CHAPTER III

A THEORETICAL APPROACH TO ACCIDENT COST ALLOCATION

3.1 INTRODUCTION

There are several ways in which an accident compensation scheme could be financed if producing adequate revenue was the only goal. Traditionally levies on employers have been used because of the supposed effects on the other goal, that of accident prevention. Also, levies are widely believed to be desirable from an equity point of view so that there is no subsidization of hazardous industries by safe industries, i.e. the user-pay principle is satisfied.

Accidents as the unwanted by-product of production activities are conveniently viewed in the broad framework of externality theory.[1] This theory is first described generally, and then particular reference made to a modern branch of externality theory, environmental economics. The analogy between accidents and pollution would seem to imply that accidents also should be handled by an effluent tax approach. However, there are some important complicactions to this approach which derive from the unique character of accidents as externalities. For example, the determination of the true social costs of accidents and the way in which these should be allocated provide formidable problems. These and other limitations to the simple pollution/accident analogy are discussed.

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[1] There have been several other approaches to the theory of accidents in the literature, for example, at least one writer has regarded accidents as a factor cost, akin to repairs, depreciation and maintenance expense of capital, see G.R. Steele, 'Industrial Accidents: an Economic Interpretation', Applied Economics, 1974, 6, pp.143-155. Other approaches have emphasised the neoclassical model of the firm and treated accidents as joint products, e.g. W. Oi, 'Workmen's Compensation and Industrial Safety' in Supplemental Studies for the National Commission on State Workmen's Compensation Laws v.I, Washington, 1973, pp.41-106.

When a levy system such as has been operating during the past four years in New Zealand is used, in which differential levies are determined by the industry experience and are unadjusted in the light of the firms' own experience, then the direct impact on accident prevention is uncertain, perhaps perverse. The likely indirect effects on long-term resource allocation is discussed using some rather conjectural incidence theory. If levies could be made more like accident taxes, then there would be much more leverage on the firm's efforts to produce safety. The theory of experience-rating and other techniques will be examined in subsequent chapters.

3.2 EXTERNALITY THEORY AND ENVIRONMENTAL ECONOMICS

Early theory on externalities, which had its origins in Pigou's classic work in 1920[1], tended to concentrate on social costs (and benefits) arising from two person/two firm or one person/one firm types of interaction. Pigovian taxes and subsidies were invoked to internalize the externality and restore optimality. Coase[1] demonstrated that from an allocative viewpoint, the result is the same whether the affected party bribes the producer of the externality or the offender makes compensatory payment to the damaged party, assuming full knowledge and zero transaction costs. Mishan[2] held that when welfare effects were large, there was no necessary symmetry. There are two concepts to be distinguished: the compensating variation (cv) which is defined as the money transfer necessary to maintain the original level of welfare, and the equivalent varitation (ev) i.e. the money transfer which in the absence of contemplated change, affords the individual an exactly equivalent change in his welfare. The maximum sum a person will pay for something valuable is limited by his resources while the minimum sum he will accept for parting with it is subject to no such constraint. If, in the case of an environmental externality, the law is non-permissive, that is the pollutor must pay for the use of the environmental resource, then the law acts to reduce the regressive distribution of welfare.[3] A permissive law, on the other hand, could allow pollution to proceed unchecked if the damaged party were too poor to bribe the pollutor to desist. In addition, a permissive law, by promoting a subsidy or bribe approach, would tend to encourage the externality as firms would overstate their potential pollution and because the subsidy, as opposed to a tax approach,

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[1] A.C. Pigou, The Economics of Welfare, 4th ed., London, MacMillan and Co. Ltd., 1960.

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1. R.H. Coase, 'The Problem of Social Cost', Journal of Law and Economics, 1960, pp.1-44.

2. E.J. Mishan, 'The Post-War Literature on Externalities', Journal of Economic Literature, 1971, pp.1-28.

3. Environmental costs tend to be borne by lower income groups as they are less able to shift to avoid pollution.

would encourage other firms into the industry.

More recent environmental theory has emphasized that external losses imposed by man's production and consumption activities often do not readily fit into the two person/ two firm analysis. Pollution costs are often imposed on large, ill-defined groups of people ruling out any kind of mutual bargaining approach. In general, the climate of economic opinion has shifted away from a subsidy or bribe approach and settled on the desirability in most cases of a system of taxes on the offending activity as the most equitable and effective way of reaching an optimal allocation. In certain cases, taxes designed to internalise the marginal social costs of pollution may be so high that outright prohibition or regulation of the activity may be more efficient. For example, the use of D.D.T. is now thought to impose severe environmental costs and in most cases substitutes are readily available so that outright banning is feasible. Sometimes pollutors and the damaged party are one as with motor car drivers, but the individual has no incentive to install pollution-preventive measures because he will still be affected by everyone else's pollution. In such cases the concept of mutual bargaining is best replaced by the political process and a regulatory approach.

For the standard case of a firm imposing environmental costs, effluent charges are favoured.[1] A tax per unit of effluent provides the firm with incentive to treat or remove its own effluent up to the point at which the marginal cost of treating an extra unit just equals the tax imposed. This achieves the least cost level of improvement as those firms which can reduce pollution most easily will have the most incentive to do so. The level of taxes may be set reiteratively until some satisfactory level of pollution is achieved without a precise knowledge of the shape of the underlying MC and MB curves - see Figure 3.1.

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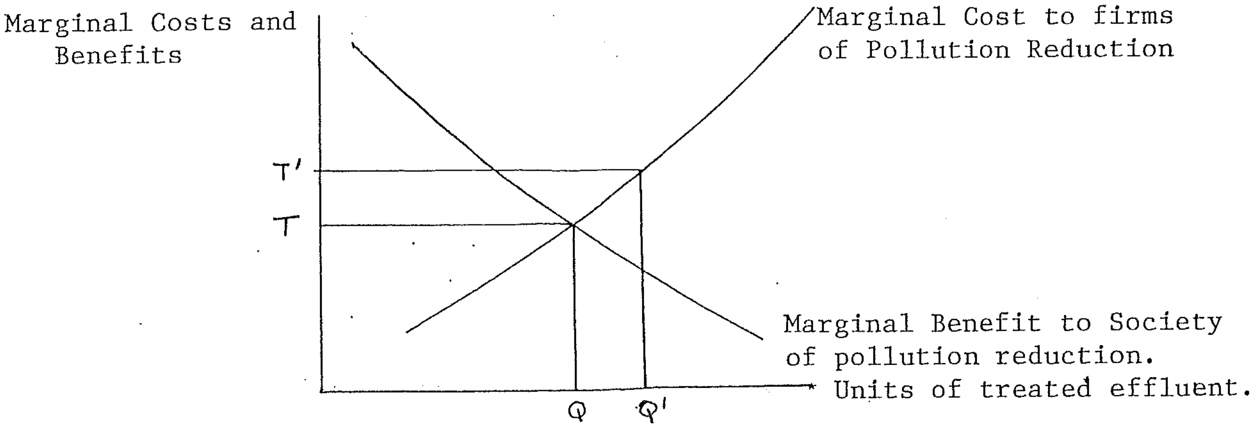
[1] For a standard approach to effluent charges, see J.J. Seneca and M.K. Taussig, Environmental Economics, London, Prentice Hall, 1974, pp.67-88.

FIGURE 3.1

THE OPTIMAL LEVEL OF TAXES



To achieve optimal level of treated or prevented effluent Q, a tax T is imposed on all units of untreated effluent.

Figure 3.1 illustrates that optimal taxes will not generally produce a zero pollution solution. The downward sloping marginal benefit curve indicates that society benefits most from the removal of the first units of pollution, and removal of subsequent units becomes less urgent. If taxes are imposed at T', then firms will treat Q' units of effluent, and this will be non-optimal from the point of view of society as a whole, because the firms' MC will exceed society's MB.

3.3 THE ACCIDENT/POLLUTION ANALOGY

For the same reasons as in the pollution case, subsidies and taxes cannot be realistically viewed as symmetrical approaches. Thus the case for subsidising a firm's expenditure on safety equipment would not be acceptable. Bargaining situations cannot readily be imagined in a world of imperfect knowledge of risks, lack of effective group organisation and the free-rider problem. Calabresi uses the example of pedestrians and car drivers.[1] If accident reduction could be achieved by fewer cars on the road, theoretically pedestrians could bribe drivers to drive less, or drivers could be charged for driving. The high transaction costs and free-rider problem of the former approach render it unfeasible. Similarly, if accident prevention can be achieved by firms' investment in safety, workers could require a wage differential for risky jobs and use the extra emolument to bribe the firms to install the safety devices.[2] Alternatively, they could purchase insurance with the differential. In the real world such abstractions, relying as they do on perfect knowledge, perfect insurance markets, no unemployment of resources etc., are idle propositions.

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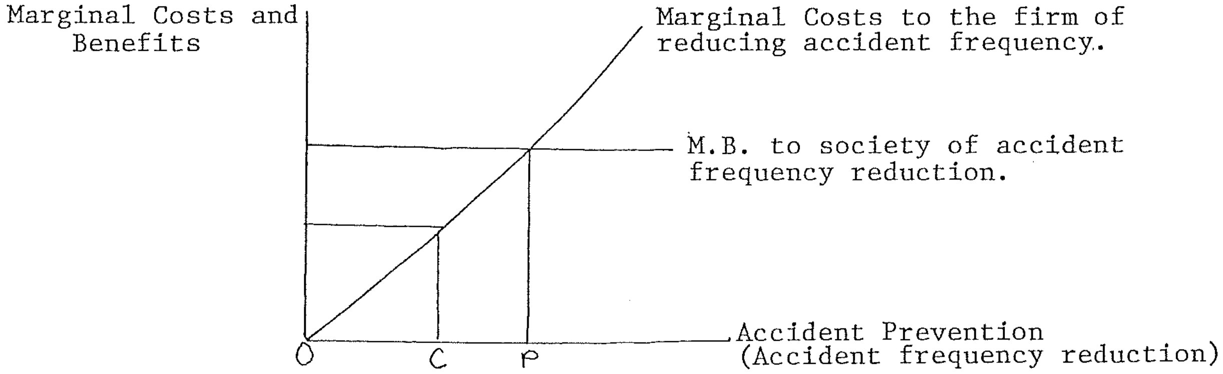
1. G. Calabresi, 'The Decision for Accidents: An Approach to Non-Fault Allocation of Costs', Harvard Law Review, v.78, no.4, Feb., 1965, p.732.
2. For the moment, the simplifying solution is made that the firm is the only party responsible for accidents.

The major benefit of pollution control comes from removal of the first units of effluent until the pollution is at a tolerable concentration. The marginal cost of removing subsequent units exceeds the marginal benefit enjoyed. For accidents, the parallel to an effluent charge would be an accident tax and a similar curve of declining marginal benefit would be obtained if accident severity was the relevant parameter under the firm's control. If accident frequency is the more appropriate concept, the marginal benefit of removing the first unit of frequency is the same as removing the last - since costs are borne discretely by individuals. Thus the MB is horizontal. The aggregation of costs and benefits so that marginal social costs are equal to marginal social benefits, hides the unequal distribution of the costs, mitigated to the extent that the tax is applied to compensation.

FIGURE 3.2

ACCIDENTS AND THE FIRM


Marginal Costs and Benefits
Marginal Costs to the firm of reducing accident frequency.
M.B. to society of accident frequency reduction.
Accident Prevention (Accident frequency reduction)
O
C
P

The point O represents the frequency rate if the firm were to take no preventive measures. Without an injury tax system, the firm is probably operating at a frequency rate specified by C. This is because there are already large incentives to reduce accidents provided by all the indirect costs of accidents such as property damage, loss of morale, costs of replacement labour, etc.

If some particular accident frequency reduction is held to be desirable, then injury taxes could be set to achieve this. The size of the tax would depend on the slope of the MC curve, i.e. the relative difficulty experienced by the firm in achieving this goal. If the cost was then felt to be too great, then ideas of the desirable or optimal level of accident reduction would have to be revised downwards.

Smith investigated the feasibility of an injury tax approach.[1] His purpose was to question the OSHA[2] standards approach to safety which requires a certain set of safety inputs rather than penalising the unwanted outcome, accidents. The standards approach was seen as not generally compatible with the achievement of a given reduction in injuries in the least-cost manner. Smith took aggregated data for thirty manufacturing industries and estimated the response of the injury rate to an increase in the marginal cost of accidents. He concluded that employers were responsive in their safety efforts to the cost of injuries, but that substantial fines would be necessary to reduce the injury rate by even moderate amounts. For a 10% reduction in the injury rate, his study suggested fines of between 1600 and 3100 dollars (1970) per injury.

Smith's approach was exploratory and his treatment of accidents or injury rates simplistic. He did not consider severity as a factor, nor the definition of an injury which would attract a fine. Nor did he discuss the possibility of insurance against liability for fines which would remove much incentive effect except in so far as premiums are related to experience of the individual firm rather than the industry. Nevertheless, his conclusions indicate the MC to the firm is steep. The 10% reduction itself could be regarded as optimal only if the fine per accident reflected the true marginal external social costs as illustrated in Figure 3.3. Also for the achievement of an optimal accident level, one has to be sure that the firm is the only party able to influence accident rates, i.e. that the marginal cost to the firm coincides with the true marginal social cost to society. Figure 3.4 illustrates the situation when the marginal social cost is less than the firm's marginal cost, the implication being that the least accident cost position will not be efficiently achieved by charging the firm alone.

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[1] R. Smith, 'The Feasibility of an "Injury Tax" Approach to Occupational Safety', Law and Contemporary Problems, v.38(4), Summer-Autumn 1974, pp.730-44.

[2] The Occupational Safety and Health Act of 1970.

FIGURE 3.3

AN OPTIMAL ACCIDENT LEVEL ATTAINED BY A 10% ACCIDENT FREQUENCY REDUCTION

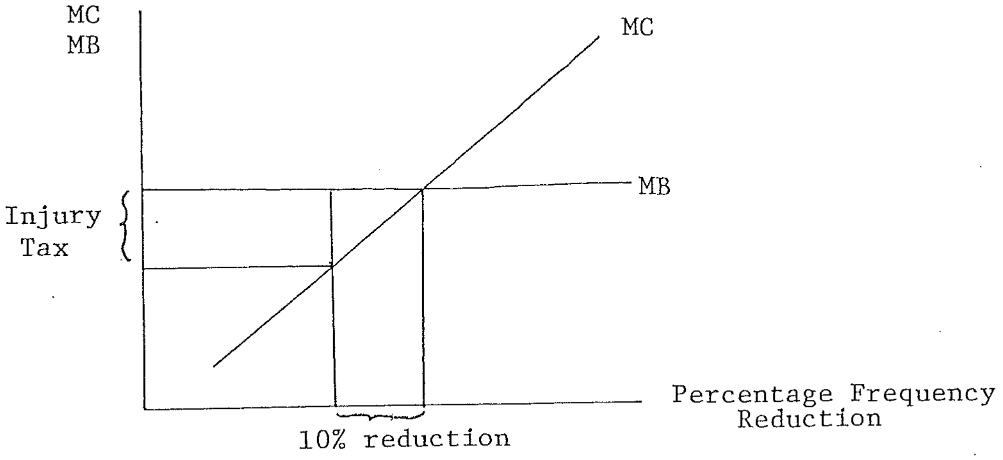
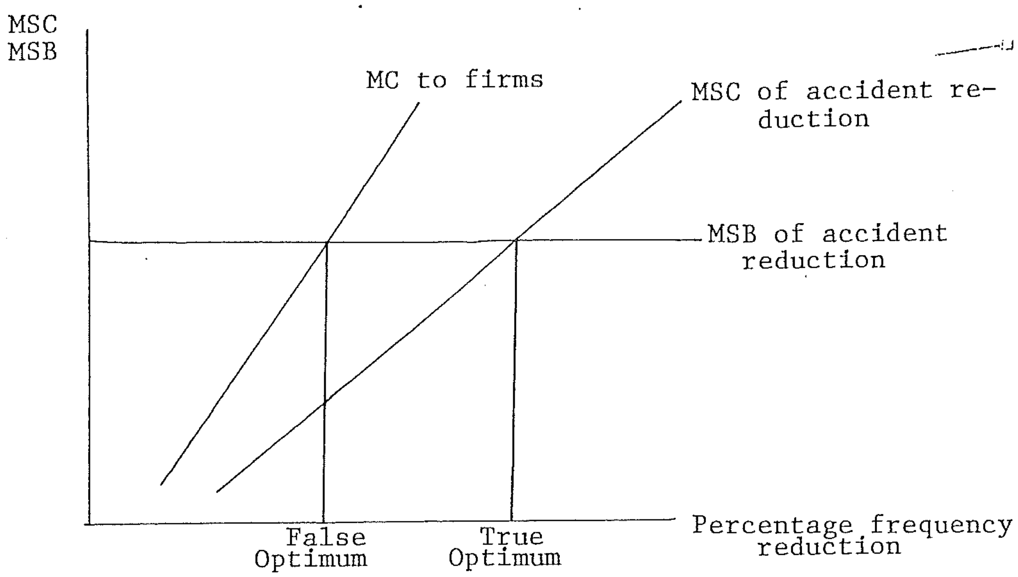


FIGURE 3.4

THE TRUE OPTIMAL LEVEL OF ACCIDENTS



3.3.1 Accident Prevention through Reduction in Level of Activity.

In the case of industrial injuries it has been tacitly assumed that accident taxes cause the firm to reduce accidents through investment in safety. There is a second way in which accidents may be prevented and that is through reduction in the level of accident-producing activity. Williamson, Olson and Ralston[1] who are of the few to treat accidents specifically as externalities, emphasise the attainment of an optimal level of activity after allowing for an optimal investment in safety equipment. From a consideration of different possible outcomes, Williamson et al focus on a two person interaction where A's activities give net private gain to A as measured by the area under the Marginal net gain curve, and A's activities impose marginal costs on B.

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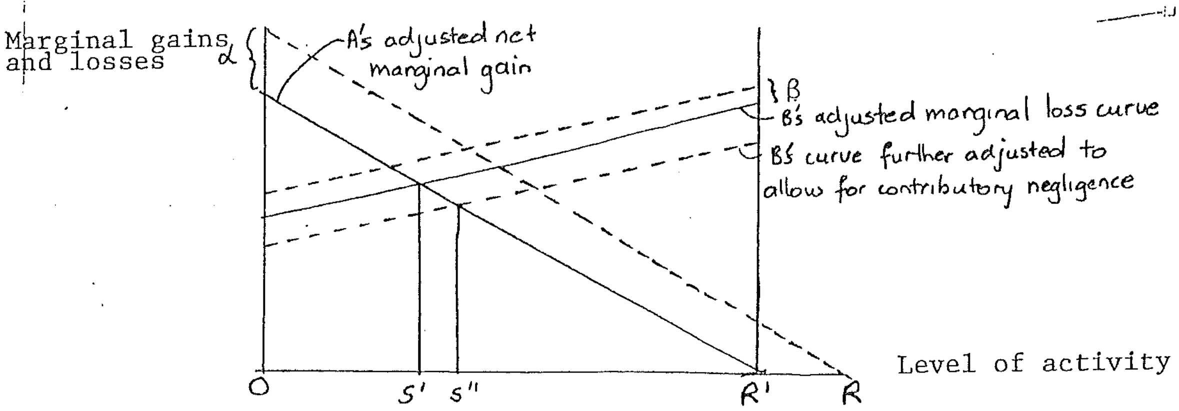
[1] O.E. Williamson, D.G. Olson and A. Ralston, 'Externalities, Insurance and Disability Analysis', Economica, vXXXIV, no. 133-136, 1967, pp.235-53.

FIGURE 3.5

ACCIDENT PREVENTION THROUGH REDUCTION IN LEVEL OF ACTIVITY



Source: Adapted from Williamson et al, p.242.

When A is not required to take into account any of the costs he imposes on B, he will maximise his net gain by operating at OR. A's marginal net gain is adjusted downwards by α, and B's marginal loss curve by β if safety devices are installed. This may be optimal from the point of view of the system as a whole if the change in expected loss on B exceeds the loss of gain by A. Such a change could be mandatory or accomplished by requiring A to compensate B in which case the optimal level of activity OS' is attained. (N.B: B's schedule could be further adjusted downwards to reflect adaptations in his behaviour, which then leads to true optimum level OS".

Where A's level of activity is continuously monitored, a rate can be charged which reflects the expected social costs that the activity will generate. For large operators, size permits experience ratings to be calculated with confidence and correct incentives result in opera tion at OS'. Where A is small and the frequency of accidents per exposure unit is low, the administratively feasible insurance premium would resemble a lump-sum rather than a marginal tax. The lump-sum entry fee will drive some operators out altogether, but for those who remain the incentive to operate at OS' is absent, likewise the incentive to install safety devices may vanish and operation at OR may prevail.

Williamson et al apply their model to automobile injury. For the operation of automobiles, they suggest that because the operating unit is so small, marginal rate adjustments are too difficult and compulsory insurance premiums (albeit in broad rate classifications) are more akin to a lump-sum or entry-tax and the individual has no incentive to install safety devices or operate at OS' rather than OR. For firms who are experience-rated, incentives exist for operation at OS'; however, Williamson et al express concern that the under-compensation bias of workers' compensation schemes render the incentives incomplete and stress need for 100% compensation for true allocative efficiency.[1]

The ultimate effect of an ideal system of accident taxes is to produce the optimal combination of accident prevention investment and reduction in the level of accident-causing activity.

3.4 LIMITATIONS OF THE SIMPLE ACCIDENT/POLLUTION ANALOGY

3.4.1 The Indeterminacy of the True Social Costs.

If accidents involved only temporary disability, loss of earning power and medical expenses, then the social economic cost would be approximated by the economic value of compensation and medical expenses. When permanent disability or death is the consequence, then determination of social costs by conventional methods poses almost insoluble philosophical problems.

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[1] They note that less than 100% compensation is probably desirable from the point of view of worker incentives.

The economic cost of a man's death is commonly calculated as the present discounted value of his expected future earnings. A second method, referred to as the net output approach, takes the present discounted value of earnings which would have accrued to others. Some rather dubious inferences follow from these types of approaches. From the first method it would appear that welfare could be increased by a shift in the distribution of deaths from high earners to low earners or to non-earners. In addition, the first approach implies that maximising GNP is all that matters and confuses the value of a livelihood with the value of a life.[1] The net output approach even has sinister implications as many persons' net output would be zero or negative. Mishan quotes Devon's ironic comment 'If we could only kill off enough old people we could show a net gain on accidents as a whole!'[2] The fundamental problem with the net output approach is that it is an ex-post evaluation which entirely ignores society ex ante. Ex ante, the amount a man will pay in order to avoid certain death (his EV) is limited by his resources, but the amount he would

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1. For a full discussion of some approaches to evaluating accidents and death see C.J. Mishan, Elements of Cost-Benefit Analysis, London, George Allen and Unwin Ltd., 1972, pp.101-8.

2. Ibid, p.102.

require in exchange for his certain death (his CV) would be an incalculable sum. The economic rationale behind equating marginal social costs and benefits is to ensure that the resulting distribution of resources and final output is Pareto Optimal.[1] When a firm's production entails social costs of accidents, then its activities are only justified if it can show net social benefit over and above the cost of restoring the welfare of all its victims. Thus the CV must be a relevant concept.

Mishan attempts to solve this problem by proposing that the relevant costs involved in a cost-benefit analysis of a particular project are not those of certain deaths for specific persons, but rather the costs of exposure of all persons involved to increased risk of death. These costs are measured by the extra premiums required by those exposed. Some attempts have been made to calculate the implicit value imputed to a life or disabling injury from such risk premium data. Oi[2] gives the example of window cleaners who demand a 50 cent an hour premium for a job which increases the probability of death by 0.5 per thousand man years. The implicit value of a life calculated from this data is over 1.3 million dollars. Oi suggests that the value of a death so calculated will many times exceed economic losses as conventionally assessed.

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1. The unfettered working of the price mechanism will ensure Pareto Optimality only when all costs and benefits have been internalised. Then there will be no costless adjustment of production or consumption which will make one person better off without making anyone else worse off. Opportunity for a potential Pareto improvement exists when the gainers could fully compensate the losers and still be better off.

2. W.Y. Oi, 'Workmen's Compensation and Industrial Safety', in Supplemental Studies for the National Commission ... I, Washington, 1973, p.61.

While Mishan is concerned to place a value on the cost of exposure of workers to increased probability of injury or death, Accident Compensation schemes require the costing of specific accidents once they have occurred. Thus when such schemes equate the value of a death or disabling injury with the total compensation paid, which may vary with arbitrary factors such as dependency or age, (i.e. life expectancy in the case of the permanently disabled), then the costs so calculated will deviate from those required for true allocative efficiency.

Part of this problem may be mitigated by imputing an average cost in the case of death or permanent disability. But as long as costs are defined as the compensatory benefits payable by a particular scheme, rather than true ex ante costs, then the true marginal social costs and benefits will not be equated.

3.4.2 The Allocation of Accident Costs.

In the case of environmental pollution, causation is usually a straightforward matter. Equity requires that the user pays and imposing effluent taxes on the offending activity should bring about optimality in pollution-reduction investment and in the level of activity. A more difficult cost allocation problem arises when pollution comes from man's consumption activities. Should the product bear the price, or should the consumer be charged directly? Several approaches have been tried to overcome disposal problems of certain goods. Effluent-type charges on certain products have been made refundable in return for specific behaviour by the consumer. In other cases a flat percentage tax has been levied on certain hard-to-dispose-of goods, or the consumer charged directly through tipping charges, etc.[1] The efficacy of such schemes in reducing environmental damage can only be resolved empirically.

The causation problem is immensely more complex in the case of accidents. Usually there is a juxtaposition of two or more activities and even in simple cases it is rare to be able to assign 100% fault to just one party. The immense history of the operation of the law of torts is testimony to the difficulties encountered. As with pollution, accidents arising from use of products as opposed to their manufacture compound the problem.[2] If one were to try to allocate costs on the criterion of fault, then financing accident compensation would be back into the immensly contentious wasteful litigation procedure so recently abandoned, at least in New Zealand. Calabresi would argue, however, that just because allocation is difficult, to externalise accident costs by transference to a social security scheme funded by general taxation would be the worst possible solution from an accident minimization viewpoint. If fault, as determined by a court of law, is not to be the basis of allocating costs, then some other allocation rule must be found.

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[1] For a general discussion of this type of problem see Seneca and Taussig, pp.172-6.

[2] For example, alcohol may be safe from a production viewpoint, but is associated with accidents in its consumption. A firm may experience an accident from the use of a piece of equipment produced by another firm. Should the first or second firm be charged? When consumers are injured when partaking of a service, e.g. at taverns, or on bus tours, should the costs be imputed to the service?

It will still be necessary to identify activities which broadly speaking "cause" the accidents, and these activities must be responsive to price. Thus one would want the greatest practical sub-classification of activities that is administratively feasible.[1] For example, charging dog-owners for dog-caused accidents might have little effect if the elasticity of demand for dog-owning was low. However, there may be scope for substitutibility between types of dogs and those types which were more accident-prone could be successfully made more expensive.

The question of who should bear the cost becomes a question of who is best able to reduce accidents and in the absence of clear-cut information, a rough allocation of costs may be the best that can be done.

Calabresi, in considering such questions of non-fault cost-allocation, does not call on the market mechanism to do the whole job of accident-cost minimization. Some conduct societal attitudes deem as "useless" should be banned, or subject to criminal penalties, even if the individual participant is aware of the accident costs of his activity and is prepared to pay them.[2] He describes a simple methodology to find the accident costs of a particular activity. The cost of any activity A includes the sum of the costs of accidents in which A alone is involved and some

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1. For discussion of this point, and example of the dog-owners, see P.S. Atiyah, Accidents, Compensation and the Law, Great Britain, Willmer Bros., 1970, p.579.

2. G. Calabresi, op.cit.p.725.

part of the cost of all other accidents in which A is involved with other activities.

To solve the problem is more complex, and becomes a matter of making guesses.[1] To give examples of complexities which arise, consider motor vehicle accidents; pedestrian-auto accidents involve two activities: walking and driving; accidents involving alcohol involve at least two activities: drinking and driving. Suppose, through allocation of cost, motor vehicle use is discouraged, one cannot ignore the implication of substitute activity. For example, if some persons are discouraged by price from motor car driving, they may switch to motorcycle or bicycle or walk, which may indeed have the overall effect of increasing accident costs. Thus, the injury risk associated with some activities depends strongly on the level of other activities.

Calabresi outlines situations in which the outcome is the same where two activities are involved regardless of who is initially charged.[2] However, in the more general case, where bargaining is impractical, it does matter who bears the initial cost. Thus, if the cheapest way to reduce auto-pedestrian accidents is to have fewer cars on the road, charging the cost to drivers will bring this about, whereas if pedestrians are charged, the desired effect would never come about. This is because, in the absence of

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1. The solution involves establishing criteria for apportioning costs among the causative activities, based on the goals of the system and will vary from case to case.

2. G. Calabresi, op.cit., pp. 725-7.

coercion, some pedestrians would decline to pay their share of the cost of bribing drivers to drive less.[1] But charging pedestrians should produce less walking - perhaps less walking and less driving would be a more efficient way of reducing the costs. In other words, you cannot assume that the combination of activities which bring about a least-cost reduction in accidents is known, allowing cost allocation arrangements to then bring this about.

Atijah, in discussing Calabresi's views, considers road accidents.[2] Suppose that the most efficient way to reduce these is to have:

(i) safer roads;
(ii) better designed cars; and
(iii) less driving.

Charging motorists alone will reduce the incidence of driving but will have no effect on (i) or (ii). If some of the costs were imposed on highway officials, then they would have an incentive to improve roads. If car manufacturers were charged, they would have a direct incentive to produce safer cars.

In the case of pollution, effluent charges automatically achieved least-cost optimal pollution reduction. In the case of accidents, the allocation of costs between activities only produces the desired effect if the allocation is made 'correctly'. Calabresi mentions how, if costs are

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[1] G. Calabresi, ibid, p.731. Note the distributional consequences of charging pedestrians.

[2] P.S. Atijah, op.cit., pp.580-2.

are misplaced from an allocative point of view, then artificial bargaining should mitigate at least part of the error, but as already discussed, bargaining or bribe situations are rarely costless, most often unfeasible, and very often, unacceptable from an equity point of view.

When one activity is clearly in a better position to evaluate the risk and institute accident reduction procedures, then Atiyah suggests there is a strong case for charging that activity alone.[1] When workers' compensation schemes were first introduced, charging the employer had the dramatic effect of rapid reduction in accident rates, the momentum of which was eventually dissipated. The firm was in a much better position than the worker to evaluate risk and take direct action on accident-prevention. Smith cites a study which suggests that now accidents are only amenable to action by the firm in 25% of cases, and the other 75% can be attributed to the normal hazards of being alive.[2] Other studies implicate human factors, such as marital stress and alcoholism in accident causation.

If it is assumed that employers are the only ones who can directly prevent accidents, then charging the employer is the 'correct' allocation. If workers, however, do have

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1. P. Atiyah, op.cit., pp.572-5.

2. Smith, ('The Feasibility of an Injury Tax'), uses the results of a Wisconsin study done by Oi to suggest why his injury taxes have to be so high to produce reduction in accident frequency, see p.742. In 'Workmen's Compensation and Industrial Safety', Oi quotes statistics which suggest that one-third of all employed persons confront a lower risk on-the-job than at other times, and he attributes many work accidents to living in general and thus more susceptible to reduction by workers, pp.72-3.

a contributory part to play, then charging employers creates a 'bribe' situation, i.e. the workers have to be bribed to behave safely, with the attendant difficulties of this type of approach.

The problem of what in fact constitutes an accident cost is not fully developed by Calabresi. Some of the costs of an accident depend on the characteristics of the injured person. A particular auto-pedestrian accident may involve compensation and medical costs which vary according to the condition of the pedestrian prior to accident. For permanent disability, a young pedestrian may require compensation over a longer period of time than an older person; similarly, the marital and family status will influence compensation required. Thus some of the direct costs are associated with the activity of having dependents, or in the long run, quite simply being alive.

The innovative aspect of Calabresi's approach is the use of involvement as a criteria for allocating costs as opposed to fault or causation. His approach requires a broad view of the way in which accident-prevention may be achieved and would seem to be particularly applicable to an all-accidents scheme such as New Zealand's. Although Calabresi's work is often quoted, very little attempt has been made in designing the New Zealand scheme to actually use his approach. Rather, he has been used as the authority justifying the retention of differential rating in one exclusive area, namely industrial activities.[1]

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[1] See, for example, comments made by G. Palmer 'Accident Compensation in New Zealand: the First Two Years', in The Social Welfare State Today, p.199.

3.4.3 The Insurability of Accident Costs.

So far it has been argued that, although an ideal system of accident taxes should produce optimal resource allocation, there are crucial problems in determining and assigning costs in a real-world situation. A further problem arises from the stochastic nature of injuries which gives rise to the possibility of insurance. This causes the ultimate breakdown in the pollution-effluent-charge analogy, although it may be possible to salvage some of it through techniques considered in Chapter IV.

Although accidents are random, there is sufficient regularity within an industry to enable fairly stable accident rates to be calculated. In a system such as operates in New Zealand, the employer is charged a differential premium based on the experience of the industry to which he belongs. Without a system of adjusting the levy in the light of individual experiences, the levy rate is unalterable by the firm and is like a payroll tax. An exception may exist where the firm is the only or major member of the industry in which case the firm's experience directly affects the class rate, providing the levy rate is regularly adjusted by the authorities.

3.5 THE IMPLICATIONS FOR ACCIDENT-COST MINIMIZATION OF AN UNADJUSTED LEVY SYSTEM.

Total accident costs for the firm comprise those indirect costs automatically internalised, e.g. property damage, loss of morale, cost of replacement labour, and direct costs imposed by workers' compensation schemes. Clearly there is great incentive to the firm to reduce accidents without a levy system. Heinrich,[1] often referred to as the father of the modern safety movement, suggested a 4:1 ratio of indirect to direct costs. Others, subscribing to the Total Loss Control School, have put the ratio much higher.

The imposition of a levy on a firm is like a payroll tax and, as such, does not add to the incentives to produce safety. There are some theoretical possibilities of how a firm may react to a payroll tax, but very limited empirical evidence.[2] The final incidence of the levy depends how successful the firm is in shifting the burden of the tax. This will depend on the type of market structure, e.g. degree of monopoly power which relates to the elasticity of demand for the product, and elasticities of supplies of the factors.

If firms do nothing when confronted with a payroll tax, but pay it like a lump-sum tax, then the whole burden would be borne out of profits and ultimately by the owners of capital.[3] Another extreme reaction would be if the producers pass the cost completely forward in prices (assuming a

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1. H.W. Henrich, Industrial Accident Prevention, 4th ed., McGraw-Hill Book Co. 1959.

2. W. Vroman attempts an analysis of ways in which firms do react in 'The Incidence of Compensation Insurance Premium Payments', Supplemental Studies ... v.II, 1973, pp.252-6.

3. It becomes more complex and less helpful to take incidence theory too far, e.g. in this example, growth may be affected which will have ripple effects throughout the economy and the final impact of the tax will be quite conjectural.

very high degree of demand inelasticity) or backwards to labour (assuming weak union power). In none of these situations is safety improved. The firm is more likely to do a combination of raising product prices, lowering money wages, and substituting capital for labour. The exact outcome may depend on factors such as the stage of the business cycle, as in good times costs may be passed forward more readily. Vroman sets up an idealised incidence model to show how backward shifting to labour may favour less risky products, but only if workers do not accept the wage reduction and are mobile. His assumptions are restrictive and he concludes that most, if not all, insurance premiums are paid out of labour's share in total income.[1] Russell analyses the effects of a payroll type levy on the incentives to use less accident-intensive technologies.[2] She concludes that a payroll tax, in so far as it is not shifted, by directly reducing use of labour, is ambiguous in its effect on total accidents. More capital-intensive technologies may or may not be safer in terms of the accident rate and absolute number of accidents. There is no clear-cut incentive to safety provided, unless the payroll tax is modified by experience-rating so that it in effect becomes an accident tax. An accident tax, by relating directly to accidents, not payroll, provides an incentive to accident reduction by a change to a less accident-intensive production process whether more or less capital or labour-intensive.

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1. W. Vroman, op.cit., pp.242-6.

2. W. Russell, 'Pricing Industrial Accidents', Supplemental Studies for the National Commission ... v.III, Washington, 1973, pp.27-52.

A firm in perfect competition would have the least possibility of passing the tax forward initially and would thus seek to reduce it by discriminating against labour. But ultimately the least efficient firms in the industry would be forced out and the final result would be a reduced supply of the good and a higher price depending on the elasticity of total demand for the product. In so far as the costs of competing products or services do reflect the accidents generated in their production, consumers will discriminate against products entailing high accident risk. This concept constitutes the theoretical resource allocation argument which has been used to justify the unadjusted levy system.

Atijah discusses the resource allocation argument in reference to the prevailing British system in which flat rate non-risk discriminatory levies apply, and concludes the ultimate effect of a differential levy system would be small. In the case of a hazardous industry, such as coal mining, the status quo implies a subsidy from safer industries. However, a realist would have to conclude that although the resource-allocation argument may have some validity in this extreme case, the future of the coal industry is far more dependent on the politics of the government of the day than marginal differences in the competitive position of coal and other fuels.[1] The smallness of accident cost differentials provide another reason for the likelihood of minimal effect. In addition, the distortions

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1. P.S. Atijah, 'Accident Prevention and Variable Premium Rates for Work-Connected Accidents' - II, International Law Journal, 1975, p.89.

produced by government in its selective taxation and subsidy schemes may completely mask the differentials which do exist.

3.6 SUMMARY AND CRITIQUE OF THE NEOCLASSICAL METHODOLOGY OF EXTERNALITY ANALYSIS

The externality framework allows a broad view to be taken of accidents which is important in considering an all-accidents scheme. Accident taxes are theoretically appropriate, but in practice there are problems arising from indeterminancy of costs, which are the appropriate activities to be charged and the stochastic nature of accidents. From an equity point of view, although fault is not a suitable basis for charging, activities which are broadly responsible for accidents should have costs allocated to them, particularly if they are in a position to take remedial action. The 'correct' allocation of costs should then produce optimal accident-cost minimization . When unadjusted levies are used, these are more akin to pure payroll taxes and, as such, any impact on safety is ambiguous, with probably minimal longrun resource allocation in favour of less risky products. A much greater leverage could be exerted on a firm's safety efforts if levies could be made more like accident taxes and ways in which this may be done will be discussed in Chapter IV.

The case for accident taxes derived from externality theory has implicitly assumed that all the neoclassical specifications of that theory are fulfilled. Each good is made to bear its true costs so that MSC=MSB and price = marginal cost in all markets. Unfortunately in the real world market imperfections exist causing deviation from the P=MC rule and even if accident costs are correctly allocated, many other costs and benefits remain non-internalized. If accidents were the only remaining externality and market imperfections were insignificant, the theory of second-best[1] would still render any partial implementation of MC pricing suspect. To make one activity internalize accident costs while ignoring substitute activity may lead one further from Pareto Optimality. Oi questions whether Pareto Optimality is even a meaningful concept in view of the rejection of consumer sovereignty implied by compulsory social insurance schemes such as workers' compensation.[2]

More fundamentally the emphasis on efficiency and the attainment of Pareto Optimality implicitly sanctions the existing income distribution. In fact there are many Pareto Optimal positions possible, each corresponding to a given income distribution and a resulting set of relative prices. Movement towards a Pareto Optimal position, if the underlying income distribution is unsatisfactory, may in fact move society further away from the true optimal or bliss position.[3] Economists must be aware of the tendency to be preoccupied with concepts such as efficiency which lend themselves readily to analysis while ignoring more fundamental, less quantifiable, issues.

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[1] See I. Little, A Critique of Welfare Economics, 2nd ed., Great Britain, Oxford University Press, 1957, for a full exposition of second-best theory.

[2] W. Oi, op.cit., p.69.

[3] The Bliss Point is the Pareto Optimal state corresponding to the highest level of social welfare function attainable. See R. Musgrave and P. Musgrave, Public Finance In Theory and Practice, Japan, McGraw-Hill Inc., 1973, pp.60-4.

> ... there are critical social choices yet to be debated if we can but turn our ears from the daily chanting of efficiency slogans reminiscent of 'Four legs good: two legs bad.'[1]

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[1] E.J. Mishan, The Costs of Economic Growth, Great Britain, Penguin, 1967, p.11.