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AN ECONOMIC ANALYSIS OF INSURANCE FRAUD

by

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Résumé

Dans cet article, nous présentons une analyse économique de la fraude à l'assurance. Nous mettons l'accent sur le fait qu'une définition claire de la fraude à l'assurance doit être fournie par l'industrie pour pouvoir mesurer son ampleur avant que des mesures de prévention et de correction importantes soient entreprises. Nous montrons que les intermédiaires (garagistes, médecins, avocats, ...) jouent un rôle important dans la fraude à l'assurance. Il est en général, très difficile pour un assuré de commettre un acte frauduleux seul. Nous discutons des contrats d'assurance classiques non désignés pour tenir compte de la fraude à l'assurance. Nous mettons aussi l'emphase sur le rôle de la concurrence entre les assureurs comme facteur pouvant limiter la lutte à la fraude. La fraude à l'assurance est un problème d'industrie et celle-ci doit entreprendre des mesures correctives pour la combattre. Finalement, nous présentons des résultats statistiques d'une étude sur les accidents de travail.

Mots-clés: Fraude à l'assurance, définition, intermédiaire, contrats d'assurance, concurrence, industrie, résultats statistiques, accidents de travail.

Abstract

In this article we present an economic analysis of insurance fraud. We first emphasize that a clear definition of insurance fraud has to be provided by the industry so as to be able to measure its extend before any major preventive and correction measures are undertaken. We show that the intermediaries (mechanics, doctors, lawyers, ...) are important in insurance fraud. Usually, it is very difficult for a typical insured to commit fraud alone. We discuss classic insurance contracts which are not designed to take into account insurance fraud and for which some clauses might even encourage economic agents to engage in fraudulent activities. We also emphasize the role of competition between insurers as a factor which might slow the battle against fraud. Insurance fraud is an industry problem, and therefore the industry will have to take appropriate measures to fight it. Finally, statistical results from a study pertaining to accidents in the workplace are presented.

Keywords: Insurance fraud, definition, intermediaries, insurance contracts, competition, industry, statistical results, workers'accidents.

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INTRODUCTION

Insurance fraud has become a major concern in many countries. Its impact on insurance activities depends upon its intensity and the measure of its intensity depends upon its definition. The organizing committee of this conference used the following definition for insurance fraud:

" A voluntary act to take advantage of a contract. This act rests upon the ill-intention of the insured party. There is no fraud if the insured party acts mistakenly or with the legitimate belief that he does not commit any irregularity."

(Fortin and Girard, 1993)

This definition is quite general and might lead to confusion. For instance, is the negotiation of a deductible with a mechanic an act of fraud? Or is it fraudulent to omit to inform one's insurer about the recent downward fluctuations of one's assets or building? Should insurance fraud be limited to concealment of goods or assets in order to obtain reduced premiums¹, to thefts and to accidents or fires set up by insured parties? Should we also include all abusive compensations (claims), no matter their gravity?

We don't have any definite answers to these questions, but the insurance industry must define insurance fraud clearly so as to be able to measure its extent before any major preventive and corrective measures are undertaken. Every agent in the market should be able to act in accordance with the accepted definition.

This last remark leads to the second subject of our presentation. In almost every document that we have consulted², we have noticed that very limited attention has been devoted to the role of intermediaries³, who intervene in insurer-insured relationships. Broadly, we define an intermediary as an agent providing a service to the insured party after an accident or during an illness⁴.

¹ Or yet, the inscription of prevention measures that are non existant such as fire alarms on every floor.

² See the bibliography for more details.

³ As we will see later, recent American studies show that these agents play an important role.

⁴ This definition does not include financial intermediaries

Mechanics are good examples of intermediaries. So are dentists, doctors and lawyers. These agents might be motivated to offer additional services to the insured since they anticipate that their economic reluctance will be weaker than that of uninsured consumers. Some fraudulent act might result from an insured-intermediary coalition. Everyone knows of a dentist who took the time to enquire about the extent of your insurance coverage before offering you a treatment plan. Or a mechanic who offers a deductible reduction to lure you. These activities are not necessarily fraudulent, but they can be quite suggestive.

This discussion enables us to draw a unusual conclusion: it is very difficult for a typical insured party to commit fraud alone. A consumer, a worker or an injured person who tries to obtain fraudulent compensation from an insurer generally needs an accomplice. Intermediaries play a significant role in these activities. They are sometimes leaders:⁵ automobile theft networks, networks of doctors and lawyers inciting injured persons to ask for greater compensation than necessary, doctors urging uninjured workers to consume some services that might be judged as useless (Dionne, 1984). When searching for ways to reduce insurance fraud, it is important to take into account the role of intermediaries.

It is quite difficult to assess statistically the importance of insurance fraud. We do not have much data for the province of Quebec or for Canada⁶. But we have had access to some recent American studies and we will outline their principal results in Part I of our presentation. In this

⁵ In Los Angeles, a network of doctors and lawyers was discovered giving \$ 200 premiums to "head hunters" ready to find them clients who would be willing to declare themselves subject of accidents in the workplace. Without collusion between insured and intermediaries, the existence of a deductible or partial coverage rate can limit the fraudulent solicitation but to a very small extent. On the other hand, the mere fact of insurance is a strong encouragement to intermediaries to offer such services since they know well that the insured only pays a fraction of the total cost.

⁶ See however the three recent studies: Clermont, Yvan, Massé, Brigitte, Tremblay, Pierre "Enquête sur le milieu des assurances générales - les fraudes en assurance: enquête pilotée auprès des enquêteurs-régisseurs et experts en sinistres indépendants", Document d'atelier pour le Colloque "La fraude à l'assurance", Université de Montréal, 26 février 1992.

Massé, Brigitte, Tremblay, Pierre, "Sondage auprès du public québécois - Perceptions sur la majoration délibérée des réclamations", Document d'atelier pour le Colloque "la Fraude à l'assurance", Université de Montréal, 26 février 1992.

Clermont, Yvan, Cordeau, Gilbert, Massé Brigitte, Tremblay, Pierre, "Les fraudes et leur contrôle - le SACA en perspective: notes préliminaires", Document d'atelier pour le Colloque "La fraude à l'assurance", Université de Montréal, 26 février 1992.

section, we will also discuss certain figures taken from annual reports of the Insurance Crime Prevention Bureau of Canada.

In Section II, we will identify the principal causes of insurance fraud. In particular, we will discuss classic insurance contracts which are not designed to take into account insurance fraud and for which some clauses might even encourage economic agents to engage in fraudulent activities. We will also emphasise the role of competition between insurers as a factor which might slow the battle against fraud. Insurance fraud is an industry problem, and therefore the industry will have to take appropriate measures to fight it.

Many correctives mechanisms will be discussed in Section IV of our presentation. But We are sure you have not come to the University of Montreal only to talk about the problem and some practical solutions. You must be expecting to hear about University research. So part III will provide some details. We will talk about rational fraudulent decision making, about a theoretical framework to describe this type of behaviour and about a methodology to measure abuses or fraud. Statistical results from a study pertaining to accidents in the workplace are also presented. Even though the results are for bodily injuries, we want to emphasize that the methodology presented can be adapted and applied to other forms of insurance, provided adequate data banks can be set up.

To conclude, we will present an American anti-fraud experience which has been very successful and is spreading rapidly. It is Michigan's program against automobile thefts.

SECTION I: RECENT DATA

Table I summarizes the principal results of a recent automobile insurance study carried out in Florida. A poll was conducted with consumers, lawyers, claims agents, investigators and attorneys. Twenty-five companies, accounting for 65% of the private automobile insurance market in Florida, took part in the study. It should be emphasized that the results in Table I represent the opinion of interviewed participants and cannot be used directly to assess the real importance of insurance fraud. For instance, the first figure in Table I states that 13% of the claims are fraudulent. This is considered a minimum by many researchers. Massachusetts study specifies that 31.8% of all claims contain an element of fraud, and that fraud accounts for 16% of total claims costs. Another poll from the Insurance Information Institute, conducted among claims departments, concludes that 14% of all claims are fraudulent.

Table I

Results from a study on fraud and automobile insurance recently conducted in Florida (numbers in parenthesis are other data from the Insurance Information Institute report)⁸

Percentage of fraudulent claims	13% of the total, that is about \$ 379 million (10% of all claims or 8% of premiums)
Consumers opinion	<ul style="list-style-type: none">• 37% of all applications are fraudulent• 38% of all repair bills are overstated with almost 50% for those between the ages of 18 to 34• 15% of all accidents are staged or plotted• 17% of all stolen car reports are fraudulent• 37% of all medical expenses are overstated with almost 50% for those between the ages of 18 to 34.
Perception of insurance fraud	<ul style="list-style-type: none">• 33% of interviewed consumers think that it is acceptable to falsify risk to obtain lower premiums• 50% of interviewed consumers think that it is acceptable to overstate repair bills to recover deductibles (31%)• and this, even if 85% of interviewed consumers understand that cost increases due to fraud will be reflected in the premiums

⁷ Florida Insurance Research Center, "Automobile Insurance Fraud Study", University of Florida in cooperation with Florida Insurance News Service and Citizens' Fraud Prevention and Education Foundation.

⁸ Mooney, S.F., Salvatore, J.M., "Insurance Fraud Project: Report on Research", Insurance Information Institute, November 1990

Reasons motivating these fraudulent behaviours	<ul style="list-style-type: none">• 28% interviewed consumers think that insurers' profits are too high• 24% of consumers think that they deserve this money• 23% of consumers think that insurers are dishonest• 14% of consumers say that they need this money• 6% of consumers think that they won't get caught• 3% of consumers say that they do it because others do it too• 2% of consumers say that they are trapped in a fraud scheme
Penalties for giving false risk declarations	<ul style="list-style-type: none">• 50% of interviewed consumers understand that claims might be reduced or denied or that legal action might be initiated for giving false statements while purchasing insurance• 25% of consumers think that there is no penalty for giving false information while purchasing insurance
Penalties for false claims	<ul style="list-style-type: none">• 43% of interviewed consumers understand that they might be subjected to legal action• 25% of consumers understand that claims might be reduced or be denied when filing claims, and• less than 25% link jail terms with fraudulent claims

Many conclusions can be drawn from Table I. A first impact perceived by 85% of interviewed consumers is that existing insurance fraud increases insurance premiums. Companies cope with increasing costs by raising premiums. This short-term strategy is rational if the phenomenon is perceived as temporary and if insurance demand elasticity is small (that is, if after a 10%

increase in premium demanded coverage decreases by less than 10%). It is also rational in the short term for markets that have mandatory insurance coverage. But in the long run, ongoing premium increases might elicit certain types of insurance fraud, which in turn increase premiums which in turn...

Results in Table I stress that what may be costly to the industry is the abundance of small infractions by many insured parties. For instance, many consumers attempt to recover their deductibles. It thus seems obvious that increasing deductibles to recuperate certain costs has a perverse effect on insurance fraud. But once again, is it really insurance fraud?

Consumers who observe that other insured consumers commit fraud without trouble or penalty tend to ask, "Why shouldn't I try it too?". This line of reasoning might generate (and effectively does so in certain regions) fraud epidemics, which might in the long run decrease voluntary insurance demand and threaten the existence of some markets. The insurance industry has an image problem, and the perception that it does not want to commit itself to combat fraud doesn't help. Finally, the rules of the game are misunderstood. Fraud definition is vague and the associated penalties are not well known.

Table II presents other interesting American data. In particular, it shows that following important increases in workers compensation premiums, many small entrepreneurs have reduced their insurance demand or have simply declared fewer employees than they in fact had. Thus, many injured workers may not receive compensation. This becomes an important long-run (predictable) impact if the scope of insurance fraud is as broad as we suspect. But, insurance fraud does not explain all the problems found in the American and Canadian insurance markets for work related accidents. In the United States, 20% of all claims appear to be fraudulent.

Table II

Other American Data

Work related accidents	20% of the claims are overstated or fraudulent, and these claims have contributed to higher premiums. But the substantial premium variations are explained by increased medical expenses
Important impacts	<ul style="list-style-type: none">• Premium costs have risen and the increases have partially affected small businesses: lower profits and loss of competitiveness for some small industrial sectors• Some employers do not declare all their employees to insurers in order to reduce their premiums, which explains why many workers are uninsured <p>Source: New York Times, December 1991</p>
Automobile accidents	In Massachusetts, the auto insurance system has been modified and in particular the minimum amount of claims with responsibility has been raised from \$500 to \$2,000. This change has substantially increased the number of cost build-ups for small accidents in order to reach the \$ 2,000 threshold.
Impact of threshold increase (from \$ 500 to \$ 2,000)	The frequency of claims has been significantly modified: <ul style="list-style-type: none">• Back related injuries have increased by 40% and,• The indexes that measure the build-up of costs indicate that 46.8% of all claims have been artificially overstated (especially the increase in medical expenses, marked by a significant increase in the number of back-related injuries) <p>Source: Automobile Insurance Bureau of Massachusetts, Boston, 1991</p>

The data in Table II enables us to identify yet another major impact of insurance fraud that deals with certain parameters of insurance contracts. Following the increase in the threshold (from \$ 500 to \$ 2,000) to enable access to compensation for suffering and loss in quality of life, insurers have observed a sharp increase in small claims. The insured overstate their claims to

surpass the new limit, despite the insurers tighter control that includes a higher number of verified medical expenses as well as medical audits. However, the study showed that very few penalties were imposed on claimants since insurers worry about their competitiveness and they seldom go to court for small claims. Here, prevention is a significant way to limit costs.

Now to Canadian data. The information in Table III was taken from the annual reports of the Insurance Crime Prevention Bureau. Looking at Table III we note that, in 1989, 8,843 arson cases were reported and 100,175 automobile thefts took place, and of those, 26,000 were never recovered. It must be noted that all these stolen cars were not necessarily taken for insurance fraud purposes. If we assume that 20% of the vehicles never recovered constitute insurance fraud⁹, and that their average value was \$ 10,000, we can estimate the cost of the insurance fraud to be \$ 52 million. If we also assume that about 50% (conservative) of all arson cases are for insurance fraud purposes and that the average cost of such fires is \$ 10,000, we can estimate that the total cost of this second type of insurance fraud at \$ 45 million.

In light of these figures, it is worth noting that during the same period the Insurance Crime Prevention Bureau inquiries resulted in the recuperation of only \$ 21 million (about twice its limited operating budget, for the types of fraud that they cover). Furthermore, only 219 cases of fraud have been exposed, while it is presumed that as much as 1,439 cases of fraud have been reported to them by insurers. These figures seem to indicate a lack of will by the Canadian industry to tackle fraud directly¹⁰. This reality might be one of the leading causes of recent increases in insurance fraud or at least the perception of an increase that has motivated the organisation of this conference.

⁹ This figure is an estimate from the "Sureté du Québec".

¹⁰ A similar conclusion can be obtained for 1990. We would like to thank the Insurance Crime Prevention Bureau for its collaboration in the preparation of Table III.

Table III

Insurance Crime Prevention Bureau

	1990	1989
Amount of private insurance fraud	277	219
Amount of presumed fraud	1,637	1,439
Total amount of inquiries requested	4,792	4,577
Classification of real or presumed fraud	<ul style="list-style-type: none"> • 20% arson • 41% other property damage • 39% automobile insurance fraud 	not available
Amount saved following inquiries	\$ 25.8 million	\$ 21 million
Amount saved following prevention methods	\$ 3.6 million	\$ 5.2 million
Total amount saved	\$ 29.4 million	\$ 26.2 million
Number of fires in Canada	67,556	67,182
Number of arson cases in Canada	10,371	8,843
Number of automobile thefts in Canada	107,346	100,175
Number of stolen vehicles never recovered	28,769	26,000

SECTION II: PRINCIPAL CAUSES OF INSURANCE FRAUD

Why has this problem grown substantially during the past few years? The principal cause of insurance fraud lies in the fact that it is easily set-up in many sectors of activity. The probabilities of getting caught are very slim. Although data is scarce, it is known that very little money is being invested by insurance companies to fight fraud.

Insurers are generally reluctant in initiating legal actions since these are more costly than the short term expected gains. They also make a swift claim settlement virtually impossible. Companies which worry about their competitiveness will therefore avoid them. Insurance brokers favour companies that offer fast claim settlements in order to maintain good customer service, and do not appreciate suspicion in respect of their clients. In other words, competition limits the fight against insurance fraud.

The second cause of insurance fraud is that insignificant penalties are awarded when such fraud is legally proved. In many instances, penalties are not enforced because it would be too costly to do so. Therefore, they lose their preventive aspect and do not deter fraudulent behaviour. Many consumers consider obtaining a reduced premium by making misleading statements or negotiating a deductible with a mechanic as quite normal. The only anticipated penalty is the readjustment of the premium or payment of the deductible. Some intermediaries (including brokers), to keep their customers, offer to reimburse the paid deductibles.

But there is more. Following recent cost increases, due in part to insurance fraud, some insurers have raised the premiums as well as the deductibles. This policy might lead to adverse results since more consumers might negotiate with intermediaries to recuperate their deductibles. We will show in more detail later that classical insurance contracts are not designed properly to minimise insurance fraud. The existence of a deductible (or other partial insurance) can be explained by the presence of administrative costs and information problems (moral hazard and adverse selection). But it is not clear that the introduction (or variation) of the deductible is an efficient mechanism to deter insurance fraud since the fraud decisions are made ex-post or after the accidents.

The above discussion is all the more pertinent since private and publicly-owned companies have not found new ways to fight fraud. Others will argue that insurance fraud is but a part of the increase in all types of fraud in society: credit cards, social security benefits, taxes and customs. They believe that insurance fraud is merely a reflection of an epidemic. Certainly, we can find moral, social and even economic causes for fraud. Young people today find it difficult to advance in society through normal channels like honest work. Economic recessions generate substantial unemployment and the legal system no longer sends a clear message when it comes to correctional measures. This is caused by the high cost of the fight against theft and other infractions while governments run huge deficits.

If we focus on insurance fraud alone, its rapid growth can also be explained by other factors that will influence the elaboration of solutions:

- It is not clear (or has not been in the past) that the fight against insurance fraud is profitable for insurers on an individual basis. All insurance companies are faced with the same cost increases, which can be offset by an increase in premiums instead of fighting fraud. But, as previously mentioned, a substantial increase in premiums might be an incentive to fraud. Consumers declare smaller risks in order to reduce their premiums and increase their claims to recuperate both deductible and premiums paid during years without accidents.
- Insurance fraud is a social problem that creates externalities for insurers. The fight against fraud generates social benefits that individual companies can hardly internalize. On the other hand, the costs associated with this fight are incurred privately and are often substantial. This can explain why it is mandatory in certain American States for insurers to report all fraudulent claims and co-operate with the industry.

- The recent boom in insurance fraud can also be explained by the fact that the public and industry players do not regard fraud as a priority for the industry. It seems that the fight against fraud is left to individual insurers which, for reasons mentioned above, cannot address the problem adequately. This leads us to conclude that insurance fraud should be considered as an industry problem.

All these factors then, have contributed to the spread of fraud. A direct relationship exists between the increase of fraud in society and the increase in insurance fraud. However, despite the correlation between the two increases, a link of causality is not evident. The example most often used is automobile theft. Is the recent increase in automobile theft due to an increase in insurance fraud (easily explained because insurance companies are not very aggressive)? Or has insurance fraud grown because auto thefts are only solved in 20% of the cases? Finally, it is not clear that vehicle owners have perceived or received new incentives from insurers to improve methods of prevention.

But quite independently of the causes, it seems too evident that insurance fraud is on the rise. But despite the increase, and for the reasons outlined above (including competitive conditions between insurers), the companies have not reacted significantly to this phenomenon:

- Insurance contracts remain virtually unchanged;
- Pre-contract investigation of the nature of the risk and of some clients have not evolved significantly;
- Post-accident investigation by individual insurers has not really progressed in any important way.

Let us examine these elements more closely by considering examples of insurance contracts. Some insurance contracts provide mostly for repayment of replacement or depreciated value in excess of the deductible for theft and fire, and for reimbursement of repair costs exceeding the deductible for material damage. As for claims for revenues lost because of car or workplace accidents, 90% of net revenues is reimbursed up to a certain limit with a declining percentage thereafter. For health and hospitalisation coverage, insured receive partial compensation.

These various contracts were designed without consideration for fraud. They are primarily designed to cover other types of moral hazard, more specifically ex-ante moral hazard, or in other words those associated with preventive action of individuals prior to the accident. This type of rate schedule is also justified by the presence of adverse selection and transaction costs.

As we already mentioned, two types of behaviour should be considered. The first concerns the protection of the insured and insurers against fraudulent solicitations from intermediaries such as excessive doctors visits, unjustified car repairs... Often, the insured do not have sufficient incentives to desist from such activities. They remain easily influenced or persuaded.

Experience in the automobile insurance market shows clearly that auditing is a much more effective tool than partial insurance coverage in reducing the rate of fraud. Reducing the coverage of the insured is generally less effective since the insured are not always sufficiently well informed to evaluate the service offered by the intermediaries. Finally, partial insurance unjustly penalizes those insured who are not responsible for this type of fraud.

The second type of behaviour relates to an insured who encourages fraud and/or agrees voluntarily to participate in fraud. Here, partial insurance is of no use at all and is a burden on all insured who are honest.

Finally, for the past few years, insurance fraud has become very much a specialist activity. One thing is certain, professional thieves have at their disposal technology that has developed enormously during the past few years. This technology can be used by those intending to commit insurance fraud and by those who simply seek to benefit from theft. Again, traditional insurance contracts are not efficient in limiting this type of fraud. The fight against such fraud, requires a strategy involving directly the consumer, the industry, police, the legislative and judiciary systems and it should be put in place as soon as possible.

SECTION III: ECONOMIC ANALYSIS OF INSURANCE FRAUD

III.A IS FRAUD A RATIONAL CHOICE?

For economists, fraudulent activities are considered as any activity of production or consumption (Ehrlich, 1973). The optimal choice is set where the marginal revenue of fraud is equal to its marginal cost. For many individuals, the optimal choice is never positive (have principles or believe the cost is too high); but for others, never say never (depending on the opportunity); and for a third group, the optimal choice varies according to different parameters. By definition, fraud occurs because of faulty information flow among the different participants of the economic system. It may also be explained by social inequalities (Robin Hood), by the taste for adventure (a rich lady who decides to steal a hat at Eatons) and by the existence of fraud itself (network of drug traffickers using stolen cars or boats).

Insurance fraud is primarily a problem of information flow between insurer and insured, but also a problem of information between insurer and intermediary, i.e. the agent providing a service to the insured when the accident occurs. Today, we are going to focus on the decision making process of the insured. Those who require further information on the effect of insurance on the possibility of fraud should refer to Dionne (1984).

It is difficult for the average consumer to take steps against insurance fraud alone. In most cases, the consumer must convince other economic agents that it would be worth it to collaborate. Here, we are thinking of overconsumption or non-payment of the deductible. Without collaboration from the intermediary, the scope of these activities would be very small. It is true that exceptions exist in medicine where it might prove difficult for the intermediary to verify all of the sources of pain, in particular those associated with the spine, stress or general fatigue.

Let us take the simple example of a worker who has had an accident and who wishes to prolong the period off work for a number of days with compensation (N) above the level accorded if there were no lack of information in the market (L). The benefit of this extra consumption would be equal to:

- $\alpha w (N-L)$ if the worker doesn't get caught (where α is the rate of insurance coverage and w is its rate of wage)
- 0 otherwise (it could be negative if the penalties for this kind of activity were enforced, such as loss of compensation already accumulated ($-\alpha w L$)).

Otherwise, the only cost that applies is that of searching (C) or finding a doctor who will agree to guarantee the insurer that the worker needs the extra days of compensation. In other words, expected net revenue of the worker is equal to:

$$p(.) (\alpha w N) + (1-p(.)) (\alpha w L) - c (N-L)$$

where:

$p(.)$ the probability of success

$c(.)$ the cost of finding and persuading a doctor to collaborate.

It can be shown that generous insurance coverage increases the marginal benefit of this type of activity (Dionne and St-Michel, 1991). In other words, the variation of one parameter of the insurance contract may incite the insured to increase fraudulent or unnecessary consumption. For example, an increase in α will increase (N-L).

We should stress here that a reduction in one insurance parameter is not necessarily a good method to reduce fraud because this penalizes all the insured. In fact, the auditing of files with appropriate penalties should comprise the optimal solution to this type of problem. However, auditing is very costly and therefore it must be properly oriented: that is, to find the characteristics or statistically important factors which will allow identification of the priority areas. This approach is already under study to reduce the cost of bodily injury associated with car accidents in the United States. But, we have already applied it for accidents in the workplace, and some results will be presented later (see Dionne and St-Michel, 1991 and Dionne, St-Michel and Vanasse, 1992).

We can also envisage stochastic or random auditing which offers a way to reduce auditing costs. But to preserve the same incentives provided by deterministic auditing, we must introduce much higher penalties. This approach is the subject of theoretical studies in the area of tax fraud and was used by the Canadian Customs. Individuals can use an express line after signing a declaration describing the goods being imported. Those choosing to use the fast lane know well that their signed declaration can be verified on a random basis and that heavier penalties will be imposed if their declaration contains false information.

Arson and auto thefts are other forms of insurance fraud that require the calculation of ex-ante costs and benefits. It would be difficult to present a comprehensive model of the motivations for arson. If we were to exclude such reasons as murder, suicide, revenge and other monetary

motivations, it would seem obvious that a rational individual will engage in arson only if his expected gains are superior to his costs. The net expectancy is given by the following formula:

$$p(.) (RA - VM) - (1 - p(.)) (VJP + VM)$$

or $p(.) RA - (1-p(.)) VJP - VM$

where:

(1-p(.)) is the probability of a successful but detected arson
p(.) is the probability of a undetected successful arson
RA is the insurance reimbursement specified in the contract
VM is the market value of the building
VJP is the economic value of the number of days in jail

We note that the insurance reimbursement must exceed the market value of the building to push the owner to deliberately set it on fire. This simple formula can also be applied to another type of insurance fraud, namely automobile thefts. The formula is therefore modified by inverting the algebraic signs in the first and second part of the equation to obtain:

$$p(.) (RA + VM) - (1 - p(.)) (VJP - VM)$$

$$p(.) RA + VM - (1 - p(.)) VJP$$

where:

VM is the market value of the car.

Let us once again consider the case of arson. We must remember that all reported cases of arson are not necessarily insurance fraud. Only those with ex-ante expected net economic gains might qualify as such.

A second important aspect that may incite individuals to resort to arson require that:

- there is a significant difference in $p(\cdot)$ (RA - VM) or,
- a low value for $(1 - p(\cdot))$ VJP.

For the first requirement, the difference is increasing in $p(\cdot)$ and RA but decreasing in VM. This explains why assessing accurately the difference (RA-VM) and having efficient investigation activities (low $p(\cdot)$) is important for insurers. The sum of the terms also show that the financial situation of individuals weighs in their decision making process.

Here, random auditing is of little use. It is mainly post-accident investigations (detailed auditing of suspicious cases) and their efficiency that matters. Preventing recidivism is also important, giving urgency to having computerized information on every case of presumed fraud in the industry no matter how small.

III.B THEORETICAL FRAME OF ANALYSIS

Generally, the mathematical expectation of loss for the insured (or its actuarial risk) who has selected a level d ($d > 0$) of deductible and a level α ($0 \leq \alpha \leq 1$) of coverage is given by:

$$Risk = p \int_0^m \alpha (x - d) f(x) dx$$

where:

- p is the probability of accident during a given period
- x is a continuous variable standing for amounts of loss or claims
- m maximum amount of insurance coverage allowed by the contract
- $f(x)$ is the conditional density of losses.

When $\alpha = 0$ there is no insurance. When $\alpha = 1$ there is full insurance coverage for all amount of loss exceeding the deductible (d) and lower than the maximum amount covered (m). This is the typical automobile insurance contract for material damages as well as for thefts. For bodily injuries, the "Société de l'Assurance Automobile du Québec" (SAAQ) and the CSST provide

level of $\alpha = 0.90$ of all positive loss of revenue ($d = 0$) to a certain limit (m). Those with revenues exceeding this limit receive a level of coverage inferior to 90% of their lost net revenue. The "Régie de l'Assurance Maladie du Québec" (RAMQ) pays a level of $\alpha = 1$ ($d = 0$) regardless of $x > 0$ and of revenues.

The ex-ante moral hazard problem stems from the fact that individuals can affect p and $f(\cdot)$ with their prevention activities. Since these activities cannot be observed by insurance companies, they must introduce methods to maintain a certain exposure to risk. $d > 0$, $m < +\infty$, $\alpha < 1$ are ways of doing so. A certain exposure to risk will provide the insured with an incentive to protect themselves against thefts, fires or other kinds of accident. Rebate premiums are frequently being offered to insured engaging in prevention activities. Rate schedule based on past experience is another type of incentive method.

But p , $f(\cdot)$ and $m(\cdot)$ also depend upon individual characteristics that cannot be observed ex-ante. Generally, individuals are asked to reveal them at the signature of the contract. Here, individuals can lie in order to obtain lower premiums or to insure non-existent goods. This form of fraud is frequently reported by insurers, but it could be significantly reduced if they would use such efficient methods as applying penalties or any revelation mechanisms that introduces incentives to tell the truth.

These methods are not used in a systematic way by the industry. In most cases, actions are limited to a readjustment of the insurance premium when a false declaration is discovered. The anticipated net cost of fraud is nil for those who engage in such activities. This leads to significant levels of fraud, especially in areas or territories characterized by high insurance premiums. The insurers could benefit from ongoing research, and some results could be applied at very little cost.

Other cases of fraud are more problematic since the validation of characteristics must be carried out after the accident. The first case is when an accident is staged, that is when p is set to 1 (voluntary fires, faked car thefts, staged car accidents). The amount of loss can also be fixed or claims can be aggravated. This last activity will be the theme of the following section.

III.C A METHODOLOGY TO MEASURE MORAL HAZARD (EX-POST)

In the following pages, we summarize the methodology proposed by two of the authors of this article. The methodology provides a way to measure abuses and the effects of ex-post moral hazard on the number of days of compensation for workplace related accidents (Dionne and St-Michel, 1991 and Dionne, St-Michel and Vanasse, 1992). We define abusive consumption¹¹ as any consumption of days of compensation that is unnecessary to recover health ((N-L) in the preceding section). We assume that the insured worker initiates this overconsumption activity¹². It is possible for the insured to do so since he has more information about his health status than any other participant in the market. In other words, we assume that doctors play a passive role since they cannot verify in a definite way the presence of a pain or symptoms, or because they don't have any economic incentive to control abuse. The methodology presented in this section can be adapted and extended to other cases of abuse or cases of ex-post moral hazard in the insurance industry.

The model we have developed serves to ascertain if certain parameters of the insurance contract encourage workers to increase their compensation days. It does not provide for direct detection of individuals who abuse the system, but the results can be used to help set-up guidelines for moral hazard detection. We will return to this aspect later.

¹¹ In this section, the expression moral hazard (ex-post) designates overconsumption, abuse and possible fraud.

¹² This hypothesis is not necessary to apply the model.

But prudence is advisable. Every increase in the number of compensation days for accidents in the workplace does not necessarily involve abuse. The challenge facing researchers is to distinguish the variation in total consumption of the number of compensation days in two parts: 1) non abusive variation or variation corresponding to full information, 2) abusive variation (ex-post moral hazard). The methodology which follows makes the distinction quite clear.

In other words, to identify the behaviour associated with the asymmetry of information between the insurer and injured workers in respect of the state of their health, we have regrouped the basic diagnostic task into six leading categories: 1) fracture; 2) lower back pain; 3) amputation without permanent partial disability (PPD); 4) sprains; 5) friction and 6) contusion.

We can distinguish two groups of lesions according to their severity:

- lesions of a grave degree (MA): fracture and spinal disorder,
- those less serious (MI): amputation without PPD, lower back pain, contusion and friction burn.

In respect of diagnostic difficulty, our classification of the nature of lesions conforms with information generally carried in the medical literature on such subjects. In the classification outlined below, the kinds of lesion are linked respectively to the most difficult cases to diagnose ($j=2$) and to cases that are most easily diagnosed ($j=1$):

- 1) contusion, amputation without PPD, fractures and friction burn ($j=1$); and,
- 2) lower back pain and sprains ($j=2$).

We can therefore regroup each of the types of lesion according to their severity and the difficulty of diagnosis. This grouping is shown in Table IV.

Table IV

Kinds of work related lesions according to severity and relative difficulty of diagnosis		
Severity (relative) of the injury	Difficulty of diagnosis	
	Easy diagnosis (j=1)	Difficult diagnosis (j=2)
Minor Injury (MI)	Contusion, amputation without PPD, and friction burn	Lower back pain
Major Injury (MA)	Fracture	Sprain

It should be stated at this stage that categories (lower back pain and sprains) include diagnoses associated with the back as well as others which are not. In carrying out an empirical study of the effects of asymmetry of information, we will take into account this distinction between the two categories of lesion by controlling the location of the injury (head, lower limb and back,...). This classification allows clear identification of cases of back pain or spinal problems and also makes adequate analysis possible.

We have decided to call special attention to back injuries as identified in the medical literature as difficult to diagnose. Spitzer and al (1987) issued a report outlining the state of this medical problem. It explains the problem by:

- 1) Difficulty of identifying the precise source of pain;
- 2) Absence of changes in tissue which we cannot see in our present state of knowledge;
- 3) The fact that tissue samples are not taken because of the less serious degree of such cases.

Moreover, the authors also submit that this difficulty of diagnosis results from a natural lack of uniformity of diagnostic categories in the case of spinal injuries. In order to cope with this situation, they have developed a classification based on simple criteria and appropriate to workplace problems.

The approach based on taking into account financial incentives and the type of workplace lesion is the cornerstone of the methodology. This seeks to explain the phenomenon of the growth of consumption (or the extension of periods without work) when the insurer faces an information problem that is costly to eliminate, namely the exact verification of the health of the injured worker.

Many researchers have analyzed and measured the effects of a change in the rate of monetary coverage for absence from work on the incidence of workplace injuries or on the duration of compensation, see the recent study of Moore and Viscusi (1992) and literature review of Lannoie (Canadian Public Policy, March 1992). On the other hand, very few researchers have analyzed the effects of the cost of information with respect to the duration of absences from work. Staten and Umbeck (1982) were the first researchers to investigate the problem of estimating such cost. But their analysis dealt only with one single type of workplace injury.

SECTION III.D RESULTS OF A STATISTICAL STUDY

• Population base and sampling

The population base comprises all Quebec workers who had at least one work related accident in 1987 (more precisely originating in 1987) and which resulted in one or more days off work. This statistical base includes about 210,000 administrative files and excludes deaths, occupational illness and preventive leave.

Preliminary statistical testing indicated that a sampling of 1,500 accidents would be adequate. The reason why we chose to make a sample stems essentially from budget considerations. In fact, verification of the codified information on the computer files as well as gathering complementary information from the injured parties are costly operations and therefore call for the use of a sample. A sampling adequately set up does not introduce any significant bias and allows the results obtained to be projected over a complete statistical base. The task of carrying out a poll explains why the study was limited to accidents that originated in 1987. On the one hand, we wanted to minimize the problem of change of address (changes that might not be in the files), and on the other, to ensure the details of the accidents were fresh in the minds of the workers concerned.

The data was collected from computer files and from conventional files containing results of the telephone poll of injured workers. In order to increase our understanding of the different factors motivating each of the agents participating in a file, namely the injured, his employer and treating physician, a telephone poll covered 1,500 injured workers.

Table V explains the average number days of compensation paid according to diagnosis and insurance profile¹³. In general, the worker has an insurance profile if he has access to income tax deductions higher than those applying to household revenue. In other words, the worker with an insurance profile benefits from a real insurance coverage greater than someone who does not have it. Table V shows that individuals with an insurance profile have an average compensation period of 30 days, or higher than those without such profile (21 days).

But the insurance profile does not seem to have the same effect in respect of differences in diagnosis. Not only does the extent of the variations fluctuate a great deal, but the direction of the variation can change from one diagnosis to another. For example, individuals suffering from sprains (back) and with an insurance profile have an average compensation period of 50 days, nearly twice as long as those with the same diagnosis but without insurance profile (30 days). Take another example: lower back pain (back). The average length of absence from work associated with this complaint is 31 days with insurance profile compared with only 12 days without insurance profile.

¹³ For an individual to have an insurance profile, he must conform with at least one of the following criteria:

- 1) Have a spouse in the active population;
- 2) Have at least one dependant other than a spouse;
- 3) Have declared a gross household revenue lower than the gross revenue projected by the insurer; and
- 4) Have part time

Table V

**Average length of absence from work
(number of days)**

Type of injury	All injured workers (1)	Workers with insurance (2)	Workers without insurance (3)	Diff. (2-3)/3
Contusions, amputations with PPD, Friction burn	14	15	13	+15%
<u>Lower back pain (back)</u>	<u>25</u>	<u>31</u>	<u>12</u>	<u>+158%*</u>
Lower back pain (non back)	15	17	13	+31%
Fractures	80	82	75	+9%
<u>Sprains (back)</u>	<u>43</u>	<u>50</u>	<u>30</u>	<u>+67%*</u>
Sprains (non back)	19	19	19	0%
<u>TOTAL</u>	<u>26</u>	<u>30</u>	<u>21</u>	<u>+43%</u>

* Statistically significant in the econometric analysis. See Dionne, St-Michel, Vanass (1992) for more details.

Statistical measure of moral hazard

In order to ascertain the effects of some important behaviour variables (other than moral hazard) that may influence the average length from work, we used multivariate statistical regression.

To measure the effects of the insurance profile on the average number of compensation days in the econometric model, the insurance variable is a dichotomic variable that is equal to 1 for individuals most likely to have a real insurance coverage greater than 90% of their net salary and 0 otherwise.

As well as taking implicitly into account the rate of insurance coverage provided by the insurer, the variable measures indirectly other forms of compensation stemming from the methodology used to project gross revenue by the insurer and from the fiscal treatment of households. Indeed in 1987, for this last item, the calculation of net retained revenue was likely to introduce a fiscal bias in favour of the injured. Sources of the bias originated in fiscal advantages granted to spouses and in the exclusion of their revenues, as well as of the other household dependants. Finally, the method for calculating revenues favoured part-time workers.

• Economic results

This insurance profile variable has a significant effect in all the estimated econometric models¹⁴. The fact that it is significant does not necessarily indicate that the insurance system favours prolonged periods of work absence. In effect, the insurance profile variable may indicate only that the cost of consumption of compensation days is lower for those who qualify. Thus it can be expected that such individuals will extend their absences further since the daily cost of absence-from-work is relatively lower in their case.

But, when asymmetry of information occurs, for instance, when it is costly to verify the exact state of health of the injured, insurance can influence the behaviour of the insured for other reasons than the simple reduction in cost from being absent from work: it reduces the incentive to return to work. The empirical hypothesis proposed in Dionne and St-Michel (1991) suggests that the variation in the length of work absences should be statistically more significant for cases where diagnosis is difficult to establish and verify.

¹⁴ The results of the econometric calculations are not given in this article but are available upon request from Georges Dionne

In practical terms, this implies that the technical coefficient related to the diagnosis should be in part determined (or influenced) by the insurance profile and that the coefficients of diagnosis difficult to establish or verify should be the most influenced. The regression results validate this hypothesis. So, the coefficients of the interaction variables *Lower back pain (back) * Insurance profile* and *Sprains (back) * Insurance profile* are significant and positive since they indicate that the injured workers having insurance profiles are absent from work for longer periods when they have undergone a lower back pain (back) or a sprain (back) than other workers having the same diagnosis without the insurance profile. On the other hand, they are not associated with a higher level of consumption in the case of other diagnoses, even though the average length of absence for workers with insurance profile differs from those without profile (see Table V).

These two diagnoses are thus serious candidates for abusive consumption and fraud. That does not necessarily mean all workers who are victims of accidents involving back injuries do abuse the compensation system. But the result of this study indicates that the probability of abuse is higher. Many mechanisms can be considered to correct such abuse. A first group covers improvements to the insurance contracts; the second relates to the auditing of claims made by the insured (and possibly by the doctors consulted). However, a systematic audit of all claims would be too costly. This study suggests how to identify doubtful diagnoses and indicates the target areas for auditing. This audit may be random or not.

The methodology is not confined to workplace compensation. It can also be applied directly to car accidents or any kind of insurance where the amounts of compensation may be affected by individual behaviour. It can also apply to the frequency of accidents, in particular fire and the

SECTION IV - WAYS TO FIGHT INSURANCE FRAUD EFFECTIVELY

In this section, we outline possible solutions designed to fight insurance fraud. They are not exhaustive, but reflect the different points made in the preceding pages:

- 1) Give a more precise definition of the concept of insurance fraud so that everyone concerned can work from the same base;
- 2) Fraud detection must be better organized and should not be left solely to the initiative of individual companies. The industry should have a common strategy. A first step would be to set up a central computerized data bank containing relevant information and allowing a rapid flow of information. For example, this data bank could contain all the serial numbers of stolen vehicles or those reported missing. It could also contain details of all recent discoveries of insurance fraud in the industry.
- 3) Insurance contracts should be rewritten to encourage the insured to protect themselves most effectively against fraud in general (in particular fire and theft) and against insurance fraud. We could consider a Bonus-Malus system against fraud. We must increase the incentives for the insured to protect themselves against theft and we should make it more difficult for those already implicated in insurance fraud to buy insurance policies. A Bonus-Malus system would be even more effective if the information base were centralized and well managed and if the industry adopted a common strategy rather than letting the perpetrators of fraud move from company to company. We should also study systematically the effects of deductibles on fraud.

- 4) The use of fraud indicators to ensure earlier and more targeted detection:
- Statistical measures of the importance of each pertinent indicator (multivariate analysis) with continuous updating;
 - Systematic use of indicators to guide the audit and detection process (financial situation, type of employment,...);
 - Use of random auditing with penalties and bonuses as a method of prevention, as is used in income tax and custom declarations. Who should carry out the audit? The insurers or independent firms? It is a question of credibility and commitment to the insured;
 - Greater use of specialists to detect fraud: doctors, specialized salespersons,...
 - Recognize that some intermediaries active in insurance fraud must be taken into account.
- 5) Better coordination of insurers' activities within the industry. Better co-operation by the industry with other participants (regulators, justice system, legislatures, consumer governments,...).
- 6) But proceed very carefully and, above all, ensure a level of ethics beyond reproach such anti-fraud activities:
- the whole body of insured should not be penalized;
 - any excessive anti-fraud zeal should be controlled and above all mistakes that may occur should be corrected.
- 7) Publicize the fight against insurance fraud to improve its effectiveness and to provide a positive image to the public. But the fight against fraud should not be perceived as a witch hunt.

CONCLUSION

To conclude, we present an example of successful anti-fraud action which shows how it is possible to fight the battle effectively when all participants work together. The Michigan anti car theft case where consumers, insurers, the judicial system and police decided to unify their efforts to reduce insurance fraud. The State of Michigan, early in the 80's, had the highest rate of automobile theft per capita in the United States. In order to correct this, the Automobile Theft Prevention Authority was set up by the state government and financed by the insured at the rate of \$ 1 per year¹⁵.

The money collected was used to finance (by way of subsidies) agencies charged with ensuring respect for the law, consumer groups active in theft prevention, researchers and prosecutors, etc. About \$ 7.4 million was so distributed during 1991. These direct subsidies increased the total financial resources available to fight theft. They led to more arrests of thieves, and the rate of success in legal actions reached 85%. Also, they allowed increased prevention and in particular, the financing of research and establishment of new prevention measures such as a new sticker (applied to all windows of all vehicles with serial numbers). This new sticker forced thieves to change all the windows when selling the stolen vehicles.

Research also encouraged establishment of standards for anti-fraud activities and invention of anti-theft equipment. Insurers now often give premium reductions to those who use such equipment. The results are spectacular. From 1985 to 1989, automobile theft dropped 19% in Michigan while it rose an average 42% in all of the United States. Insurance theft premiums dropped in 1989. It was not the \$ 1 per insured that explained the success of the anti-fraud battle, but the determination of all parties concerned, including the insurance industry itself, to find a remedy.

¹⁵ Those who require more information should call or write to the Automobile Theft Prevention Authority, 714 South Harrison Road East, Lansing, MI 48823, (517) 336-6192.

BIBLIOGRAPHY

- Addis, Karen K., "The Fraud Squad", Security Management, Vol. 33, No. 9, September 1989, 53-57.
- Allingham, M.G., Sandmo, A., "Income Tax Evasion: A Theoretical Analysis", Journal of Public Economics, November 1972, 323-338.
- Anderson, Gregory W., "Insurance Fraud: Unhealthy Business", Security Management, Vol. 34, No. 8, August 1990, 64-68.
- Anderson, Kim, "The Phony-Claims Drain", Insurance Review, Vol. 51, No. 8, August 1990, 20-23.
- Aron, Debra J., Olivella, Pau, "Bonuses and Penalties as Equilibrium Incentive Devices, with Application to Manufacturing Systems" The Center for Mathematical Studies in Economics and Management Science, Northwestern University, Discussion Paper No. 392.
- Barracato, John S., "Auto Insurers Fired Up to Combat Arson Woes", National Underwriter (Property & Casualty), April 5 1991, 9.
- Becker, G.S., "Crime and Punishment: An Economic Approach", Journal of Political Economy, 1968, 76, 169-217.
- Block, M.K., Heineke, J.M., "A Labor Theoretic Analysis of the Criminal Choice", American Economic Review, Vol. 65, No. 3, June 1975, 314-325.
- Bonneau, Danielle, "Offensive contre les voleurs de voitures, un système antivol permet d'économiser sur les assurances", La Presse, 19 février 1992, D1-3.
- Brotman, Billie Ann, Fox, Pauline, "The Impact of Economic Conditions on the Incidence of Arson: Comment", Journal of Risk and Insurance, Vol. 55, No. 4, December 1988, 751-755.
- Brousseau, S., "Note d'instruction: détection et traitement de la fraude à l'assurance" AXA Assurances, Direction Technique Sinistres, No 90.0083, 23 octobre, 1990.
- Bryant, Phil, "Adjusters Can Get Burned Hiring a Fire Investigator", National Underwriter (Property & Casualty), May 6 1991, 9.
- Bussewitz, Walter, "Oregon Jail Crunch Benefits Insurance Cheats", National Underwriter (Property & Casualty), August 20 1990, 65-66.
- Clarke, Michael, "The Control of Insurance Fraud: A Comparative View", The British Journal of Criminology, Vol. 30, No. 1, Winter 1990.
- Clarke, Michael, "Insurance Fraud", The British Journal of Criminology, Vol. 29, No. 1, Winter 1989.
- Clermont, Yvan, Cordeau, Gilbert, Massé, Brigitte, Tremblay, Pierre, "Les fraudes et leur contrôle - le SACA en perspective: notes préliminaires", Document d'atelier pour le Colloque "La fraude à l'assurance", Université de Montréal, le 26 février 1992.
- Clermont, Yvan, Massé, Brigitte, Tremblay, Pierre, "Enquête sur le milieu des assurances générales - les fraudes en assurance: enquête pilote auprès des enquêteurs-régleurs et experts

en sinistres indépendants", Document d'atelier pour le Colloque "La fraude à l'assurance", Université de Montréal, le 26 février 1992.

Clermont, Yvan, Vallé, Luc, "L'instabilité des motivations de l'incendie criminel dans le secteur de l'habitation résidentielle à Montréal", Hautes Etudes Commerciales, 10 février 1992.

Cloninger, Dale O., "Arson and Abandonment: A Restatement", Journal of Risk and Insurance, Vol. 57, No. 3, September 1990, 540-545.

Cloninger, Dale O., "Moral and Systematic Risk: A Rationale for Unfair Business Practice", Journal of Behavioral Economics, Vol. 11, 1982, 33-49.

Cloninger, Dale O., "Risk, Arson and Abandonment", Journal of Risk and Insurance, Vol. 48, 1981, 494-503.

Cloninger, Dale O., "The Economics of Crime and Law Enforcement", Burgess Publishing Co., Minneapolis, 1975.

Collins, L., "Quel Type d'Audit pour l'Avenir?" HEC - Chaire de sciences comptables, cahier No. 6.

Crane, Steven E., Nourzad, Farrokh, "Tax Rates and Tax Evasion: Evidence from California Amnesty Data", National Tax Journal, Vol. XLIII, No. 2, June 1990, 189-199.

Crawford, Alan P., "The White Lie Syndrome", Insurance Review, August 1991, 24-27.

Crawford, Alan P., "Fuel to the Fire", Insurance Review, Vol. 52, No. 3, March 1991, 39-43.

Cremer, H., Marchand, M., Pestieau, P., "Evading, Auditing and Taxing: The Equity-Compliance Tradeoff", Journal of Public Economics, Vol. 43, No. 1, October 1990, 67-92.

Crepeau, Philip J., "Photo Inspection Helps Deter Auto Fraud", National Underwriter (Property & Casualty), September 18 1989, 18-20.

Cummins, J. David, Tennyson, Sharon, "The Tort System and Insurance Fraud: Theory and Evidence from Automobile Insurance", Manuscript, Wharton School, University of Pennsylvania, March 24, 1992

D'Arcy, Stephen P., Doherty, Neil A., "Adverse Selection, Private Information and Lowballing in Insurance Markets", Journal of Business, Vol. 63, No. 2, 1990, 145-164.

Delagrave, Charles, "Un modèle économétrique du vol d'automobiles au Canada", Mémoire de Maîtrise en sciences économiques, Avril 1989.

Derrig, Richard A., Weisberg, Herbert I., "Preliminary Evaluation of Massachusetts Automobile Bodily Injury Tort Reform - A First of the AIB Study of 1989 BI Liability Claims", Automobile Insurance Bureau of Massachusetts, July 19, 1991.

Derrig, Richard A., Weisberg, Herbert I., "Fraud and Automobile Insurance: A Report on Bodily Injury Liability Claims in Massachusetts", Journal of Insurance Regulation, Volume 9, No. 4, March 1991.

Dickens, W.T., Katz, L.F., Lang, K., Summers, L., "Employee Crime and the Monitoring Puzzle", Journal of Labor Economics, July 1989, 7, 331-347.

- Dionne, G., "Analyse des effets de l'assurance et de la relation de confiance consommateur-producteur sur les possibilités d'abus des chirurgiens", L'Actualité Economique, avril-juin 1980.
- Dionne, G., "Search and Insurance", International Economic Review, 357-367, juin 1984.
- Dionne, G., "The Effect of Insurance on the Possibilities of Fraud", Geneva Papers on Risk and Insurance, 304-322, July 1984.
- Dionne, G., St-Michel, P., "Workers Compensation and Moral Hazard", Review of Economics and Statistics, LXXXIII(2), May 1991.
- Dionne, G., St-Michel, P. and C. Vanasse, "Moral Hazard, Optimal Auditing and Workers' Compensation", Working Paper, Université de Montréal, July 1992.
- Donahue, Richard, "Health Fraud Becomes Big Profit Business", National Underwriter (Life, Health & Financial Services), March 28 1988, 1.
- Driskill, B., Hanon, M., Johnson, B., Tretter, D., "Special Investigation Unit Group Organization - 1990 Revised".
- Dubbin, Jeffrey A., Graetz, Michael J., Wilde, Louis L., "The Effect of Audit Rates of the Federal Individual Income Tax, 1977-1986", National Tax Journal, Vo. XLIII, No. 4, December 1990, 395-409.
- Dubbin, Jeffrey A., Wilde, Louis L., "An Empirical Analysis of Federal Income Tax Auditing and Compliance", National Tax Journal, Vol. XLI, No. 1, March 1988, 61-74.
- Ehrlich, Isaac, "Participation in the Illegitimate Activities: A Theoretical and Empirical Investigation", Journal of Political Economy, May-June 1973, 521-565.
- Faculté de Droit et de Sciences Sociales de L'Université de Poitiers, "La lutte contre la fraude à l'assurance", Actes du Colloque organisé à Niort les 28 et 29 juin 1990 par la Faculté de Droit et des Sciences Sociales de Poitiers.
- Feldblum, Sholom, "Auto Injury Claims Examined for Clues to Relentless Rise in Insurance Costs", The Actuarial Review, November 1991.
- Florida Insurance Research Center, "Automobile Insurance Fraud Study", University of Florida in cooperation with Florida Insurance News Service and Citizens' Fraud Prevention and Education Foundation.
- Frieden, Joyce, "Fraud Squads Target Suspect Claims", Business & Health, April 1991, 20-33.
- Friedman, Sam, "ICAC Continues to Battle Arson", National Underwriter (Property & Casualty), July 30 1990, 3.
- Garcia, James L., "Fraud: The Hidden Element in Health Care Costs", Compensation & Benefits Management, Vol. 6, No. 1, Autumn 1989, 49-51.
- Geisel, Jerry, "Senate OKs Insurance Fraud Penalties", Business Insurance, July 15 1991, 1.
- Ghezzi, Susan G., "A Private Network of Social Control: Insurance Investigation Units", Social Problems, Vol. 30, No. 5, June 1983, 521-530.

- Gilbert, Evelyn, "Fraud Detection System to be Automated by February", National Underwriter (Property & Casualty), January 28 1991, 3.
- Gilbert, Evelyn, "Aetna Awards Efforts to Combat Arson", National Underwriter (Property & Casualty), December 1989, 4.
- Grannan, David W., "Company's Investigative Unit Ferrets Out Fraud", National Underwriter (Property & Casualty), October 7 1991, 20-21.
- Guzzi, James R., "Furious about Fraud", Best's Review (Life & Health), April 1989, 66-68.
- Haggerty, Alfred G., "Insurers Win Suit in Bogus Trucker Scam", National Underwriter (Property & Casualty), August 5 1991, 3.
- Haggerty, Alfred G., "California Fires Cost Insurers About \$150 Million", National Underwriter (Property & Casualty), July 9 1990, 1.
- Harness, Wendall C., "Fraud Costing Insurers \$15 Billion Annually", National Underwriter (Property & Casualty), September 18 1989, 28.
- Herdt, Timm, "Incendiary Losses Tend to Increase in a Depressed Economy: FIA Study", Business Insurance, August 25, 1975, 4.
- Hershbarger, R.A., Miller, R.K., "The Impact of Economic Conditions on the Incidence of Arson: A Reply", Journal of Risk and Insurance, Vol. 55, 1988, 755-757.
- Hershbarger, R.A., Miller, R.K., "The Impact of Economic Conditions on the Incidence of Arson", Journal of Risk and Insurance, Vol. 45, June 1978, 275-90.
- Howard, Lisa S., "Claims Involving Fake Deaths on the Rise", National Underwriter (Life, Health & Financial Services), October 26 1987, 4.
- Howard, Lisa S., "Officials See Merit in Giving Fraud Bureaus Arrest Powers", National Underwriter (Life, Health & Financial Services), September 28 1987, 1.
- Inspecteur Général des Institutions Financières, "Rapport sur la tarification en Assurance", Gouvernement du Québec, 1989, 1990, 1991.
- Insurance Research Council, News Release, May 1991.
- Jarrett, J.E., "An Abandonment Decision Model", Engineering Economist, Fall 1973, 35-46.
- Jones, David C., "Illinois Blues Helping FBI in Lab Scam Probe", National Underwriter (Life, Health & Financial Services), January 7 1991, 32-34.
- Journal of American Insurance, "Fighting Fire with Fact", Vol. 63, 3rd. Quarter 1987, 20-22.
- Joy, Maurice O., "Abandonment Decisions: A Clarification", Journal of Finance, 30 September 1976, 1225-1228.
- Kerr, Peter, "Vast Amount of Fraud Discovered in Workers Compensation System", New York Times, December 29, 1991.
- Kertesz, Louise, "Labscam Jolts Insurers", Business Insurance, September 9 1991, 3.

- Kittrel, Alison, "Health Insurance Fraud Rampant: Study", Business Insurance, Vol. 22, No. 47, November 21 1988, 62-63.
- Knowles, Robert G., "Recession, Drug Sales Fan Flames in Fight vs. Arson; Numbers Game Hard to Pay for Arson Control Specialists", National Underwriter (Property & Casualty), December 2 1991, 2.
- Knowles, Robert G., "Georgia Regulator Hits Fraud with Sting Operations", National Underwriter (Life, Health & Financial Services), June 17 1991, 3.
- Knowles, Robert G., "Auto Fraud Costs Florida Insurers \$379 Million", National Underwriter (Property & Casualty), February 25 1991, 47.
- Knowles, Robert G., "Florida Gets \$500 Million Fraud Ring", National Underwriter (Property & Casualty), January 15 1991, 1.
- Kolm, S. Ch., "A Note on Optimum Tax Evasion", Journal of Public Economics, July 1973, 2, 265-270.
- Krzyszowski, Frank E., "Matching Wits with the Arsonist", Security Management, Vol. 33, No. 7, July 1989, 26-37.
- Lanoie, Paul, "Government Intervention in Occupational Safety: Lessons from the American and Canadian Experience", Canadian Public Policy, Vol. XVIII, March 1992, 62-75.
- Lanoie, Paul, "L'intervention de l'état et les accidents du travail: l'expérience nord-américaine" Revue internationale de gestion, volume 16, No. 4, novembre 1991.
- Lawrence, Stewart D., Hosay, Cynthia K., "Total Compensation Plan Design", Compensation & Benefits Management, Vol. 6, No. 4, Summer 1990, 354-356.
- Litton, Roger A., "Crime and Crime Prevention for Insurance Practice", Averbury, Gower Publishing Company Ltd., Aldershot, England, 1990.
- Margolis, Adrienne, "How to Unravel Insurance Fraud", Reactions (UK), March 1991, 49-50.
- Marter, Sarah S., Weisberg, Herbert I., "Medical Costs and Automobile Insurance: A Report on Bodily Injury Liability Claims in Massachusetts" Journal of Insurance Regulation, Volume 9, No. 3, March 1991.
- Marter, Sarah S., Weisberg, Herbert I., "Medical Expenses and the Massachusetts Automobile Tort Reform Law - First Review of the Automobile Insurers' Bureau Study of 1989 Bodily Injury Liability Claims", Automobile Insurers Bureau of Massachusetts, July 30, 1991.
- Martin, Donald W., "Insurers Cited as Society's Scapegoat", National Underwriter (Property & Casualty), October 9 1989, 36.
- Massé, Brigitte, Tremblay, Pierre, "Sondage auprès du public québécois - Perceptions sur la majoration délibérée des réclamations", Document d'atelier pour le Colloque "La fraude à l'assurance", Université de Montréal, 26 février 1992.
- McCombs, Karen, "Right Questions Can Prevent Claims Fraud", National Underwriter (Property & Casualty), August 14 1989, 10-11.

- McCombs, Karen, "Insurers Fights Fraud with Document Analyser", National Underwriter (Life, Health & Financial Services), December 5 1988, 2.
- McLoed, Douglas, "Insurance Fraud Tough to Spot: Ex-Con", Business Insurance, Vol. 23, No. 45, November 6 1989, 1.
- Michigan Automobile Theft Prevention Authority, "A Model Program", Annual Report 1991.
- Michigan Automobile Theft Prevention Authority - Annual Report 1989.
- Miller, Harry S., "Fraud: The Unseen Enemy", Life & Health Insurance Sales, June 1991, 16-17.
- Miller, Harry S., "Rolling Lab Operations Costing Insurers Billions", National Underwriter (Life, Health & Financial Services), March 4 1991, 55-56.
- Millon Cornett, Marcia, "Undetected Theft as a Social Hazard: The Role of Financial Institutions in the Choice of Protection Mechanisms", Journal of Risk and Insurance, Vol. LV, No.4, December 1988, 723-733.
- Mookerjee, Dilip, Png, I.P.L., "Enforcement Costs and The Optimal Progressivity of Income Taxes", Journal of Law, Economics and Organization, Vo. VI, No. 2, 1990, 411-431.
- Mooney, Sean F., Salvatore, Jeanne M., "Insurance Fraud Project: Report on Research", Insurance Information Institute, November 1990.
- Moore, M., Viscusi, K., "Social Insurance in Market Contracts: Implications of the Structure of Workers' Compensation for Safety and Wages", in G. Dionne (Ed.), Contributions to Insurance Economics, Kluwer Academic Publishers, 1992.
- Mossin, J., "Taxation and Risk Taking: An Expected Utility Approach", Economica, February 1968, 35, 74-82.
- Mulcahy, Colleen, "Domestic International Insurance Fraud Grows", National Underwriter (Property & Casualty), November 19 1990, 30-31.
- Mulcahy, Colleen, "Health Workers Compensation Fraud Victimizes Small Businesses", National Underwriter (Property & Casualty), November 19 1990, 88.
- Mulcahy, Colleen, "Insurance Fraud Stings Companies, Consumers", National Underwriter (Property & Casualty), July 4 1986, 36.
- Munchener Ruckversicherungs-Gesellschaft, "L'escroquerie à l'assurance", 1988.
- Murrey, Joe H., Dale, George, "The Disturbing Economics of Arson: A Growing National Problem", The MidSouth Journal of Economics and Finance, Vol. 5, No. 3, 1981, 65-71.
- National Insurance Crime Bureau, "Information and News Release", 10330 South Roberts Road 3-A Palos Hills, IL 60465.
- National Underwriter (Property & Casualty), "Team of Experts Outlines Methods to Prosecute Fraud", June 3 1991, 40.
- National Underwriter (Property & Casualty), "Hoyt, Robert E. Professor says Fraud Impacts Consumers and Insurers Alike", April 29 1991, 31.

- National Underwriter (Property & Casualty), "California Files RICO Suit Over Workers Compensation Fraud", March 5 1991, 1.
- National Underwriter (Property & Casualty), "Technology Major Help in Suspicious Claims", February 25 1991, 17.
- National Underwriter (Property & Casualty), "Insurance Fraud Bureau Formed in Massachusetts", February 11 1991, 11.
- National Underwriter (Property & Casualty), "Bogus Employee-Leasing Leads to More Workers Compensation Fraud", December 24 1990, 4.
- National Underwriter (Property & Casualty), "AIA Backs New Jersey Governor's Auto Fraud Battle", August 20 1990, 21.
- National Underwriter (Property & Casualty), "Company Fraud Units a Good Investment", February 19 1990, 43.
- National Underwriter (Property & Casualty), "Nationwide Steps Up Fight Against Insurance Fraud", October 9 1989, 55.
- National Underwriter (Property & Casualty), "United Front Sought to Combat Fraud", December 12 1988, 36.
- National Underwriter (Property & Casualty), "Staged Auto Accident Top Fraud List", July 18 1988, 52.
- National Underwriter (Property & Casualty), "Fraud Costs Consumers \$15 Billion Annually", February 29 1988, 37.
- National Underwriter (Property & Casualty), "Fraud Causes High Auto Rates", October 5 1987, 75.
- National Underwriter (Property & Casualty), "Insurance Fraud Investigations Nationwide Net \$6 Million", July 27 1987, 32.
- O'Dowd, Joseph F., "Joining Forces in the Battle Against Arson" Best's Review (Property & Casualty), April 1991, 61-64.
- Pantridge, Margaret, "The Grifters", Boston Magazine, December 1991.
- Patch, G., "Trinidad: A Pyromaniacs Convention" Canadian Underwriter, October 1990, 40-42.
- Perry, Harvey J., "Taxation in Canada - Fifth Edition", Canadian Tax Paper No. 89, Canadian Tax Foundation, 1990, 267-285.
- Pestieau, Pierre, Possen, Uri M., "Tax Evasion and Occupational Choice", Journal of Public Economics, Vol. 45, No. 1, June 1991, 107-125.
- Pflaum, Brenda B., Rivers, Joyce S., "Employer Strategies to Combat Health Care Plan Fraud", Benefits Quarterly, Vol. 7, No. 1, First Quarter 1991, 6-14.
- Reinganum, J.F., Wilde, L.L., "Equilibrium Verification and Reporting Policies in a Model of Tax Compliance", International Economic Review, 1986, 27, 739-60.

- Revol, Sylvie, "Déclarations frauduleuses de risque et de sinistre en assurance I.A.R.D.", Presses Universitaires d'Aix-Marseille - Université de Droit d'Economie et des Sciences d'Aix-Marseille, 1984.
- Revue Canada Douanes et Accises, "M. Jelinek dévoile les détails d'une voie rapide au poste frontière de Douglas (Columbie-Britannique)", 18 mars 1991.
- Revue Canada Douanes et Accises, "M. Jelinek annonce un nouveau système de passage à la douane", 14 décembre 1990.
- Reynolds, M.O., "Crimes for Profit: The Economics of Theft", Unpublished doctoral dissertation, University of Wisconsin, 1971.
- Robichek, A., Van Horne, James C., "Abandonment Value and Capital Budgeting", Journal of Finance, December 1967, 577-589.
- Service Anti-Crime des Assureurs - Rapport Annuel 1990-1991.
- Service Anti-Crime des Assureurs - Rapport 1923-1988.
- Sjoquist, P.L., "Property Crime and Economic Behavior: Some Empirical Results", American Economic Review, June 1973, 63, 439-446.
- Shavell, Steven, "Specific versus General Enforcement of Law", Journal of Political Economy, Vol. 99, No. 5, October 1991, 1088-1108.
- Sowder, Kathleen, "Fighting Fire with Detection", Security Management, Vol. 34, No. 10, October 1990, 33-42.
- Spark, George J., "Environment a Winner Under New Arson Law", Canadian Insurance, Vol. 96, No. 4, April 1991, 28-29.
- Spitzer, W.O. et al., "Scientific Approach to the Assessment and Management of Activity-Related Spinal Disorders - A Monograph for Clinicians Report of the Quebec Task Force on Spinal Disorders", Spine, European Edition, Supplement 1, Vol. 12, No. 75, September 1987, 59 p.
- Staten, M.E., Umbeck, J., "Information Costs and Incentives to Shirk: Disability Compensation of Air Traffic Controllers", American Economic Review, Vol. 73, No. 5, December 1982, 1023-1037.
- Teague, Paul, "Arson: The Growing Problem", Fire Journal, Vol. 70, No. 2, March 1976, 19.
- Tillmann, G., "Tax Evasion in an Open Economy", Research Memorandum No. 461, Institute of Economic Research, Faculty of Economics, University of Groningen, January 1992, 44p.
- van Aartrijk, Peter, "Floridians Fight Insurance Fraud; Insurance Fraud Outlined", National Underwriter (Property & Casualty), February 29 1988, 4.
- Wall Street Journal, The, "An Epidemic of Arson Afflicts Many Cities; Recession is a Factor", May 24, 1976.
- Williams, George F., "The Two Faces of Fraud", American Agent & Broker, Vol. 63, No. 6, June 1991, 18.
- Woods, Everett K., Wallace, Donald H., "Investigating Arson: Coping with Constitutional Constraints", Security Management, Vol. 35, No. 11, November 1991, 80-84.

- Zalma, Barry, "An Invitation to Fraud", Best's Review (Property & Casualty), September 1987, 80-84.
- Zelizer, Viviana A., "Human Values and the Market: The Case of Life Insurance and Death in 19th-Century America", AJS, Vol. 84, No. 3, 1978, 591-609.
- Zinkewicz, Phil, "In Search of a Better Mousetrap", Insurance Review, Vol. 50, No. 2, February 1989, 36-38.