by good carriers. We would call the first contract: participatory constraint and the second one incentive constraint.

CONCLUSION

The marine ecosystem undergoes various forms of contamination and pressure from human activities. Protection and continuous improvement of its quality is the concern of all: several mechanisms for cooperation and consultation are active in this field.
The habit was taken to distinguish between these contaminations and pressures depending on whether they are from land related to the activities at sea or resulting from accidents. But we adopt a more integrated approach to nature conservation and protection of biological diversity.

In this study, we have shown the impact of oil maritime risk on the performance of oil shipping in general. This study was made on the basis of an analysis of the concepts of risk and performance. And the risks of maritime oil transport are considered as new risks that, globally, we do not know how to cover them by the classical methods of prevention, insurance (or investment). The difficulty of covering oil risk insurance concerns the component: "risk of oil pollution.

The oil trade and the market are subject to an inexorable competitive pricing. In reality, the age of the tanker intervenes in the decision-making process; it is often the cheapest available tonnage offered by the oldest ships that controls prices. It is therefore difficult to ensure that quality pays for; this phenomenon probably involves some risk for the maritime security as a whole: human (accidents, shipwrecks) and environmental (vegetation pollution e.g. fauna and flora), and on health).
We particularly believe that the absence of an unlimited, coherent and preventive responsibility of a national regime to be applied to oil transport by the sea, both at national and international levels, allows the maritime actors and their shippers to bear an inconsistent risk with the preservation of the environment which remains viable in case of disaster.

Unlike the UN agencies, the IMO does not work on the principle of "one state - one vote" but according to the relative weight of States in respect of maritime transport. Consequently, flags of convenience such as Liberia, Panama, Malta and the Bahamas, which represent 40% of maritime traffic, make out a law of it. The rules of the IMO Maritime suffer from this backing of the lobby of private operators, ship owners, chatterers and major petroleum owners. Flags of convenience are countries that offer tax advantages, a social right and a discount on almost total laxity in regulation (inspection of ships, etc. ...). Rather than fight against their existence, the great maritime nations (USA, EU, China ...) relations with this system are troublesome.
The contribution of industrial ecology in terms of environmental sustainability can be summarized by a reduced consumption of natural resources (biomass, fossil fuels, minerals ...) and emissions per unit of riches created in the sea.
Worldwide, operators require the highest levels ever of environmental and social performance of industry.

REFERENCES

[1] BERTRAND Alain-R 2000 Transport maritime et pollution accidentelle par le pétrole: faits et chiffres (1951-1999). Paris Editions Technip

[2] Sorrell S., E. O'Malley, J. Schleich, S. Scott, 2004, The economics of energy efficiency: barriers to costeffective investment, Cheltenham: Edward Elgar

[3] Étienne Amic, Gilles Darmois, Jean-Pierre Favennec 2006 L'énergie à quel prix: les marchés de l'énergie Editions TECHNIP, Paris France

[4] A. Handler, Credit Risk Management in Energy Trading – Dealing with the physical, gtnews, 21 mai 2007)

[5] G.M. Grossman & A.B. Krueger, "Economic Growth and the Environment", *Quarterly Journal of Economics*, Vol. 110(2), 1995

[6] Arrow, K., Bolin, B., Costanza, R., Dasgupta, P., Folke, C., Holling, C. S., et al. (1995). Economic growth, carrying capacity, and the environment. Ecological Economics, 15(2), 91-95.

[7] Grossman, G.M. and Krueger, A.B.. (1993). Environmental Impacts of a North American Free Trade Agreement. In "The Mexico-U.S. free trade agreement", P. Garber, ed. Cambridge, Mass.: MIT Press.

[8] Harbaugh, Bill, Arik Levinson and Dave Wilson (2002) "Reexamining the Empirical Evidence for an Environmental Kuznets Curve," Review of Economics and Statistics, 84(3) August 2002.

[9] Millennium Ecosystem Assessment (2005) "Ecosystems and Human Wellbeing: Synthesis" Island Press, Washington, DC. Online at http://www.maweb.org//en/Products.Synthesis.aspx

[10] GODARD Olivier., HENRY Claude, LAGADEC Patrick., KERJAN E. Michel *2002 Traité des nouveaux risques*, Paris Editions Gallimard

[11] KENNETH Joseph Arrow, 1974 The American Economic Review

[12] KENNETH ARROW ''Alternatives approaches to the theory of Choice in Risk-Taking situations '' Econometrica Vol 19,N° 4 1951

[13] KENNETH ARROW and F.Hahn ''Notes on sequence economies, Transaction Coast and Uncertainty'' Journal of Economic Theory 1999

[14] *Lambert* (*D-C*), 1996 *Economie des assurances.* Paris Editions Armand Colin

[15] *LAPIED André. et KAST Robert., 2004, Analyse économique et financière des nouveaux risques. Paris, Editions Economica,*

[16] LEONARD Patrick, 1993 Prévention technique et couverture financière des risques maritimes, Paris Editions IFREMER,

[17] LEROY Alain. et *SIGNORET Jean-Pierre, 1992 Le Risque Technologique. Paris, PUF*

[18] LEROY Alain., 2003, *Gestion de risque*, Paris, Editions Hermès.

[19] NEUMEISTER Michel, 1993 *Sécurité des pétroliers*, in Journal de la marine marchande. (JMM),

[20] Ronald H. Coase, 1960. "The Problem of Social Cost." *Journal of Law and Economics* 3 (October): 1–44.

[21] RUFFIEUX Bernard, La différenciation intra-sectorielle des performances des entreprises. Théorie et évolution en France depuis 1975, thèse de doctorat d'Etat soutenue en 1990. Université de Grenoble. Editée 1991(CNRS),

[22] Brahim Idelhakkar & Faris Hamza Oil/petrol shipment risk: insurance contract between regulations and environmental policy,Springer in Journal of Transportation and Security 27 August 2010

[23] Brahim Idelhakkar & Faris Hamza, Risk management of oil maritime transportation, Springer in Energy Systems, February 2011

[24] Brahim Idelhakkar & Faris Hamza, Pollution as a true mode of externality The regulatory approach and the free negotiation between the agents,to be publish in NovaPublishers in Advances in Sustainable Petroleum Engineering Science publication to appear in Volume 2 Issue 4.

ACRONYM:

IMO International Maritime Orfanization

ISM CODEINTERNATIONAL SAFETY MANAGEMENT CODE

OECD: RGANIZATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

SOLAS SAFETY OF LIFE AT SEA

STCW STANDARDS OF TRAINING, CERTIFICATION AND WATCHKEEPING FOR SEAFARERS.

UN UNITED NATIONS

MARPOL MARINE POLLUTION CONVENTION

EU EUROPEAN UNION