RISK, UNCERTAINTY AND MORAL HAZARD

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ABSTRACT

This paper gives precision to the meaning of the term "moral hazard." It then analyses the implications which the phenomenon of moral hazard has on the welfare effects of public insurance schemes and the present shortage of medical doctors and hospitals in the United States. It concludes that the existence of moral hazard does not necessarily invalidate the case for welfare increasing public provision of insurance as Pauly has claimed in his criticism of Arrow. Finally, the analysis explores the implications the phenomenon of moral hazard has for Knight's famous distinction between risk and uncertainty.

The analysis of the conditions under which compulsory government insurance schemes raise public welfare is of considerable theoretical and practical significance. One aspect of Arrow's important contributions to this issue has recently been challenged by Pauly, who argued that Arrow's formal demonstration of the welfare raising effects of compulsory insurance is invalidated by the proper consideration of an empirical phenomenon known in the literature of insurance economics as "moral hazard."

The paper is designed to give greater precision to the concept of moral hazard than has hitherto been available and to analyze its cause in some detail, in the process shedding light on the Arrow-Pauly controversy. The concept is shown to have very important implications for current and future decision-making about public insurance schemes and the alleged present shortage of medical doctors and hospital space in the United States.

The second part of the paper develops a criterion allowing the judgment to be made whether or not a given compulsory public insurance scheme improves welfare even when moral hazard exists. In the last part, it is shown that the concept of moral hazard and the previously developed decision-making criteria add to an understanding of Frank H. Knight's famous distinction between risk and uncertainty.

Concept of Moral Hazard

The literature dealing with the economics of insurance defines "moral hazard" as "the intangible loss-producing pro-
pensities of the individual assured.\textsuperscript{3} Moral hazard thus refers to the generally well known empirical phenomenon that a group of persons which is insured against a certain risk tends to become victimized by the risk more often or more severely than a comparable group not insured.

The concept of moral hazard can be made more precise with the help of Figure 1, where the horizontal axis measures the statistical frequency with which persons in a group of 100,000 individuals, randomly selected from the population, fall victim to a particular risk during a specified period of time.

For example, consider the risk of falling ill resulting in the number of hospital bed occupation days ON required each year by the randomly selected group of 100,000 persons. The vertical axis measures the proportion of the marginal cost of hospital confinement, including the out-of-pocket cost of the care, the psychic cost and the opportunity cost of the person's time, which is borne by the person in the hospital. At 100 percent of the marginal cost borne by the individual the number of hospital bed days is ON, at 50 percent it is OP. A category of risk which exhibits a perfectly vertical line MH is said to be free of moral hazard. The more elastic the line MH the greater the moral hazard.

The functional relationship shown assumed the existence of the specific form of coinsurance known as the percentage deductible. An analogous functional relationship exists when the insurance provides for a fixed-sum deductible, except that it is more difficult to show diagrammatically. However, it is worth noting that percentage deductible coinsurance is universal if one considers properly all costs associated with the occurrence of any insured damage, for there are no known

\textsuperscript{3} E. J. Faulkner, Health Insurance, New York, 1960.
insurance schemes which compensate the insured for all losses, including those of a psychic nature and the foregone income.

From the economist's point of view, one of the most interesting aspects of the moral hazard phenomenon is its ultimate cause. Textbooks in insurance tend to stress the lack of "morality" on the part of the insureds, which leads them to exaggerate the size of their losses and to contribute actively to the occurrence of the loss. It is a well-known fact that insured bankrupt retail stores and restaurants tend to go up in flames more often than do financially sound establishments of this type.

However, the moral hazard phenomenon, probably most often and quantitatively most significantly, is due to behavior which only in a very special sense can be considered to be against society's moral norms. Medical doctors in the United States have given the following account of their decision-making processes resulting in claims on hospital insurance: Faced with a patient who shows the symptoms of an illness which is difficult to diagnose in the office, a doctor often recommends hospital confinement for a thorough analysis of the person's functions, or exploratory surgery because of the possibly serious consequences of a wrong or late diagnosis of the true illness.

Doctors readily admit that for any given set of undiagnosed symptoms their decision to admit a person to the hospital depends on their judgment as to the individual's ability to bear the cost, i.e., whether he has hospital insurance or not. Similarly, the length of hospital stay demanded and accepted by a patient or recommended by a doctor in connection with a given illness is increased in attempts to reduce the probability of relapse. In general, the level of relapse probability chosen is lower and therefore hospital confinement longer the lower the individual's marginal cost of hospital stay.

In the case of other insurance forms such as automobile, fire, theft and life insurance the moral hazard phenomenon arises from the willingness of the insured to take greater risks on an uncertain outcome. The electric wiring in a house always represents some fire danger. If persons are willing to forego repairs to the housewiring when they have insurance, which they would undertake in the absence of insurance, "moral hazard" as defined above exists.

Even in the case of life insurance there is likely to exist positive moral hazard in this sense. Consider a person who is at the margin concerning the decision to take a job involving much hazardous travel or a job in an office. If this person is induced to take the more hazardous job through the availability of life insurance and the knowledge that his family is financially secure in case of his death, then logically death rates for that person's age group are greater when life insurance is available than when it is not. It is clear that in the case of death, accident, and fire insurance the element of coinsurance tends to be extremely high so that moral hazard tends to be small.

Unfortunately, at present there appear to exist no systematic measures of moral hazard even though multiple regression techniques lend themselves readily to the measurement of the phenomenon from data available to insurance companies. However, in the absence of careful statistical inquiries, it may be worth quoting the statistics presented privately to the author by an officer of the American Medical Association. This medical doctor made the empirical judgment that the U.S. demand for hospital beds would decrease by at least 40 percent if coinsurance on hospitalization were 100 percent, i.e., if there were no hospital insurance and individuals were required to bear the full marginal social cost of hospital confinement. This is not the place to discuss
the validity of the specific estimate quoted. However, it is clear that if moral hazard in connection with health insurance is anywhere near this figure, recent public discussions about the shortage of hospital facilities and medical personnel staffing them, may well have been based on false premises.

The preceding description of the motivation underlying the actions which give rise to moral hazard support strongly Pauly’s argument that the phenomenon is wrongly called a “moral” hazard. For the most part, these actions are expected, economically rational behavior of persons confronted by the lowered price for a service. Arrow, on the other hand, while agreeing with the general validity of this proposition nevertheless expresses the hope that the public can be persuaded to set its demands for medical services in “accordance with some commonly accepted norms,” presumably in light of true social marginal rather than only private marginal cost. He believes that such a persuasion could be successful since the public attitudes to be developed are much like the ones which result in “the relations of trust and confidence between principal and agent . . . so that the agent will not cheat even though it may be ‘rational’ economic behavior to do so.”

Whether it is possible to develop such public attitudes is an extremely important question for governments which are contemplating the institution of compulsory insurance schemes in the future, because if they cannot be developed the case for such schemes will be weakened considerably. Therefore, it is worth analysing this problem of the development of public norms of behavior in some detail. In this context it is useful to consider the question whether butchers do not cheat with their weight because they act according to some accepted norm of behavior or because they are afraid of being found out and losing customers? Do people obey traffic signals because of commonly accepted norms or because they are afraid of accidents and of being caught by the police?

Some reflection on the nature of these behavioral patterns, their relation to commonly accepted norms and self-interest reveals the following principles. In cases where common norms of behavior serve public welfare, but there are private incentives to break the norms, society passes laws which through a system of punishments for violators change private incentives in favour of norms’ obedience. In general, such laws are passed only if their enforcement is technically feasible and does not require excessive resource expenditures. Most butchers have sufficient private incentives to use honest weights; easily enforceable laws strengthen incentives to conform to the public norm. Most motorists obey traffic laws because it is in their private interest to do so, but the existence of a ready law enforcement machinery has added incentive effects for those tempted to break the norm when it would otherwise suit their self-interest.

Arrow’s formal demonstration that compulsory public insurance increases welfare if moral hazard is absent provides a rationale for setting out a norm which states that hospital space paid for by the insurance should be demanded only under conditions which would also have led to the demand for it in the absence of the insurance. Obedience of this norm is in individuals’ self-interest since it makes the government insurance feasible and a rational government would introduce it, raising overall welfare. But, as was argued above, the demonstration that obedience of a norm is in one’s own interest is in-

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4 Pauly, op. cit., p. 534.
6 Ibid., p. 538.
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sufficient for its universal acceptance whenever private incentives to break the norm are strong.

In the case of the norm under discussion, private incentives to break it are strong because of the peculiarity of the service and as the estimate of the magnitude of moral hazard referred to above indicates. Laws designed to create a better balance of incentives have not been and probably never will be passed because their enforcement is impossible with the present state of technology. This is so because presently no-one can prove in any court of law that a given patient who stayed in the hospital five days with the cost paid by his insurance, would have stayed fewer days, had he been forced to pay the costs out of his own pocket, anymore than it is possible to prove that my consumption of beer would be smaller if the price were doubled.

There is no harm done by the publication of the issues, private and social costs and the specification of a public norm of behavior in countries which already have widespread public health-insurance schemes. However, it is highly unlikely that, for the reasons just discussed, such publication will reduce the extent of moral hazard in the long run and by a significant degree.

An interesting fact bearing on this question is that in the United Kingdom the elasticity of moral hazard regarding drugs was found to be so large when the degree of co-insurance approached zero, that the labor government of Prime Minister Wilson was forced to reintroduce a greater percentage of co-insurance through a charge on prescriptions, even though this step was ideologically against the principles of the labor party.

Moral Hazard and Social Insurance

As Arrow admits, the existence of moral hazard invalidates his formal proof that welfare is raised by the compulsory government provision of insurance to cover a previously uninsurable hazard. However, it is possible to show that under certain circumstances compulsory insurance raises public welfare even when moral hazard exists.

Consider Figure 1 and assume that the line MH represents the U.S. demand for visits to dentists at various levels of co-insurance. Pick one level of co-insurance, say 50 percent, where the average U.S. public demand for dentist visits is OP per year. At a cost of D dollars per visit the total cost of these visits is OP x D dollars. Assuming the cost of administering the scheme to be K and the total U.S. population to be Q, then the average premium required to cover the cost of the scheme is $C = ((OP \times D) + K)/Q$ dollars per year. Theoretically, the government institution of the dentist insurance scheme not now available from private industry is equivalent to the introduction of a service in the market, i.e., protection against 50 percent of the cost of dental care expenses, at the price C per year.

It is now possible to pose tests for social acceptance or rejection of the scheme. Consider first the possibility that all people voluntarily would purchase the protection at cost C. Clearly, under these circumstances total welfare would be increased by the introduction of the scheme. However, the nagging question arises why under these conditions the private insurance industry does not provide such a service in the market.

While there may be institutional restrictions and market imperfections, there are only two important economic reasons why a competitive insurance industry does not provide the service. First, the actual magnitude of moral hazard is unknown and experimentation to discover it is too risky and costly for a single entrepreneur to

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\[^7\] Arrow, *ibid.*, p. 538.
undertake. It could be said that the knowledge has large externalities associated with it. If this is the case, then the government should make the investment in the assembly of the knowledge, which it has to do whether the service is ultimately provided privately or not. It should then make this knowledge available to the public free of charge. Under competition, entrepreneurs will utilize it to sell the public dental insurance at premium $C$.

Second, the actual cost of operating the scheme is smaller under government than under private auspices, possibly because of economies of scale in administration or because of lower selling (information distribution) costs under government sponsorship. However, it should be noted that the difference in these costs must be substantial in order to lead to the result that at the government premium $C_0$, the entire public would purchase it voluntarily while at the private industry premium $C_1$, no-one would purchase it. While it is hard to know ex ante what the cost differences are, it is worth noting that the government also has selling costs if the condition is to be met that the insurance is bought voluntarily by all.

Turn now to the more realistic case where offering to the public a 50 percent coinsurance for dental care at an annual premium $C$ results in the situation where some people do and some do not wish to purchase it at this price. Under these circumstances, the government institution of the scheme can be made to break even only if it is made compulsory for everyone to purchase at price $C$. This compulsion lowers the welfare of those who do not consider the service worth purchasing at price $C$, and raises the welfare of those who previously had to do without it but would have been willing to purchase it. Whether the introduction of the scheme raises or lowers overall welfare can be decided scientifically only if the gainors bribe the losers into its voluntary accept-

ance of the scheme and the gainors are still better off after the compensation. Governments willing to make value judgments can justify the institution of a compulsory insurance scheme if they decide that welfare would be raised if compensation were undertaken.

Again the question arises why private industry does not supply insurance to the segment of the population willing to purchase it at price $C$. As in the preceding case, the reasons for not doing so are uncertainty or higher costs and premiums. It may be worth noting one important source of higher costs encountered by private but not by compulsory insurance. Whenever a private insurance scheme is offered for sale, the seller is faced with the problem of adverse selection, which means that at the given premium proportionately more loss-producing individuals are induced to sign up than there are in the population as a whole. Private insurers take account of this phenomenon by setting up risk classes with different premiums, to which they assign individuals according to the best estimates of their loss-producing propensities. The administration of these risk classes and the investigation of individuals result in costs not experienced under compulsory schemes and contribute to the existence of types of hazard for which private insurance is not available because it cannot be sold at a profit, but which some people are willing to purchase at the government encountered cost.

Finally it is necessary to introduce into the analysis the possibility that external effects or socially desirable income redistribution effects are associated with the universal introduction of an insurance scheme. In connection with health insurance it is often argued that such effects are positive and large. These effects can be incorporated into the analysis by subtracting an estimate of their social values (E) from the costs and recomputing a
premium necessary to cover the net social cost of the scheme, i.e., \( C_c = (OPxD) - E + K \). This premium estimate then has to be presented to the public and the same decision-making calculus as before has to be applied. It is clear that if external and income redistribution effects and the government administrative savings are large enough, it is much more likely that at the resultant \( C_c \) the entire public would purchase it voluntarily while at the private \( C_c \) it would be totally unsalable.\(^{8}\)

The preceding analysis has been presented for the case where a 50 percent coinsurance was offered at the appropriate breakeven costs \( C \) and \( C_c \). Logically it is possible to engage in analogous experiments using all other levels of coinsurance and corresponding cost estimates. For any given insurance scheme the following outcomes may result:

First, at no level of coinsurance different from 100 percent the service is purchased voluntarily by all or net welfare benefits are positive. Under these conditions the hazard is genuinely non-insurable.

Second, at several levels of coinsurance all people wish to purchase it and at no levels is there lack of unanimity. The problem is here to choose among levels of coinsurance all of which are desired universally. There are no economic criteria for choosing among the alternatives and a plebiscite or value judgment is necessary for the choice of an optimum level of coinsurance.

Third, at several levels of coinsurance it is decided that the welfare losses of the coerced are smaller than the gains of the remaining population and at no level the scheme is accepted voluntarily by all.

In this case optimisation requires choice of the level of coinsurance with the highest level of total welfare, which requires no more interpersonal comparisons of utility than already have been undertaken in the initial estimates of overall net gains.

Lastly, at some levels of coinsurance there is voluntary unanimity and at some other levels welfare gains outweigh losses from coercion. Under these circumstances no economic criteria of choice are available and value judgments have to be brought into the decision.

In sum, the analysis of this section has shown that differences in private and public administrative and selling costs, and the existence of external and income redistribution effects, can lead to the situation where total welfare is raised by the introduction of a government sponsored compulsory insurance scheme against a form of risk for which no private insurance is available, even though moral hazard exists. This result is not too surprising if it is realized that private insurance is available for many forms of risk for which moral hazard exists.

Risk and Uncertainty

The preceding analysis can be used to give greater precision to F. H. Knight's famous distinction between risk and uncertainty, where the former is an insurable and the later an uninsurable hazard. The alleged economic cause for the observed distinction in risk-classes is that for the first there exist objective experience rates, on the basis of which profitable premiums can be set by insurance companies, while for the second no such objective data exist.\(^{9}\)

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\(^{8}\) It goes beyond the scope of this paper to analyse the argument whether, even under these circumstances, it would not be more efficient to attain the desired income redistribution effects through direct transfer payments and to subsidize private industry to the extent of the externalities.

\(^{9}\) "The practical difference between the two categories, risk and uncertainty, is that in the former the distribution of the outcome in a group of instances is known (either through calculation a priori or from statistics of past experience), while in the case of uncertainty this is not true . . ." F. H. Knight, Risk, and Uncertainty and Profit, Houghton Mifflin, Boston and New York, 1921.
The best known of non-insurable risks discussed by Knight is, of course, profits. The preceding analysis suggests that the essential difference between business and fire losses is not the unavailability of statistics on their frequency, for certainly it is possible to estimate what proportion of businesses will make losses in the future or fail to attain a given return on their capital just as it is possible to estimate the proportion of houses consumed by fire and flood in the future. While the standard error of the forecasts may be different and while there may be a greater interdependence of the risk of business losses, the two classes of risk can be estimated identically by consideration of the past experience amounting to millions of observations spanning a long period of time.

However, what is available for fire losses and not for business losses are objective data on the degree of moral hazard, that is how much losses would increase at the different marginal private cost of each loss to the insured between zero and 100 percent. But still these data are attainable in principle. Historically many forms of risk, which at one time were considered uninsurable because of the unavailability of measures of moral hazard, have become insurable as some entrepreneurs or governments attained experience and were able to produce estimates of the degree of moral hazard. Thus, even on this basis, the risk of fire loss is not essentially different from the risk of business loss. After all, there now exists a form of coinsurance for business loss through U.S. government-tax laws and many governments have provided insurance against losses from foreign trade. In both of these cases moral hazard is measurable for the degree of coinsurance employed and experience has shown that it is not particularly large.

Thus, what remains of Knight's distinction between risk and uncertainty? The preceding discussion suggests that, theoretically, a socially uninsurable risk is one for which at all degrees of coinsurance the premiums required to cover the cost of losses and administration are so large that the group to be insured is unwilling to pay the premium in order to obtain the coverage. There are no a priori reasons for believing that business losses are uninsurable at all levels of coinsurance, but if they are it may be worth while to retain the distinction between risk and uncertainty.