

The Economics of Safety, Health, and Well-Being at Work: An Overview

Peter Dorman

InFocus Program on SafeWork, International Labour Organisation
The Evergreen State College

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Note: The opinions expressed in this paper represent those of the author and not necessarily those of the ILO or its constituent programs.

I. Introduction: Why Economics?

Occupational injury and illness are matters of health, but they are also matters of economics, since they stem from work, and work is an economic activity. The economic perspective on occupational safety and health (OSH) encompasses both causes and consequences: the role of economic factors in the etiology of workplace ill-health and the effects this has on the economic prospects for workers, enterprises, nations, and the world as a whole. It is therefore a very broad perspective, but it is not complete, because neither the causation nor the human significance of OSH can be reduced to its economic elements. The purpose of this paper will be to indicate the most important contributions economic analysis has made to our understanding and management of OSH, and to suggest directions for future work in this area.

Economics means one thing to the specialist and another to the general public. When most people hear the word “economics”, they think it has to do with the management of money. In particular, “the economics of occupational safety and health” suggests for many little more than “how can better working conditions be made profitable for business?” Certainly, the role of OSH, its financial costs and benefits, in business management is an important aspect of economic analysis, but it does not exhaust the topic. Above all, economics is a social science; its perspective is that of society as a whole, which includes workers, their families and their communities as well as enterprises, and it recognizes that not all the effects of ill-health show up in monetary transactions. In order to understand the contribution of economics, then, it is important at the beginning to be clear on just what economics is.

Economics has two general features that distinguish it from other social sciences. First, and obviously, it focuses primarily on the economy, the ways in which individuals and communities produce, distribute and consume goods and services. Modern economics is most comfortable studying market economies, since much more is known about the workings of markets than other types of economic mechanisms, but there are many economists who also study the economics of households, enterprise organization, and non-market societies of the past and present. In addition, economists generally assume that all decisions are made in a “rational” manner, where rationality has a very specific meaning. To be economically rational, a decision-maker is (a) outcome-oriented, basing his or her choices entirely on the predicted consequences of each action, and (b) systematically calculating, estimating the probability of each possible outcome and assigning each a positive or negative value. Because of this, the calculus of costs and benefits plays a central role in economic reasoning. Of course, this is not an entirely accurate account of how decisions are made in the real world, and in many situations calculations of costs and benefits play a minor role. Nevertheless, while conventional economics does not provide a complete explanation of human behavior, its explanations will be more effective where market competition is an important element—as it is increasingly coming to be.

Broadly speaking, there are three general purposes that economics can serve for OSH. First, identifying and measuring the economic costs of occupational injury and disease can motivate the public to take these problems more seriously. This is true at all levels, from the enterprise that may be only dimly aware of the toll that worker ill-health takes on its performance to national governments that may not realize the impact of OSH problems on economic growth and development. Second, understanding the connections between the way firms and markets function and types of OSH problems that arise is crucial for the success of public policy. Why are conditions better in some sectors or regions than others, and why are particular groups of workers at greater risk? What is the likely effect of changes in social insurance coverage, government regulation, or, for that matter, new international patterns of trade and investment? As the pace of

economic change picks up throughout the world, these questions need to be addressed on a continuing basis. Finally, as important as the protection of worker health and well-being is, it is not the only objective of modern society. Economic analysis can help show when safeguarding working conditions is complementary to other social goals, and it can illuminate the tradeoffs when it is not. Clearly, to the extent that there are tradeoffs, they don't go away if we refuse to measure them.

For all of these goals, a central concept is that of costs. On the one side, we have the costs of improving the conditions of work, in order to reduce the incidence of injury and disease. On the other, we have the costs of *not* doing these things. But the concept of costs is not simple; there are many kinds of costs, and the distinctions are important for the analysis of OSH. I will have more to say about this in later sections; for now, these will be the ways we will distinguish costs:

Economic vs noneconomic costs. Without going deeply into the subtleties of economic theory, it is enough to say that economic costs are those which can be expressed in monetary units. They include the costs paid or expected to be paid by individuals and organizations acting within the economy, as well as the monetary values implicit in activities undertaken and foregone. Noneconomic costs are no less real, but for one reason or another cannot be captured in monetary terms. In the case of injury and disease, the noneconomic costs are above all the subjective costs of pain, fear, and loss suffered by the victims, their families, and their immediate communities.¹ For shorthand, we will refer to them as the “human costs” of ill-health or premature death. In addition, it should be recognized that the loss of life and health is often opposed for reasons that are not reducible to their cost in either the economic or noneconomic sense. This is particularly the case when standards of social justice are violated: what may make a particular injury unacceptable, for instance, may not be (only) its cost, but also the fact that it could have been prevented but wasn't, due to the employer's obsession with making the greatest possible profit.²

Private vs social cost. All the costs of worker ill-health, to whomever they might accrue, could be added up; this sum would be the full social cost. “Society” has traditionally been thought of as equivalent to the nation, but it makes increasing sense to think of the entire world as our society, due to economic integration. Within this overall accounting, however, costs fall on different parties. The particular portion of the cost paid by any one individual or organization is called the private cost, and this is the cost relevant for decision-making on that level insofar as the decision-maker is economically rational. Three points should be borne in mind. First, private costs do not necessarily enter into the social cost, because they may be offset by benefits to other members of society. Suppose, as a result of a catastrophic industrial accident, a firm loses half its market share. This constitutes an enormous private cost to the firm, but if the sales are taken up by other firms this is not a component of social cost. If the firm suffering the accident was more efficient than its competitors, however, the increase in the cost to society of supplying the goods (a much smaller sum) would qualify as social. Second, not all social costs appear as private costs. For instance, a significant portion of the medical cost of occupational injury and disease in the industrialized countries is indemnified by social insurance systems. Who pays this cost and how? Some of it can ultimately be traced to specific contributors, but the cost may be so spread out as to be invisible at the private level. Moreover, imagine that the insurance system borrows money to finance the extra cost, and that the ultimate effect is to reduce the funds available for other projects—how would this be allocated to particular individuals and organizations? Rather than pursue such hopeless investigations, we simply say that the cost is social but not private. Third, the possibility for social costs to be borne by one group or another gives rise to the concept of

cost-shifting. A firm, for instance, may try to reduce its exposure to OSH costs by shifting some of them to their workforce, to other firms, or to society as a whole. This is another reason why studying private costs may be a poor guide to social costs. Nevertheless, for the purpose of understanding why individuals and firms behave the way they do, the study of private costs is indispensable.

Financial vs implicit cost. Earlier, I suggested that all economic costs could be expressed in monetary units, but not all take the form of actual money changing hands. When monetary payments are made, we can speak of a financial (or out-of-pocket) cost, but these are often dwarfed by costs that can be inferred from their effects and given estimated monetary values. Consider, for example, an accident to a worker that results in medical treatment as well as damage to a machine. The firm may pay “real” money to the health care provider; this is a financial cost. But if the useful life of the machine is reduced by two years, and if there is no other factor to attribute this to other than the accident, the increased depreciation is also a cost, just as real despite being an inference. Ultimately, from an economic point of view, financial costs are potentially deceptive, since, as we have seen, they may be more or less than true social cost. Only the inferred cost of an event in terms of all its impacts on society, based on full information and careful analysis, can be a satisfactory basis for social cost. Economists refer to this as the *opportunity cost*—the difference between the value of the goods and services available to society with or without the event, decision, etc. As we will see, calculating opportunity cost is a difficult enterprise and usually depends on a willingness to make questionable assumptions—but, economically speaking, there is no alternative.

This brief discussion of cost prepares us for the rest of this paper, which will explore the application of these concepts for policy and practice in OSH. As an organizing principle, we will go from the bottom to the top: from cost at the level of individuals, families and communities, to cost at the level of the enterprise, to the level of the nation, and finally to the entire world.

II. The Economic Costs to Individuals and Communities

Without question, the most important costs of occupational injury and disease to workers and those who care about them are noneconomic. There is no need for economic calculation to replace the deep human emotions that arise when life is unnecessarily shortened or impaired. Nevertheless, economics can make two sorts of contributions to our understanding of these costs. First, it can help identify groups particularly at risk and explain why these patterns occur. In addition, it can shed light on the specifically economic costs of OSH—their amounts, who pays them, and again why.

Groups at risk. Traditionally epidemiological analysis views risk as a function of exposure to hazardous conditions or substances, but this can be supplemented by social science approaches in which risk is the result of social position, pressures, and incentives. In the discussion that follows, I will not consider which industries or occupations are more dangerous; there is already a very large literature that does this, and economics plays a small role in it. Rather, I will look at economic factors that can in turn lead people to be exposed to risks in the more traditional sense.

As a generality, one can say that the most dangerous jobs are the ones lowest in the economic hierarchy: precarious employment, informal employment, work in small and medium enterprises (SME's), and work performed by groups subject to discrimination and marginalization. I will consider each in turn.

1. Precarious employment. There has been a steady expansion in recent years of work that does not conform to the traditional model of a permanent, full-time relationship between the worker and the enterprise at which the worker works. “Nonstandard” work consists of the various alternatives, individually and in combination: temporary employment, leased employment, “self-employment” (where the nominally self-employed worker works at the location and under the direction of another enterprise), part-time employment, and multiple employments. In addition, outsourcing can lead to employment relationships that are essentially nonstandard in the above sense, even when the worker and the subcontractor have a formally standard relationship. The term “precarious” or “contingent” employment has been applied to nonstandard work that has the effect of attenuating the employment relationship: reducing its expected duration, increasing its uncertainty, or undermining the claims that workers and employers can make on one another by virtue of the employment relationship itself. Part-time work does not fall into this category, but it can have similar effects insofar as it reduces the degree of commitment entailed in employment.

The literature documenting the spread of precarious employment in the developed countries has become enormous; for recent evidence, see Quinlan (1999), Kalleberg et al. (1997), and Estevão and Lach (1999), among others. Why this trend has occurred is beyond the scope of the paper, but proposed causes include changes in technology, increased international competition, new patterns of consumer demand, and changes in government policy. Until recently, however, little attention was given to the implications of changing employment patterns for safety and health at work. In the last few years evidence has begun to accumulate indicating that work which is precarious in employment terms is likely to be physically precarious as well. As Quinlan (1999) shows, every form of precarious employment has been linked to increased risk, and studies are often able to show the specific mechanisms involved. Outsourced and contract workers receive less training and have less awareness of their rights; in some instances they do not even know who their employer actually is. Pressure to maximize output and minimize time, which makes precarious workers attractive to some employers, also leads them to cut corners and take greater risks.

(Salminen, 1995) Accident rates are systematically higher for such groups, including the self-employed. Moreover, safety and health problems often go unrecognized in the case of leased and outsourced workers because accident data are not categorized by the industry or establishment in which the accidents actually occur. (Blank et al., 1995) Workers employed by temporary health services had more reported injuries and lost work days than a matched sample of “regular” workers in the same risk classifications, using data from Washington State (US); deficiencies in training are suspected. (Foley, 1998) Similar results for the U.S. are surveyed in NAS/NRC (1998), along with evidence that racial and ethnic minorities, migrants, and workers with less education are also at greater risk.

One of the more worrisome characteristics of precarious employment is that these workers have little input into their work conditions. Aronsson (1999), for instance, reports that non-permanent workers have less knowledge about their work environment; 30% feel constrained by their status to “refuse work environment deficiencies”, while 41% said it was more difficult for their voice to be heard. Quinlan and Mayhew (2000) find that precarious workers are far less likely to be represented on health and safety committees. The data collected by Letourneux are also revealing. Among the aspects of work over which precarious workers had less control were the ability to change temperature, lighting, ventilation, and work location, and the freedom to choose when to take personal leave. All of these are important for overall health considerations. Remarkably, of permanent workers, just under 52% could not change the position of their seat; for precarious workers this percentage ranged from the low to mid 60's. Taken together, these and similar studies paint a picture of increasing polarization of the labor force, with the bottom tier excluded from many of the workplace protections long taken for granted in industrialized societies.

The safety and health concerns of precarious workers have begun to attract the attention of policy-makers. The European Agency for Safety and Health at Work (1998), reporting on its survey of EU member governments, found that 5 paid particular attention to the situation of atypical workers during the past decade, and 7 intended to do so during the coming 3-5 years. The corresponding numbers for self-employed workers were 3 and 8.³ There is no indication as yet, however, that this concern has had an impact on the formulation of policies that may contribute to the growth of precarious work. (Quinlan, 1999)

2. Informal employment. It is in the nature of informal employment that we will have poor information about it. For the most part, this type of work is concentrated in developing countries, although there are signs of a re-emergence of informal production in the industrialized world. (Branigin, 1997) In all probability, workers in the informal sector are at high risk relative to their industry and occupation. This is due to the small scale of enterprise (see the following section), the intensely competitive nature of both labor and product markets, and the general absence of public OSH monitoring, enforcement, or supportive services. It is also attributable to the widespread poverty among informal workers themselves, since poor background health conditions and unsanitary living conditions (which are also often working conditions) are risk factors as well. (Forastieri, 1999) It would be valuable to have more information on occupational injury and illness rates, but credible numbers are virtually nonexistent. (Loewenson, 1999) One intriguing study from China, however, has recently been published and casts a light on this critical issue. (Yu et al., 1999) Five years of occupational accident data were presented for a sample of town and village enterprises (TVE's) in Shunde City, a rapidly growing industrial region. TVE's vary enormously, from joint ventures with multinational corporations to essentially informal enterprises financed off the books and organized through family or other personal connections. The legality

of TVE's is generally undeveloped, and this was particularly the case during the period under investigation. (Weitzman and Xu, 1994) In particular, there is no OSH legislation governing the TVE sector in China. Overall data is presented in Table 1.

Table 1
Major Injury and Fatality rates per 100,000 Workers in Shunde City, China

Year	Major injury	Fatalities
1989	56	29
1990	51	25
1991	175	18
1992	258	26
1993	266	39
Total	163	26

Sample: 392 enterprises, employment = 116,577

A major injury is defined in this study as one which results in at least 105 lost work days; given the virtual absence of social insurance available to injured workers, these would indeed be major impairments. The numbers are remarkable, and they show a worsening trend though the study period. Adding together the two totals for 1993, for instance, yields a rate of catastrophic injury of 0.3% per worker-year. If this rate were to continue through a worker's 30-year career, and if we assume that these accidents are randomly distributed (each year's distribution is independent), this person would face a more than 1-in-12 chance of such an event. But worse are the statistics for construction. Construction is of particular interest for two reasons: it is one of the most hazardous trades throughout the world, and, even in the most developed countries, it is organized in an informal or semi-informal manner. Over the 1989-93 period, construction accounted for 4.8% of the employment in this sample; its major injury and fatality rates per 100,000 workers were, respectively, 904 and 274. These are truly astonishing numbers. They indicate that the 30-year combined risk is just under one in three. The cumulative fatality rate alone is slightly under 8%. Not surprisingly, in light of this information, a majority of small (less than 100 employees) enterprises in the Shunde sample indicated that they had no OSH system, and less than one in five performed any sort of OSH training.

It is not clear how we might generalize from this one study. TVE's occupy a middle range between formal and informal production, and the region in China from which the information is drawn is undergoing one of the fastest rates of industrial growth in recorded history. Moreover, these are data reported by the enterprises themselves, a potential source of understatement. Nevertheless it is suggestive of the scale of the problem most countries, including many of the most prosperous, have failed to address.

3. Small and medium enterprises. Logically, one would expect greater occupational safety and health problems at SME's. There are several reasons for this. First, many OSH interventions have a substantial overhead cost, and the smaller the firm, the smaller the revenue base over which these costs can be distributed. Second, the level of expertise is frequently lower at SME's. Third, the

SME environment is generally more competitive and finance is more difficult to obtain, leading to shorter time horizons (lower investment in general) and fewer expenditures on what may be perceived as “nonessential” items. Nevertheless, for many years it was thought that the relationship between firm size and workplace risk was an inverted U-shape: lower risk among the smallest and largest firms, higher risk for those in the middle. Today this is seen as an artifact of data collection: small firms are less likely to keep accident records, but tend to have even higher incidence rates than medium-size enterprises. [Mendeloff and Kagey (1990), Hunting and Weeks (1993), Leigh (1989), Tombs (1988), Nicholls (1989), Oleinick et al. (1995)] Thus, there is now a generally accepted view that size and risk are inversely correlated at all levels of scale. As we will see in the section on enterprise-level costs, the concentration of risk in SME’s poses difficult problems of economics as well as health and well-being.

4. It should be borne in mind that not all workers have an equal likelihood of ending up in employment categories surveyed above. Both women and children are, for different reasons, disproportionately represented in precarious employment and SME’s in particular. In the case of women, little is currently known about their comparative health status, due to problems in data collection (especially concerning diseases and chronic pain) and the longstanding orientation of the OSH field toward problems primarily experienced by men. (Messing, 1999) Concerning children, a major study was undertaken by the U.S. National Academy of Sciences (NAS/NRC, 1998). It found that, while children are not generally more susceptible to risk physiologically, they are more susceptible socially and psychologically, and the consequences of a major accident or illness, of course, can be more devastating. Considering the restrictions on the employment of minors in the U.S., measured rates of occupational injury are high, and fatalities are a problem particularly in agriculture. One of the reasons cited for the OSH problems of young workers is their concentration in precarious, part-time, and small-establishment employment.

Overall, it seems to be the case that all groups that have lower socioeconomic status have, on average, more dangerous working conditions. Thus, based on the U.S. experience, racial and ethnic minorities have higher accident rates (Loomis et al., 1997; Robinson, 1989), as do immigrants (Bollini and Siem, 1995), and workers with less formal education (National Center for Health Statistics, 1993). Indeed, the ultimate test of this relationship is probably income itself, and here the evidence suggests that low income is associated with higher risk (Robinson, 1988), even, for most workers, when other factors affecting wages are controlled for (Dorman and Hagstrom, 1998). Taken together, these studies point to profound equity problems in the distribution of risk: those who suffer the most from poor working conditions are also the most likely to bear other social and economic costs.

This portrait of groups at risk is cast in general social terms, but it has a particular salience for economics. Certain forms of employment appear to be more dangerous, and certain groups find themselves congregated in them. The kinds of jobs created and the distribution of those jobs are both economic phenomena; they stem from the choices, rational or otherwise, that enterprises, workers, and governments make in their pursuit of economic goals. In particular, the global trend towards more informal or precarious employment suggests that fundamental economic forces are at work. We have barely begun the enormous effort to identify, and hopefully counteract, these forces. For now it is enough to note that these forms of employment present an obstacle to the improvement of OSH conditions and exacerbate the unequal exposure to those conditions within society. These effects should be taken into consideration when employment policies are weighed.

The burden of economic costs. There are two main economic costs that result from disability and premature death at work. The most important is the worker's lost wages during the period of absence from work and possible reduced wages after return to work, either of which may or may not be a social cost, depending on whether otherwise unemployed substitute workers are found to do the same tasks.⁴ Because of the role of workers' compensation in wage replacement, the extent of lost wages has been studied in considerable detail in developed countries. This is a difficult enterprise. Some of the questions that have to be answered are:

- ! If the worker does not return to work, to what extent is this due to disability versus other factors?
- ! Should subsequent spells out of work after the initial return be attributed to the disability?
- ! What would have been the likely future trajectory of the worker's wage if there had been no disability?

Research for the United States has found that disability plays an important role in economic outcomes. Approximately one in every ten workers has a disability that limits the amount or kind of work that can be performed. The rate of participation in the labor force for disabled workers is about 2/3 that of the nondisabled, and only half of the likelihood of being in a full-time job. (Weil, 1999) While the ratio of disabled workers' earnings to those of the nondisabled has varied over time, by the mid-1980s it was only about half. For minority workers this ratio was a shocking 15% in a well-constructed study. (Haveman and Wolfe, 1990) Ominously for developing countries, the earnings ratio falls for workers with less education; Haveman and Wolfe found that disabled workers with eleven or fewer years of education made on average only 1/3 the wage of comparable nondisabled workers. Part of this employment and wage gap represents the diminished productivity of the worker following a disabling illness or injury, but a substantial part also represents discrimination. (Baldwin and Johnson, 1994, 1995) This bias is now illegal in the United States following the passage of the Americans with Disabilities Act, but the law is difficult to enforce. From a social cost standpoint, it is often assumed that lost wages are a reasonable indicator of lost worker productivity. This is difficult to justify in a precise way, but it is the only measure we have.⁵

The second major economic element is the cost of medical treatment, care during the period of disability, and rehabilitation. In countries with well-developed social and health insurance systems most of these costs are easy to measure, but there are also household costs that can escape detection. In one US sample, for instance, one in six injured workers needed some other family member to take care of him or her, and almost 2/5 required other family members to perform some or all of their household tasks. (Weil, 1999) Even though these contributions of time and effort by the families of injured workers have no prices in the marketplace, they certainly represent economic costs. We can expect that the invisible cost of care plays a much more important role in developing countries, and that failure to measure it leads observers to falsely conclude that the economic costs of poor health are low. Assigning prices to care by family members is not difficult in principle: we could either use the going rate for similar work in clinics, rest homes, etc. or we could estimate the opportunity cost of the time spent on care—the value of the other activities foregone. Remarkably, this invisible medical cost has never been quantified, although it should be.

These are not the only economic costs, however. In a fascinating study employing a unique data set drawn from workers in the U.S., Morse et al. (1998) compared social and economic outcomes

between workers who had and hadn't reported work-related musculoskeletal disorders (WRMSDs). Some of their results are reproduced in Table 2.

Table 2
Percentages of WRMSD Cases and Controls Reporting Socioeconomic Outcomes

	WRMSD	Controls	Odds Ratio
promoted	7.9	16.0	0.45
divorce	7.1	3.9	1.91
moved for financial reasons	6.4	2.8	2.41
lost home	3.1	0.9	3.44
lost car	4.4	1.9	2.45
lost health insurance	6.6	3.5	1.91

The odds ratio in the fourth column indicates the relative likelihood of a worker with WRMSD reporting the outcome relative to a worker in the control group. All of these ratios were significantly different from 1 (equal odds) at the 95% level, except for the last one (health insurance), which was significant at 94%. All of these outcomes are economically important. Failing to be promoted is a source of lost income (as would be divorce, especially for women), while being forced to move, losing one's home or car, or losing health insurance can lead to increased current or future expenses. Not all of these could be given dollar values, but clearly some of them can. Considered as a group, these typically hidden costs of chronic occupational injury may even outweigh the direct costs in foregone wages due to absence from work.

Even more alarming is the relationship between occupational injury and dependence on public assistance. Quinlan and Mayhew (1999) cite two studies, one for Australia, the other for British Columbia, that show nearly a fourth of all recipients of workers compensation ultimately ending on the welfare rolls, making this the third most important route to welfare (after being a single mother and being unemployed). This represents a tragedy for the workers involved and also suggests that part of the economic costs are being shifted from the workers compensation system, which is employer-funded, to the general taxpayer. Presumably the role of welfare is even greater for victims who, due to lack of coverage or for some other reason, never received an award from workers compensation in the first place.

Given the substantial economic costs imposed on the victims of occupational injury and disease, as well as their family and those in their immediate community, who is likely to pay them? As we have seen, many of these costs, such as those in Table 2, are unavoidably paid by the worker, but lost wages and medical costs are often reimbursed, in whole or part, by workers compensation or a similar social security arrangement. It could be said, in fact, that, from an economic point of view, the coverage and adequacy of workers compensation is the single most important determinant of who bears the cost burden of occupational ill-health.

Workers compensation systems exist in nearly all countries, although they differ widely according to who is covered, for what impairments, over which costs, and to what extent.⁶ The ILO has drafted a series of conventions on workers compensation, superceded by the most recent, No. 121, which is a framework document. According to this convention, there are five principles that must be adhered to in establishing such a system:

- ! the “employer pays” principle; the system is funded entirely by employer contributions
- ! ongoing rather than lump-sum payments for cases of long duration
- ! minimum standards for coverage, incorporating no less than half the workforce
- ! a minimum of 50% wage replacement
- ! equal treatment of native and migrant labor

These are fine commitments in principle; in practice, however, the coverage and benefits of many systems fall short these standards, and it appears that the trend is in the direction of even lower levels of reimbursement. There are two reasons for this. First, a significant portion of industrial production is moving from older, more developed regions with a long history of workers compensation to new locations in which such systems are less developed. Second, the reorganization of production to heighten flexibility has, as we have seen, led to an explosion of nonstandard employment relations, many of which do not fall under the compensation statutes.

Regarding the situation in the developing world, consider the information provided by Fultz and Pieris (1999). Less than a fifth of the working population of southern Africa is employed in the formal sector, which is effectively the universe for workers compensation. Within this fifth, however, there are many exclusions, such as workers in the public sector and in some cases those in mining and construction—the two most hazardous industries. Still, the actual coverage is less than this; ILO surveys found that, of those who by statute should be covered in Namibia, Botswana, Zambia, and Lesotho, the corresponding percentages actually covered were half, half, 56% and 80% respectively. These are fractions of fractions. With respect to benefits, only South Africa, Zimbabwe and Zambia provide any payments for rehabilitation. In contravention of ILO standards, lump sum payments are common. An enormous problem is the failure to index benefit schedules to inflation. In many countries this been the single most important reason for the deterioration of workers compensation benefits. The authors cite a case in which inflation reduced the value of benefits for mining-related lung disease to such an extent that many beneficiaries no longer bothered to go to the post office to collect them. Many of the other impediments to the systems of southern Africa are common to the developed countries as well, but are more extreme in their effects: corruption, the resistance of employers to claims filed by their workers, the second-class status of immigrant workers, and insufficient staff to process claims and adjudicate disputes. Overall, the impression is one of good intentions but seriously inadequate results. As these economies grow, and as industrial production expands or is transferred there, improving compensation systems is an urgent task.

Meanwhile, the adequacy of workers compensation is being called into question in societies that had thought that all such problems belonged to the past. Earlier, I cited research into the expansion of precarious and other forms of nonstandard employment; the important point to recognize here is that this portion of the labor force is poorly served by workers compensation. First, many workers fall under one or more exclusions, the most important being the status of self-employment, even though work is undertaken at the site and under the direction of a registered enterprise. Second, the growth of outsourcing, leased employment, and other such arrangements makes

questions of coverage and liability more complicated; workers may not even know what compensation rights they may have or what the procedure is for filing a claim. Finally, workers whose employment is insecure are less likely to file even if they do know their rights, for fear of losing their job. The available evidence indicates that all of these mechanisms are in operation. Among recent studies are these:

- ! Morse et al. (1998), using the sample described earlier, found that only 10.6% of workers reporting WRMSD's filed for workers compensation benefits, and only 21% of those diagnosed by a doctor with this condition had filed. Of those who received medical treatment for their condition, 71% were reimbursed by general insurance (again an indicator of cost-shifting), while 8% paid out of their own pockets.
- ! Biddle et al. (1998) matched a sample of workers identified as having work-related illnesses by physicians reporting to the state of Michigan against state workers compensation records. At most, 45% of these workers filed for benefits (they appeared in both groups, but possibly for different conditions); for certain only 9.6 did (they appeared in both groups for the same condition). This was a heavily unionized sample, however, and union workers are more likely to file than nonunion, so filing rates among all Michigan workers are almost certainly lower.
- ! Quinlan and Mayhew (1999) describe a 1994 survey in New South Wales which asked whether workers had had an injury, and if so whether they had filed for workers compensation. About half reported having had injuries but not filing. Of these, half said that the reason for not filing was that the injury was too minor, meaning that 25% of seriously injured workers didn't file. The most common reason given was lack of or uncertainty about eligibility, but 11% of non-filers feared a hostile or disparaging response. A different Australian survey described by these authors revealed widespread ignorance among workers regarding WC coverage, most strongly among precariously employed. This article provides references to many other publications concerning the relationship between precarious employment and effective compensation coverage.

It is worth recalling that the inadequacies of workers compensation are important for several reasons. In this context, the critical impact is on the economic burden carried by workers who are victims of occupational injury or disease, as well as by their families and their community—the failure of the social insurance function. At the same time, however, workers compensation is a pivotal system with a variety of effects we will be considering throughout this paper. It is the most important instrument by which society places a visible economic cost on the hazards of work, apparent to workers, employers, and policy-makers. It may have an incentive effect on firms, making them more eager to improve working conditions, although this is unclear, as we will see. It is frequently linked to preventive and rehabilitative services, so that failure of coverage becomes a failure of public health as well. For all these reasons, we should be concerned about the large and apparently growing shortcomings in workers compensation, a point to which I will return at the end.

To sum up, in addition to bearing the human costs of ill-health at work, workers and their families shoulder much of the financial cost as well. This cost takes easily measured but also easily overlooked forms, and it falls with particular force on the most exposed segments of the workforce: migrant workers, women, children, and workers in precarious or nonstandard

employment. The ILO has promulgated the principle that the employer should pay for the economic costs of occupational injury and disease, but because of the shortcomings of workers compensation, this principle is increasingly violated.

III. The Economic Cost to Enterprises

It is a principle of health and safety management, extending back to Heinrich, that the vast majority of accidents (and this would clearly include diseases as well) are attributable to the conditions of work, not the performance of work. In a sense, this is a semantic dispute, since even highly dangerous conditions might be regarded as “safe” if work were always performed with exacting attention and precision. But the goal of OSH management is to make the job appropriate to the capacities of the workforce, not to find ways to exclude most workers from most jobs. Hence it is customary to view the decisions of the employer concerning what production methods to use, how to implement them, and how to incorporate safety and health concerns as the decisive focus of OSH policy. From this perspective, the reason that we are interested in the economic costs of poor working conditions is that they provide the material incentives for improving those conditions.

Not all costs will do, however. There has been considerable confusion surrounding how to classify the costs to firms, and here we will invoke economic theory to distinguish between costs that do or do not enter into these incentives. In a nutshell, to provide effective incentives for the improvement of safety and health conditions, the costs of ill-health must be economic, internal, variable, and routinely visible. Each of these is important and deserves a brief discussion.

Economic versus noneconomic costs. Recalling that economic costs are those which can be expressed in monetary units, it is clear that not all such costs involve financial payments. Some can be attributed through careful analysis of production, such as the impact of an accident on the depreciation of capital equipment or the loss of raw material. Ultimately, these come down to a set of payments, but it may take a careful study to determine what portion of the payment is attributable to workplace accidents. Other costs are what economists call “opportunity costs”—the value of the opportunities lost to the firm due to worker absences or other forms of disruption due to ill-health. If a firm loses market share, for instance, this is really the cost of *not* enjoying the benefits of the higher market share that would otherwise have been possible.⁷ Finally, many intangible costs can readily be given monetary values; this is common, for instance, in the case of “goodwill”, which is a valuable attribute for a firm. The loss of goodwill, which may result from well-publicized cases of industrial accidents or disease, is an opportunity cost to the firm which can have serious economic consequences. Nevertheless, there are also costs, quite real to the firm and its managers, which are not reducible to economics. If a worker is hurt on the job, for example, the manager responsible for establishing working conditions may feel remorse—being human, it would be difficult to feel otherwise. These noneconomic motivations, which include sympathy, solidarity, and a sense of propriety (desire to adhere to social norms), may be quite powerful, but they are outside the scope of economic analysis. Here we consider the firm as an organization whose goal is to acquire profit and avoid loss. Clearly this is an incomplete description, but economics is but one of many approaches to understanding the behavior of human beings within organizations.

Internal versus external costs. This distinction is implicit in the earlier one between private and social costs and in the discussion of cost-shifting. An internal cost to the firm is a cost which it must pay; an external cost is one which is attributable to the activities of the firm but are paid by others external to it. (Workers, incidentally, are financially external to the firm they work in, a point I will return to later.) Suppose, for instance, a company experiences a certain number of occupational illnesses each year due to a compound it uses in painting, and that the potential remedy consists in buying another safer but more expensive compound. Upon examination, managers see that they pay an extra \$1 million in medical and indemnity costs—costs they could

avoid by switching paint formulas. This might provide enough incentive to make the change, or it might not. If the firm cares only about profits (and therefore economic costs), its decision will depend on whether the extra cost of the new paint is more or less than \$1 million. Let us say that it costs \$2 million to switch paints. In that case it is not in the company's immediate financial interest to solve their exposure problem. Yet, as we have seen, a large portion of the economic costs of injuries and illnesses do not fall on employers; they are paid by workers, their families, and their communities—this in addition to the noneconomic costs which, by definition, cannot show up on the firms' books. Let us suppose that these extra costs amount to another \$2 million, effectively tripling the total social cost. A \$2 million investment to save \$3 million is a good bargain for society, but not for the firm, since it stands to lose. In this example, the internal cost is \$1 million, the external cost is \$2 million, and the total social cost is \$3 million.

Economic theory tells us that the existence of external costs drives a wedge between the incentives of individual decision-makers, such as enterprises, and the interests of the wider community. Environmental pollution is often given as an example, but the costs of injuries and illnesses suffered on the job could serve just as well. A partial list of the components of external cost appears in Table 3.

Table 3
Typical Components of the External Cost of Occupational Accidents and Diseases

Victim's lost wages, concurrent and future, not replaced through workers' compensation
Victim's medical expenses not compensated through workers' compensation or other employer-paid insurance
Time and resources expended by the victim's household in nursing and recuperation
Lost household production by the victim
Public medical subsidies applied to health services received by the victim
Public subsidies, such as tax exemption, to the workers' compensation system
Environmental contamination in the vicinity of the enterprise
Productivity no longer available to society due to premature death (if not captured by lost wages)

The next-to-last of these, environmental contamination, deserves special consideration, since there is a tendency to overlook the connection between the workplace and wider ecosystem. Hazardous substances do not read signs proclaiming "private property" and "do not enter"; they migrate readily by air and water between production sites and residential areas. The risk is compounded by the usual pattern in which neighborhoods spring up around factories, mines and other places of employment. This is particularly common in developing countries, where industrialization and urbanization are part of the same phenomenon. The result can be a horrendous disaster, as in Bhopal, India; literally hundreds (and perhaps more) died from an accident in a fertilizer plant. But the routine emission of pollutants can also create an insidious problem, undermining the health of workers in their own homes. (See the discussion of the Ulsan/Onsan complex in the Republic

of Korea in World Health Organization, 1992.) The implication for cost analysis is this: depending on the production methods and control processes involved, the same factors that generate risks of injury and illness on the job generate risks off the job, and with few exceptions these wider ecological costs will be externalized. The “polluter pays” principle is more honored in the breach, and even when massive attention causes a company to pay some of the direct costs of an environmental disaster, as occurred after the Bhopal episode, these payments cover only a fraction of the full cost. Even with the best of intentions, however, it is often difficult to trace specific environmental health outcomes to individual enterprises or production methods. These costs, increasingly recognized as serious, will be paid mostly by families and communities, not businesses.

While cost externalization is a problem everywhere, it is more pronounced in some situations than others. Some of the factors which can increase the extent to which it is society and not the employer who pays are:

- C *degree of market competition*: In highly competitive markets individual firms are more likely to try to avoid bearing safety and health costs. This principle applies to whole countries, specific industries, and particular sectors of industries. Thus externalization is likely to be greater in open economies than closed ones, competitive industries than concentrated ones, and small and medium enterprises than large firms.
- C *unemployment*: When unemployment rates are high firms are more able to shed costs on their workers. Cost externalization will therefore tend to be greater during business cycle downturns, in depressed regions, and in countries with large reserves of un- and underemployed labor.
- C *transfer and social insurance programs*: Ironically, countries with highly developed public welfare programs are more vulnerable to cost externalization, since these programs either pool risks (dissipating the risk to the individual enterprise) or transfer a portion of the burden to taxpayers. An example would be publicly funded health care systems, which absorb much of the cost of occupational accidents and diseases.

Fixed versus variable costs. Within the realm of internal cost there is an important distinction to be made between costs that are essentially constant whatever the level of injury or disease, and those that vary with incidence. If a firm pays a fixed premium for workers compensation irrespective of its own claims rate, for example, there will be little financial incentive to improve conditions. On the other hand, if the same firm has a policy of keeping workers on the payroll even if they are absent as a result of an occupational injury or illness, then each episode increases the motivation to keep workers healthy. The general principle is that only variable costs generate economic incentives.

Of course, it is not the actual variability of costs that influences decision-making, but the perceived variability. This is an important point in the context of OSH. In accounting terms, to be variable, OSH costs need to be allocated to the specific activities that gave rise to them; unfortunately, it is often easier to simply assign them to overhead. (Hopkins, 1995) This will often be true not only of workers compensation premiums, but also the costs of production downtime, medical payments, and even the cost of the firm’s OSH program itself. To assign these costs to particular activities requires more elaborate record-keeping and sometimes an additional commitment of personnel to

research and analysis. The best of the modern enterprise-level cost models, however, load the indirect costs of injury and illness on the payroll expense of the employees involved, and this makes the variability of these costs transparent.

One important issue in the variability of costs deserves particular attention. Most firms maintain a certain level of slack in order to meet unexpected demands on their resources, including accidents and other working conditions-induced absences. (Rundmo and Söderqvist, 1994) Because of this reserve, many of the variable costs associated with ill-health simply do not arise. Of course, a portion of this overhead cost is due, in theory, to the level of working conditions, in the sense that better conditions would reduce the need for overhead. This relationship is complex, however, and no studies have attempted to estimate it. Instead, one procedure has been to look at what might be called the variable component of this generally fixed cost: the transient expenses that occur before the reserve can be called up or that are entailed in utilizing it (transferring workers from one department to another, for example). This has been called the “friction cost” approach. (Koopmanschap, 1994) In recent years, however, firms have begun to realize that maintaining an overhead of excess capacity is costly, not so much for the direct costs of idle equipment and personnel, but even more because the presence of planned overcapacity obscures inefficiencies in the production process. Actual disruptions to production, in this perspective, are helpful because they provide information the enterprise needs in order to locate the underlying problems and achieve continuous improvement. This is the basis for so-called “lean” and “high-performance” systems, and it is probable that they change the cost environment for OSH in dramatic ways—but the subject is unresearched. We will return to this question at the end.

Visible versus invisible costs. In an older tradition within economics, individuals and organizations were represented as omniscient, fully-informed decision-making entities whose choices always best served their interests. In modern economics, on the other hand, the cost of acquiring information is explicitly taken into account: it is very expensive to have all the facts. This observation applies with great force to the world of OSH. As we will soon see, there is a large literature devoted to calculating the cost of injury and disease to the firm, with many disputes over methodology. The most important fact about this literature is that it exists: without special studies by trained experts, many if not most of the costs of poor working conditions would never be identified. There is no corresponding literature in, for instance, the cost of energy inputs (although there is a literature on controlling these costs), because the money paid for energy is known without any extra effort.

To make matters even more complicated, in the literature on cost analysis there is an important distinction between direct and indirect costs and a tendency for each author to draw it somewhat differently. A typical approach is to simply list the costs that will qualify as direct, and assign all the rest to indirect. Since each industry is unique in terms of the kinds of costs it generates and the channels through which they are paid, it is not surprising that no two lists are the same. Another solution is to separate costs reimbursed by insurance from those not reimbursed. (Simonds and Grimaldi, 1989) The approach I would recommend is more general and is based on the attempt to answer the central economic question, will the decision-maker—for instance, a high-level manager in a private company—identify the cost and attribute it to the firm’s OSH experience *in the absence of an extra expenditure of time and resources to calculate and allocate it?* Or, equivalently, do the amount of the cost and its cause automatically show up in the firm’s routine accounting system? If yes, it would be called direct; if no, indirect.

Although not exactly the same, the lists of direct and indirect costs resulting from this approach will be similar to those found in most of the literature. Insurance premiums, legal settlements, and direct payment to physicians will typically be examples of direct costs at the company level. Indirect costs are just as real, but they must be inferred from close observation and calculation. Thus, if a machine has a shorter lifespan because it was involved in an industrial accident, this is a “hard” economic cost, but it may be one that goes unnoticed unless someone takes the extra time to measure and allocate the damage. A list of possible indirect costs at the company level appears in Table 4. In using a list like this it is important to remember that, in specific situations, a cost item may switch categories depending on the details of the payment mechanisms and accounting system.

The failure to identify and take into consideration these costs can have a profound impact on a company’s willingness to invest in workplace safety and health. Estimates of indirect costs as a proportion of direct costs have ranged from less than 1:1 to more than 20:1, depending on the specific industry and methodology of the researcher, although the recent trend is for ratios much closer to the lower end of this spectrum.⁸ In general, a firm that fails to tally the full cost it pays for poor working conditions operates under the misleading perception that it has less incentive to remedy them. Without realizing it, the firm may be undermining its economic as well as physical health. Box 1 offers an example of “full cost accounting” applied to safety and health and demonstrates the disparity between direct and full actual cost.

Table 4
Potential Indirect Costs of Occupational Accidents at the Company Level

Interruption in production immediately following the accident
Morale effects on coworkers
Personnel allocated to investigating and writing up the accident
Recruitment and training costs for replacement workers
Reduced quality of recruitment pool
Damage to equipment and materials (if not identified and allocated through routine accounting procedures)
Reduction in product quality following the accident
Reduced productivity of injured workers on light duty
Overhead cost of spare capacity maintained in order to absorb the cost of accidents

Box 1: Measuring the Costs of Occupational Injuries in Two Finnish Forestry Firms

Indirect costs are likely to be greater in industrial settings where the work process is highly interdependent. In extractive industries indirect costs will play a smaller role, yet they still shouldn't be ignored. A thorough study of the costs of occupational injuries in the Finnish forestry sector was undertaken by Klen (1989). It demonstrates how the abstract categories of fixed/variable and direct/indirect costs can be translated into actual experience.

Klen surveyed workers and supervisors at two large forestry firms in southern Finland, and cross-checked their responses against one another and the records of public agencies. His sample represented 473 accidents resulting in temporary disablement. (Fatalities and permanent injuries were not examined.)

Costs to the forestry companies were categorized into three groups:

- C *primary direct costs*: These are payments required by law to indemnify injured workers. They include the cost of transporting the victim to a hospital and medical costs, but the largest component is wage compensation paid by insurance. Insurance premiums are fully experience-rated for these firms, so firms, after a delay, can see their injury rate reflected in insurance costs.
- C *secondary direct costs*: These are other payments to either the victim or the government. They include any wages paid while workers are disabled (including partial pay on the day of the accident), the overhead of these wages, and contributions to the public occupational safety service.
- C *indirect costs*: These are costs that can be inferred but which do not take the form of direct monetary outlays. Klen's list is useful; he includes the resource costs of completing the accident compensation form, investigating the accident, paying home visits to the victim, disruption to the work of other workers, administrative overhead in the main office, damage to equipment, and interest cost corresponding to the time difference between when the firm pays its insurance premiums and when the insurance company settles its claims. In addition, Klen attempted to collect data on the costs of recruiting and training replacement workers, and absorbing their lower productivity while learning on the job, but firms didn't provide it. He also found that both firms maintained a reserve labor force, but it was not possible to determine what proportion of it was needed to cover for injured workers rather than workers on leave.

The division of cost into direct and indirect ultimately depends on the firm's accounting system. Unless the employer maintains an unusually sophisticated accounting system, most of the costs categorized by Klen as "secondary direct" will probably appear as indirect. On the other hand, the degree of experience rating in the forestry firms' insurance costs and the absence of any general safety overhead cost (like reserve labor) results, in this case, in all costs being categorized as variable.

Applying these considerations to Klen's data, we find the full cost per accident, measured in Finnmarks, breaks down in this way:

Direct	Indirect	Total
673	925	1598

Indirect costs for these firms are relatively low, since work is performed separately or in very small teams, and equipment losses are infrequent. Nevertheless, according to the definitions employed in this paper, nearly three-fifths of the total economic cost to the firm is indirect.

Why don't most firms calculate indirect costs? Reasons vary, but common factors include:

- C *measurement problems*: Measuring these costs can be difficult and expensive. Under the best of circumstances it may take considerable time to sort out the ripple effects, assign prices to them, etc. In addition, the firm may not have the trained staff this task requires.
- C *management overload*: Managers have only a limited ability to absorb new information—a problem decision theorists call “bounded rationality”. Their attention is often fully taken up by existing proposals and reports, leaving little surplus attention to devote to the complex issue of indirect safety and health costs.
- C *biases in accounting methods*: Standard accounting procedures are less able to accommodate measures of investment in, or depletion of, human resources than traditional assets of brick and steel. (Blair, 1995) This bias toward “hard” rather than “soft” asset valuation is a problem for many programs to enhance the workforce, including safety and health programs. Even when managers appreciate the importance of these efforts, outside parties, like investors and creditors, may be more difficult to persuade. This points to the need for new accounting standards that better reflect the capacities of workers, and not just the materials they work with.
- C *low status for (or nonexistence of) OSH departments*: The job of calculating and allocating OSH costs generally falls on the firm's OSH department. Their ability to do the job thoroughly and bring the results to the attention of top management depends in part on where their unit stands in the firm's overall hierarchy. Too often OSH has a low status with little claim on resources or input into the strategic level of management. An essential aspect of an effective “safety culture” is the upgrading of OSH personnel within the organization.
- C *“don't ask, don't tell”*: In some firms there is a conspiracy of silence surrounding working conditions. Managers may fear that simply recording the true financial impact of injuries and illnesses may stir up the workforce and lead to more demands from unions or similar groups. Their strategy is to avoid the topic altogether and discourage their safety and health personnel from taking their job too seriously. (Frick, 1996)

These are the obstacles that must be overcome at the enterprise level if the financial incentives to improve worker safety and health are to be recognized and acted upon. Note that many of them will be particularly acute in small and medium enterprises—precisely the firms that tend to have the most pressing safety problems and the greatest need to address them.

Table 5 summarizes these four cost distinctions.

Table 5
Distinctions in the Cost of Occupational Accidents and Diseases

Distinction	Criteria	Significance
economic/ noneconomic	whether the cost takes the form of damage to goods or services that have or can be given prices	determines the economic case for intervention, apart from the ethical and public health case
internal/external	whether the cost is paid by the economic unit that generates it	determines the gap between the economic incentive to the individual decision-maker and the corresponding incentive to society
fixed/variable	whether the cost remains constant despite changes in the incidence and severity of injuries and illnesses	determines the economic incentive for an individual decision-maker to take measures to reduce incidence or severity rates
direct/indirect or visible/invisible	whether the cost is measured and allocated through routine accounting methods	determines whether the decision-maker will perceive the economic incentives that actually exist

If firms are thought of as making benefit-cost calculations when deciding how much to spend on improving working conditions, we need to take a look at the costs of the investments as well as the value of their benefits. Enterprise managers usually regard themselves as the best authorities on the cost of OSH investments, and often they are right, but the anticipated and actual costs may differ substantially. There is an important reason for this. Typically, a work process can be made safer or healthier through additions and modifications, such as substitute materials, ventilation systems, extra safeguards attached to machines, a more moderate work pace, etc. A firm will be able to price these investments and compare them to the potential costs they may incur if the investments are not made. This process uses existing equipment, materials, and methods, so the investment costs are straightforward and usually well-known. But there also exist opportunities for fundamental innovation, creative reorganizations of the production process that simultaneously change the character of the product, its method of production, and the work environment for those who produce it. Such innovations are difficult to foresee, and firms may not always succeed in finding them, even if they are lurking just beneath the surface. In a sense, this is simply the general problem of entrepreneurship, here applied to an integrated view of production that includes occupational safety and health.

How common are these opportunities? According to one important study, they may be the rule rather than the exception. In 1995, the Office of Technology Assessment, formerly a specialized agency of the U.S. Congress, examined the cost projection methodologies employed by the US Occupational Safety and Health Administration and found that ex ante estimates were frequently overstated. Eight different regulatory standards were considered. Of the six cases for which there was sufficient cost information, the study found that three experienced actual compliance costs

between a half and a quarter of the anticipated cost. (One had slightly higher costs and the other two were unchanged.) Moreover, four of the regulated industries achieved significant productivity gains attributable at least in part to their response to the regulatory challenge. One example, a regulation limiting cotton dust exposure, is described in Box 2 below.

Box 2: Regulating Cotton Dust Exposure: Costs and Benefits to the US Textile Industry

In 1978 the US Occupational Safety and Health Administration (OSHA) promulgated cotton dust exposure limits for workers in the textile industry. The industry protested the regulation, claiming that it was not economically feasible. OSHA estimated annual compliance costs at \$280M (1982), based on the expectation that the standard would be met by retrofitting existing equipment with better ventilation and filtration devices and tighter enclosure seals. Instead, the industry, spurred by foreign competition as well as regulation, refurbished or replaced its productive stock. The new technologies simultaneously achieved faster speeds, better use of space, higher productivity—and superior dust control that met the OSHA standard. In the end, annual compliance costs were only \$83M (1982). (Source: U.S. Congress, Office of Technology Assessment, 1995)

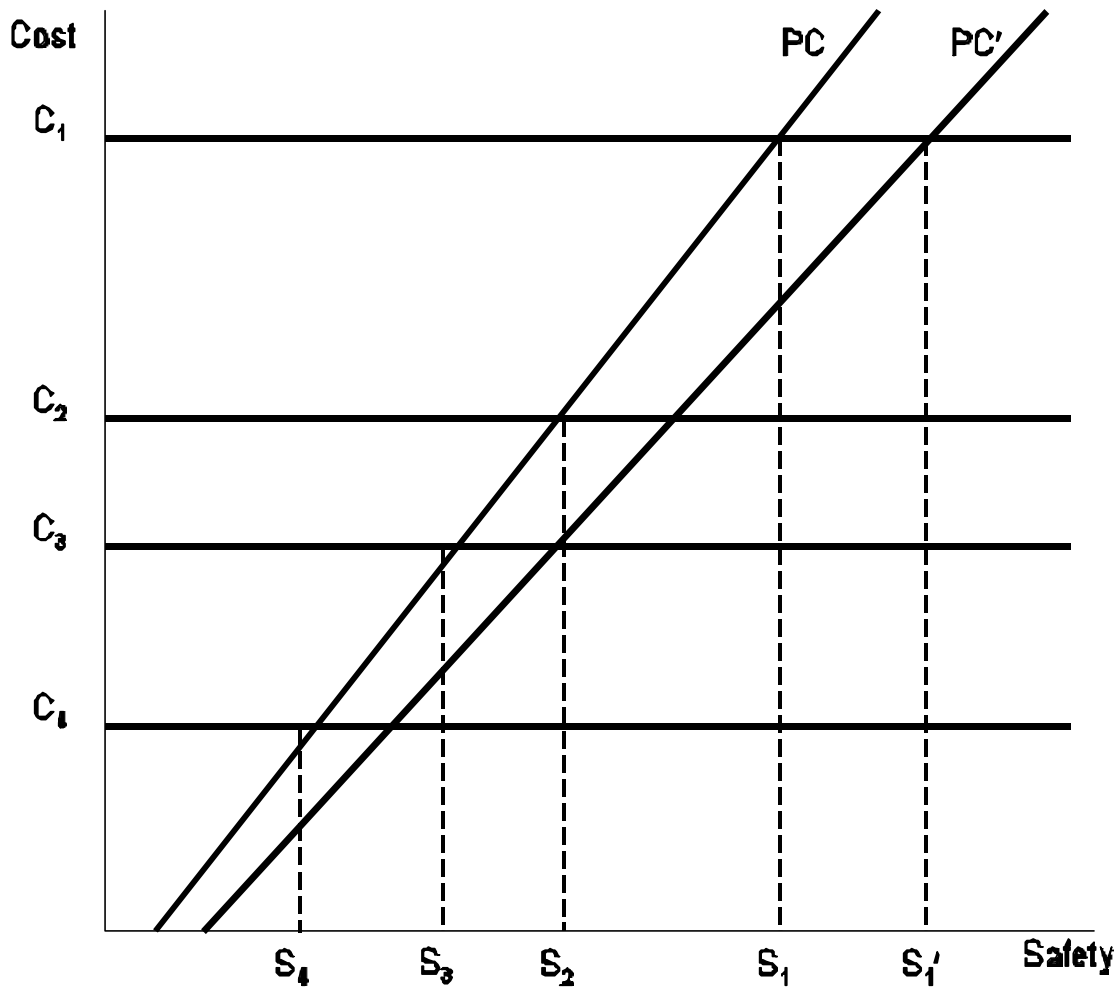
The economic logic underlying this discussion of costs and benefits at the enterprise level is portrayed in Figure 1. Suppose an “average” accident or disease has a certain total social cost in economic terms, measured as C_1 . It is assumed here that this cost is constant whatever the level of safety or risk, resulting in a perfectly horizontal marginal cost curve. That is, this curve tells us that the first harm suffered by a worker results in a cost of C_1 , the second likewise, and so on up to the point at which the job is so safe no one gets hurt any more. Thus, the vertical height of this line measures the (constant) incremental cost of safety and health problems. We can assume it measures *all* the relevant economic costs no matter who absorbs them—whether they are disruptions to production, medical costs, lost work time, burdens placed on family life, or the reduced career opportunities suffered by the worker.

Yet we have already established that many of these costs are externalized; they do not fall on the employer. A lower cost, C_2 , represents only that portion of total cost that the employer pays for. This would include damage to materials, lost worktime, hazard pay, and possible negative effects on morale and work rhythms. While substantial, these are necessarily less than the total costs, external and internal. The difference, $C_1 - C_2$, measures the extent of cost externalization. As with the combined cost, the external cost is assumed to be constant over the range of workplace risk.

Of the internal cost to the employer, one part is variable and the other is fixed. Economic logic indicates that only the variable cost is relevant to the employer’s cost calculations; here it is represented as C_3 , so that $C_2 - C_3$ represents the fixed cost.

Finally, the employer is likely to be aware of only a portion of the variable internal costs, for the reasons discussed above. This direct, variable, internal cost is represented as C_4 , so that $C_3 - C_4$ represents indirect cost, in the sense outlined earlier. *This is the cost of worker ill-health used by the firm in its cost-benefit calculations.*

Figure 1
The Costs of Risks and Risk Prevention



The curve designated PC in Figure 1 represents the cost of preventing a particular risk in the workplace. Here we assume that this cost increases as the job is made safer (increasing marginal cost). An innovation in production methods may shift this curve to PC', however. Consider the incentives associated with improvements in working conditions. According to economic logic, and assuming that no innovation in production methods is available, a safety level of at least s_1 is justified, since the cost of ill-health prevented fully equals the cost of preventing it.⁹ Under the best of circumstances—full information and full allocation of costs to the activities responsible for them (so that all are effectively variable)—the firm adopts a lower level of safety, s_2 . Incomplete allocation reduces this to s_3 , and awareness of direct costs only (assuming all are variable) results in s_4 . This is the fundamental framework for the economic analysis of OSH at the level of the individual firm. It demonstrates that there are gains to be made at each stage: by improving the firm's knowledge of its costs, its allocation of them, and their internalization of social costs. In addition, the possibility of innovation, represented by the shift in the PC curve, further distances the minimum socially justified level of safety, s_1 , from the worst-case employer-

selected maximum, s_4 . Closing this gap is the main purpose behind most economic policies, as we will see later.

There are two further points to be made about the economics of OSH at the firm level. First, up to now we have taken the costs of poor working conditions as essentially given, some combination of the cost borne by workers and their families, along with the costs incurred by firms. Firms are then pictured as adjusting (more or less effectively) to these costs. This portrayal is wrong in one fundamental respect. Enterprises to a large extent *create* the costs of worker absenteeism and turnover by their choice of production strategy. A simple model, familiar to students of industrial relations, has it this way: Imagine two different firms, A and B. A's goal is to produce a good which consumers will view as having average quality at the lowest possible price, to take advantage of being a low-cost producer for as long as this lasts, and then to exit the market swiftly. B, by contrast, is mainly concerned with convincing consumers that its good is of superior quality. It aims to have a modest market share (among consumers so convinced), earn a price premium for its product, and remain in the industry indefinitely. This difference in market strategies is then reflected in their respective personnel policies. A is less concerned with getting the best possible workers; on the contrary, it pays the lowest possible wages consistent with staffing its operations. Few guarantees of continued employment are offered, and little if any investment is made in workers' skills, health, or morale. Turnover is not considered a significant problem. Few opportunities for upward mobility are provided within the firm, and authority is exercised in a direct manner, unrestricted by formal rules or procedures. B, however, needs a different set of personnel policies to support its marketing strategy. It pays a wage premium to attract the highest-quality applicant pool and retain its best workers. Long-term contracts (explicit or implicit) are the norm, and extensive investments are made in the workforce. Worker commitment is further reinforced through internal job ladders, and trust is reciprocated through rule-based management and cooperative dispute resolution.

These are polar opposites and not necessarily reflective of the real world, where mixed strategies are apparent (including A- and B-type employment relations within the same firm). Nevertheless, the story serves a useful purpose: it reminds us of the variety of options open to the enterprise and the interconnectedness of its choices. It would make little sense, for example, for A to maintain all its other policies but also institute a costly training program. Similarly, B's strategy would fail if it didn't offer a wage premium to prevent its workers from defecting en masse and taking their insider skills with them. The relevance of the story to OSH is that good working conditions are intimately related to other personnel choices. The cost of injury and disease depends on the extent to which workers are assets—the extent to which the firm (with respect to at least these workers) is B-type. Moreover, the most reliable policies for improving the work environment rely on B-type employment relations: joint safety and health committees, careful attention to the performance attributes of the work process, effective communication throughout the organization. This set of connections makes the job of the OSH advocate easier and more difficult.

It provides those concerned with worker health and well-being an opportunity to appeal to the self-interest of employers in creative and effective ways. Many firms would like to be high-quality, high-reliability producers able to earn a premium in the market, but they don't know how to get there. Improvements in the work environment are an important component to this overall strategy, and OSH assistance can be combined with other forms of industrial extension, small business incubation, etc. It is clear, however, that many firms will be impervious to this appeal. For them, profitability depends almost entirely on cutting costs wherever feasible, and the uncertainties of

the market make investments in the workforce a pointless proposition. Perhaps the most important implication of the stylized industrial relations story, however, is that, even from an enterprise—that is, profit-oriented—standpoint, the crucial determinants of worker safety and health are not the incremental calculations typically assumed by economists, and enshrined in Figure 1, but the qualitative sorting of firms into A- and B-type strategies.

This way of posing the problem sheds new light on the situation of the small and medium enterprise. Market forces often push the SME onto path A, so that contingent employment becomes far more common and employers are not oriented toward investments in their workforce. These tendencies are significant for OSH outcomes. We have already seen that OSH problems are more pervasive in the SME sector, and Quinlan and Mayhew (2000) cite evidence from Australia showing that contingent workers are much less likely to be involved in joint OSH committees, and even that a majority of small-business owners don't know they are responsible for complying with safety and health mandates. While this should not be construed as an argument for neglecting the case-by-case work of exposing hidden costs, subsidizing OSH investment, etc., it does indicate that there are also large gains to be had from macro-level policies that alter the general economic environment for SME's.

Second, expenditures by firms on improvements in working conditions are *investments* in the strict economic sense: they are costs borne in an earlier period in order to reap benefits in later ones. But investments must be financed. For large enterprises this may not be a problem, since they may have sufficient internal finance to meet all reasonable OSH needs—whether or not they actually spend it this way, of course. Smaller firms, however, must often turn to external sources of funding, and here they encounter a problem. The cost and availability of finance is crucially dependent on the degree of collateralization—the ability of borrowers to put up assets as security behind their pledge to repay. Typically, the loans out of which investments are made are collateralized by the assets the investments purchase or produce, such as equipment, materials, patents, and stocks of finished and semi-finished goods. This does not work for OSH investments, however, because here the asset is the workforce itself, and workers cannot be offered as collateral. Firms do not actually own their workers, of course; they only rent them. Even the workers themselves are unable to collateralize their human capital, because of the prohibition on involuntary servitude. Thus, all investments in human capital, including investments in occupational safety and health, are subject to adverse discrimination in financial markets. Once more, it is clear that this problem applies primarily to SME's.

IV. Costs of Occupational Injury and Disease at the National Level

For generations, public policies in the field of OSH were justified on the basis of public health and social justice. Occasionally, advocates would assert that safer work was also more productive work, or that human carnage in industry was an economic burden on society as a whole, but no research was conducted to actually measure these impacts. In the 1990s this changed. The economics of OSH at the national level was given serious attention in a number of countries, and major studies were mounted to satisfy the demand for quantitative estimates—to put numbers on the faces of the dead and disabled.

No doubt there are many reasons for this new direction in OSH research. For one thing, the perception spread that the simple and highly cost-effective measures had all been taken in the OECD countries, and that expensive initiatives that might be taken in the future had to be justified in a more rigorous way. In addition, the political-economic context shifted: forces advocating deregulation and a greater reliance on free-market principles gained strength and sought in economic analysis the intellectual justification they needed for their policies. Whatever the reason, however, developed countries have recently produced the first credible estimates of the aggregate social costs of occupational injury and disease. After a brief discussion of the logic of “aggregate cost”, I will review the results.

From an economic standpoint, the total cost to an economy of occupational morbidity and mortality is the sum of all private economic costs that are also social costs, plus the social costs that are external to all private parties. Suppose, for instance, that an injury to a worker results in lost output. If the worker is paid during the period of non-production, this mitigates the private cost to the worker but increases the cost to the employer. A loss of production may lead to a loss of profits, which would then be a social as well as private cost, but the firm might have the ability to raise prices, maintain profits, and shift the cost to consumers. It is clear that there are vast number of considerations to take into account at the level of a specific episode of injury or disease, and that it would therefore be impractical to try to extend to the level of the nation the same techniques employed at the level of the enterprise.

Instead, the cost accounting methods typically abstract from many of the detailed questions concerning who pays what, bringing distribution back into the analysis (if at all) only at the end. The fundamental concept in this work is *opportunity cost*—the value to society of the goods or services (including leisure) it could otherwise have enjoyed had there been no diversion of resources resulting from accidents or illness at work. In general, the main sources of opportunity cost are lost output, costs of treatment and rehabilitation, and the cost of administering the various programs to prevent, compensate, or remediate occupational injury and disease. Of these, the last two are the most readily calculated, since they are generally reported by social insurance or other similar programs. The first is more difficult. Firms, as we have seen, often maintain a reserve of productive capacity that can absorb periodic absences or accelerated turnover due to working conditions; how can this cost be measured, and how much of it should be attributed to OSH rather than other factors? Moreover, there are often indirect costs of accidents and illness on productivity that firms may not even be aware of; how will the OSH researcher take account of them? Another problem is that, from the standpoint of the enterprise, the productive impact of, say, an accident is mitigated by the ability to hire a replacement worker; this puts a cap on the private cost, but what about the social cost? Does society suffer the full cost stemming from the loss of this individual's productive capacity, or does the availability of unemployed labor render this a private cost to the worker only, and not a true opportunity cost at the level of society? Finally, even given the assumption that a worker will miss work and not be replaced, how do we measure

the impact of this on productivity? It is common in this work to assume that the worker's wage is a reasonable approximation to his productivity, but there is also cause for doubt.¹⁰ In particular, discrimination and other social factors often play a role in determining wage levels, and it is troublesome to think that we are reinforcing these factors when, for instance, we assume that men, on average, are more productive than women solely because they are paid more.¹¹

In practice, researchers tend to take the path of least resistance: they equate the wage value of lost workdays (that is, the number of days of work lost times the wage paid for that labor) with lost output to society. This is meant to signify the total of direct and indirect costs due to this lost labor. Added to the medical and administrative costs, this is the figure researchers work with. The other great difficulty, however, has to do with identifying the relevant lost workdays themselves. In the case of industrial accidents this is not too problematic, although even here there are generally gaps in record-keeping. A greater source of potential error is occupational disease. Our knowledge of the extent to which different diseases can be attributed to occupational causes is limited, most diseases are actually attributable to a multiplicity of causes, and workers' exposure is difficult to ascertain in a world in which the exposures associated with particular jobs are often not known, and in which workers frequently move from one job to another. Finally, the time lag between exposure and the onset of disease confounds straightforward attempts to measure the portion of disease attributable to working conditions.

Thus the measurements that follow are the products of two uncertainties—the insufficiently understood opportunity costs of occupational illness and injury times the insufficiently understood incidence of these conditions. As we will see in the one example we consider in detail, heroic assumptions need to be made at every turn. Nevertheless, as order-of-magnitude estimates, these studies may be helpful.

Table 6 summarizes recent national calculations for a set of European countries. Most are in the range of 2.5-6%, with the exception of one of the Norwegian estimates at the high end and Great Britain on the low end.¹²

Perhaps the most elaborate attempt to calculate a national economic burden was undertaken by Leigh et al. (1996) at the behest of the U.S. National Institute on Occupational Safety and Health. At this point it will be useful to go into some detail concerning their methodology and results. Using a wide range of public and private data sources, and cross-checking their estimates against those of their predecessors, the NIOSH-sponsored team meticulously constructed cost totals by cause of impairment or mortality, by source of cost, and by ultimate payer for the year 1992. (This was an incidence rather than a prevalence study: they looked at all costs originating in the year 1992, taking into account the periods in which they would actually come due.)

As we have already seen it isn't possible to do a study such as this without making a large number of assumptions—many inevitably by the seat of the pants—and the Leigh et al. study was no exception. Heroic assumptions were made especially in the areas of occupationally-caused disease, the indirect costs of morbidity and mortality, and the extent to which employers are able to pass on the costs of workers' compensation premiums. At most points the study team adopted a conservative bias: they deliberately sought to *underestimate* the cost of injury and illness, anticipating that potential criticism would come primarily from those who believe these costs to be low. Had the assumptions been neutral—equally questionable to those whose prior belief is

that the costs are very low or very high—the totals could easily have 25-50% higher (and therefore more in line with the majority of studies reported in Table 6).

Table 6
Estimates of the Aggregate Economic Cost of Occupational Injury and Disease for Selected European Countries

Country	Base year	cost as % of GDP/NI
Great Britain	1995/96	1.2-1.4
Denmark	1990	2.5
Finland	1992	3.6
Norway	1990	10.1
Sweden	1990	5.1
Denmark	1992	2.7
Norway	1990	5.6-6.2
Australia	1992/93	3.9
Netherlands	1995	2.6

Source: Beatson and Coleman (1997)

I will summarize the Leigh et al. study in three steps. First, we will look at their estimates of the incidence and costs of fatal and nonfatal accidents and diseases in the United States. Then we will see how these safety and health statistics were translated into economic costs. Finally we will consider who pays for these costs: to what extent are they borne by the worker or the general public rather than the employer?

1. Morbidity and mortality. To estimate the incidence of fatal and nonfatal injuries, the Leigh team began with data collected by the U.S. Bureau of Labor Statistics (BLS) and other public agencies, and then adjusted the numbers for discrepancies that have previously been identified. More difficult was the problem of estimating the incidence of occupational disease. The team picked six disease categories

which have been examined for potential occupational etiology: cancer, cardiovascular and cerebrovascular disease, chronic respiratory disease, pneumoconioses, nervous system disorders, and renal disorders. The nationwide totals for each were multiplied by generally conservative estimates of the degree of occupational causation. With the exception of pneumoconioses (lung disorders due to the inhalation of dust), which were assigned 100% occupational causation, none of the others was assigned more than 10%. The overall results, including the economic burden, are summarized in the table below:

Table 7
The Number and Economic Costs of Fatal and Nonfatal Occupational Injuries and Illness, US (1992)

Category	Number	Cost (\$B)
Injuries		
Fatal	6,529	3.8
Nonfatal	13,247,000	144.6
Illnesses		
Fatal	60,290	19.5
Nonfatal	862,200	5.8
Total		173.9

Source: Leigh et al. (1996)

2. Economic cost. The second step was to calculate economic costs for different types of injuries and illnesses. For injuries, the Leigh team distinguished between fatal and nonfatal, and then further broke down the second group into standard (US) workers' compensation categories: non-disabling and disabling, with the latter consisting of permanent total disability, permanent partial, temporary total and partial, and disability limited to 1-7 work days lost. The average characteristics of each of these were applied to a set of cost calculations, encompassing both "direct" and "indirect" costs. As the table below makes apparent, their definition of direct cost is different from that used in this paper. They defined a cost as direct if it took the form of a monetary payment, irrespective of whether it was internal or external, and whether or not it would normally be allocated to occupational safety and health in a firm's accounting system. By contrast, indirect costs, in the report submitted to NIOSH, were those that could be measured only as opportunity costs; they would also be classified as indirect costs in this report, except that, in the Leigh et al. version, they include both internal and external costs.

Table 8
Direct and Indirect Costs of Occupational Injuries, 1992 (US\$B)

Direct costs total	50.1
medical costs	25.1
overhead costs for WC, private insurance, transfer programs (medical)	5.7
overhead costs for WC, private insurance, transfer programs (indemnity)	8.9
property damage	8.7
police and fire services	0.8
direct costs to innocent third parties	0.9
Indirect costs total	98.2
lost earnings (including fringe benefits)	82.5
lost home production	8.2
workplace training, restaffing, disruption	5.2
time delays	0.3
indirect costs to innocent third parties	2.0
Total direct and indirect	148.4

Cost calculations for occupational disease were much simpler. “Direct” cost, in this case, consists only of medical outlays, whether paid by workers’ compensation, the worker, or the government. “Indirect cost” is the total amount of wages not earned by workers due to inability to work or premature death, calculated on the basis of the average severity of each category of nonfatal disease and average age of death for fatal diseases. They are summarized below:

Direct cost	10.7
Indirect cost	9.0
Total cost	19.7

Taken together, the total economic costs, direct and indirect, of occupational illnesses and injuries as estimated by the Leigh team, were approximately 3% of US GDP during 1992. This sum is substantially larger than the corresponding cost of AIDS in the US during the same year, while approximately as great as the cost of circulatory diseases.

3. Who pays? Many of the cost categories are readily assigned to one group or another. For instance, firms can be assumed to bear the cost of disruptions to production, while police and fire service costs are picked up by government. The greatest areas of uncertainty are the largest in magnitude, however: medical costs and the cost of lost wages. There are two issues that need to

be resolved: how much of these costs are paid out of workers' compensation, and how much of the cost of the workers' compensation system is shifted from employers to other groups in society? To answer the first question, the Leigh team constructed estimates of the percentage of medical and indemnity costs paid through WC. WC pays approximately 45% of all medical costs stemming from occupational injuries. They applied the same percentage to the medical costs of illnesses (making the generous assumption that the tendency of WC to pay more for the same service offsets the much smaller share of occupational diseases covered by WC), and assumed that 22.5% of lost wages due to both injury and illness (half of 45%) was replaced by WC. (The true figure is almost certainly much lower.) The portion of medical costs and lost earnings not picked up by WC is borne by workers, third parties, and government. (Interesting, they report that 46% of the cost of medical care in the United States is paid through public subsidies; this is a typical source of cost externalization in countries with developed social welfare programs.) As for the ultimate burden of WC, the Leigh team assumed that employers successfully pass 10% of this cost to consumers in the form of higher prices and 80% to workers in the form of lower wages, leaving them with only 10%. This almost certainly overstates the degree of cost-shifting. Based on their assumptions, they conclude that the ultimate burden is distributed in this way:

Category	\$B	%
Employer	19.12	11
Consumer	15.64	9
Worker	139.06	80

This striking result is not entirely dependent on their analysis of WC cost shifting. Since WC payments account for about 28% of the total, each 10% change in the estimate of cost shifting changes the distribution of the full economic burden by only 2.8%. Thus, if employers actually absorb half the costs of WC rather than a tenth, their share of total economic cost remains less than a fourth.

What lessons can we draw from this work? (a) The overall share of occupational injury and illness costs in a typical developed country economy is large, not less than 3%. (b) It may well be significantly larger than this, due to the difficulty in identifying the incidence of occupational disease. (c) Workers' compensation plays a significant economic role in determining who pays which costs of disability and premature death. (d) The great majority of these economic costs are externalized, confirming the individual and enterprise-level evidence we saw earlier.

Sadly, there are no comparable studies of the economic costs of occupational ill-health in the developing world—at any level. We do not know if the cost analysis methods developed in the OECD countries apply as well to enterprises outside the OECD, nor do we have even an informal sense of whether the aggregate economic costs are greater or less in developing countries relative to the size of their economies. Finally, we do not know whether the degree of cost externalization is greater or less either. These are serious gaps in our knowledge. They preclude the calculation of a global economic burden estimate, and they make it difficult to infer whether shortcomings in worker well-being constitute a more serious problem in developing countries, again relative to other economic and social conditions. One subtle effect of our ignorance in this area is that we are able to calculate the economic costs of injury and disease only by location of production and not location of consumption. We can estimate, as Leigh et al. have shown us, the burden imposed

by all the production carried out in the U.S. during 1992, but we don't know the corresponding burden attached to the goods the U.S. consumed, since many of them were imported in whole or part from countries with no such measurements. In a sense, however, the true impact of economic activity in the U.S. depends on its share of consumption—this, in any event, is how measures of sustainability are calculated. Clearly, overcoming this gap in our understanding should be a high priority for future research.

Despite the absence of direct OSH cost studies, we can shed light on the economic consequences of occupational injury and disease by comparing them to those of other causes that have been given more scrutiny. The case of malaria is instructive. According to Murray and Lopez (1996), malaria and occupational exposure account for approximately the same share of developing country disability-adjusted life years (DALY's) lost, 2.6% and 2.5% respectively. (As malaria diagnosis has improved, it is more likely that occupational factors are relatively undercounted.) Because Africa is home to the great majority of malaria cases, researchers have attempted to estimate the economic costs of malaria in that region. The most prominent figure cited is that the combined effect of all the costs of malaria depresses the rate of economic growth in sub-Saharan Africa by 1% per year—a remarkable impact.¹³ (Gallup and Sachs, 1998; McNeil, 2000) In Africa, the level of malaria DALY's per capita is approximately five times the level for low-income countries as a whole. If we assume that each DALY imposes the same economic cost, whatever its source, this gives us the result that occupational injury and disease deprive the developing world of .2% of its economic growth each year. (Note that this is a dynamic cost; it would presumably be in addition to the static cost corresponding to the Leigh et al. type of calculation.) While not as dramatic as the malaria figure for sub-Saharan Africa, this is still a noticeable growth effect, especially in light of its probable underestimation.¹⁴ Nevertheless, despite the evidence indicating that occupational exposure is one of the principle sources of developing country DALY's, a recent exhaustive review of the literature on health and development made no mention of it. (Strauss and Thomas, 1998)

V. New Directions for Research and Policy

While there have been many studies that apply economic analysis to specific questions in the area of occupational safety and health, there has been no comprehensive economic study of the entire field. This paper has attempted to fill in some of the holes in the literature and tie together existing pieces, but far more remains to be done. In this final section I will suggest some of the issues that call for further exploration. In broad terms, there are three big questions that need to be addressed: how to give more visibility to the economic role of OSH within the enterprise, how to respond to the dramatic changes now taking place in the world of work, and how to extend OSH research, advocacy, and intervention to the developing world. What follows are detailed suggestions on each of these.

1. The economics of safety, health and worker well-being at the enterprise level. Figure 1 illustrates the conventional economic view of the firm's incentive problem. Within the enterprise there are two obstacles to be overcome, the identification of the invisible (indirect) costs of ill-health and the allocation of these costs to the activities that generated them (so that they don't appear as overhead). Society's task, in addition, is to internalize as much of the external cost as is practicable, so that the incentives to the firm correspond more closely to the needs of society. While the general framework is clear, however, the details of how these goals are to be pursued are not.

a. Making enterprises aware of their costs. Recent years have seen the production of several good instruments which enterprises can use to estimate the hidden costs of poor working conditions. Studies have documented cases in which managers, motivated by these cost considerations, were successful in reducing turnover, absenteeism and other indicators of ill-health.¹⁵ Nevertheless, most firms, including nearly all small and medium-size firms, do not use these instruments. This indicates that the focus of economic work needs to shift from the initial phase of devising cost models to the second phase of understanding why some firms use them and others don't.

From the standpoint of policy, it is becoming clear that we need new ways to reach the small and informal enterprises that employ perhaps a majority of the world's workers. Governments should take the lead in developing simple but powerful instruments that can help illuminate the often-overlooked costs of unhealthy work. This is important not only for employers but for workers as well, since informed workers can be the most powerful advocates for better working conditions. At the same time, an economic perspective should be added to existing community- and sectoral-level programs that provide OSH assistance, such as industrial and agricultural extension programs and community OSH centers. To convert knowledge into action, it is important to convey the message that the tradeoff between health and economic viability is less stringent than most people assume, and in some cases may not exist at all.

b. The problem of accounting. As discussed earlier in this paper, most human resources, including the health status of the workforce, are ill-served by existing accounting methods. An important question, then, is whether the accounting profession can generate a new set of conventions that more fully incorporate the benefits of investments in workers and working conditions. This is an area in which collaboration between economists and accountants is likely to be fruitful.

c. Qualitative aspects of enterprise costs. The incrementalist approach represented by Figure 1 is misleading in important respects. The costs that firms bear (and therefore the benefits of their OSH investments) depend on the overall strategy they adopt toward production. If the main objective is to produce at least cost, and if labor supply is sufficiently abundant, then the cost of

injury and illness will be relatively slight. If quality, reliability, productivity, and innovation are valued, on the other hand, the capacity of the workforce is crucial, and the costs of disruption and chronic disability are much greater. As a result, there are important consequences for OSH to the firm's choice of productive strategy. This in turn raises research and policy questions concerning the factors that influence this choice—market organization, support services, regulations, etc. Broadly, it should be the goal of governments to have all enterprises value and nurture the human capacity of their workforce, and determining how best to do this should be a priority of social and economic policy.

d. *Effective cost internalization and its limits.* Experience demonstrates that it is not easy to employ cost internalization to give firms the incentives pictured in Figure 1. To penalize firms for having above-average accidents rates, for instance, may simply result in firms' choosing to alter or destroy their accidents records. (Lofgren, 1989) Similarly, tightening the relationship between a firm's claims record and its workers' compensation premiums (experience-rating) has at best minimal effects on safety and health incentives: the weak positive relationship between experience-rating and safety may just be due to the incentive effects on record keeping rather than to improvements in working conditions themselves. (Boden, 1995) Indeed, there is substantial evidence that, under the impact of rising WC premiums, firms have attempted to "manage" claims (contest or pressure workers not to file them, accelerate the return to work in spite of possibly negative health effects, etc.), according to Hopkins (1995). In the end, it is easier to argue in abstract terms for cost internalization than it is to devise effective internalization policies. This is an area where additional work is urgently needed, to separate the feasible from the futile.¹⁶ A useful starting point would be a study comparing the actual effectiveness of the different national and regional workers' compensation systems in the OECD countries. There is a lively debate within each country, but thus far there has been no overall attempt to compare experiences.

2. New forms of employment relations. The uncertainties surrounding enterprise-level costs occur against a backdrop of rapidly changing employment relations, which adds a further element of uncertainty. The percentage of workers in the industrialized countries who hold "traditional" jobs—continuing, full-time, and conventionally employed by the owner of the worksite—is declining, while subcontracting, telework, and quasi-self-employment are on the rise. We have already seen that the accumulated evidence points to potentially adverse effects of these employment changes on worker well-being. More comprehensive research should be undertaken to establish that this relationship is as real and consequential as it appears, and if it is, this aspect of the change in employment relations should be forcefully introduced into the policy debate. Whenever proposals are placed on the table to deregulate employment, privatize public enterprises, or otherwise change the organization of work, we should be prepared to bring the likely OSH aspects forward. At the same time, however, much of the flexibilization of employment is beyond the scope of policy, and the question becomes how to respond to it. The two most important legs of existing policy, mandatory regulation and workers' compensation, appear to be ill-adapted to the new direction in employment. How can they be modified, so that workers in nonstandard arrangements can enjoy their benefits? To find answers, we will have to combine sharply focused research with creative thinking about new forms of public institutions. Wherever governments or nongovernmental groups innovate, there should be efforts to assess the results and draw lessons for further innovation.

3. *The economics of OSH in the developing world.* As we have already seen, the national-level research on the costs of occupational injury and disease is entirely focused on the developed countries. This is a serious problem on several levels.

a. The costs of disability and premature death are likely to be very different in the developing world—but not necessarily so different in the aggregate. Consider, for example, the problem of medical care. Injured workers in developed countries are typically treated in hospitals and clinics, usually financed by workers' compensation or another form of social insurance. These medical costs are one component of the total cost of injury. A worker with the same injury in a developing country, particularly if he or she works in the informal sector, is less likely to incur the same medical costs. Nevertheless, the health and rehabilitation needs are the same; so often the care is provided informally, perhaps by a family member. In this case, the care-giver is not paid a salary for providing these services, but from an economic standpoint this does not mean there are no opportunity costs. The care-giver may have to ask for reduced work hours, for example, or the disruption of the household may make it more difficult for children to attend school. These costs are more difficult to identify than those captured in insurance statements or hospital forms, so they need to be constructed from survey data and other individual- and community-level sources. Ultimately, true economic development is really *human* development (Sen, 1999), and it is at the level of individual workers, their families, and their communities that the benefits of health at work will be realized.

b. The argument is sometimes made that programs to improve working conditions in developing countries are misguided and counterproductive.¹⁷ On the surface, this seems plausible, since these improvements are often costly, and there are fewer resources from which to make them. But the argument, as we have seen, tends to exaggerate costs and fails to consider benefits; so research that establishes the connection between the health of the workforce, investments in human and social resources, and general economic development would have a significant impact on policy debates.

c. Understanding costs in a developing country context is also important for the same reason as in the industrialized world, because it provides guidance for policies to promote healthier work. Since working conditions are largely the product of economic forces, recognizing the direction and magnitude of those forces is a step toward developing successful interventions. In addition, in the context of limited resources (and this is always the context), it is useful to know where the most substantial costs are located. OSH policy should not be conducted in the dark, on either side of the North-South divide.

d. At the most general level, the imperative to protect human health and well-being at work is part of the movement to achieve economic sustainability. Existing sustainability indicators focus on nonhuman resources, but surely it is just as important that production not diminish the capacity of the human producers. In a global economy, sustainability is measured in terms of consumption, since production crosses borders and largely responds to consumer demand. Specifically, indicators are constructed by calculating the resource costs of the goods consumed, which is a function of the scale of demand and the means used to satisfy it. We ought to include the protection of human resources in this calculation as well, but this will only be possible once we have reasonable estimates of the human costs throughout the global production chain. On a practical level, consumers in the developed countries ought to know the full cost of the goods they purchase, so that responsibility as well as commerce can be globalized.

Notes

1. Efforts have been made by some economists to attach monetary values even to these subjective costs. For a survey of this work by one of its foremost advocates, see Viscusi (1993). For a critique, see Dorman (1996).
2. This way of characterizing the criterion of social justice makes it clear that a firm can be both economically rational and socially unjust. To the extent its reputation matters, however, the two cannot coexist for long. For more discussion of the relationship between economic calculation and social justice in the realm of OSH, see Dorman (1997).
3. “Many Member States find that the category of self-employed should have increased attention in the future. This is often because the status of being self-employed is not always voluntary and is often used by an employer as a means of avoiding social responsibility.” (9.2)
4. In the case of young workers, lost educational opportunities may constitute an important class of economic costs. (NAS/NRC, 1998) This problem appears to be completely unexamined.
5. The identification of wages and productivity follows from the marginal productivity theory of factor pricing in economics. There are two major reasons why wages and productivity would diverge in the real world. First, there are many other factors that affect individual wages, such as discrimination, social norms, union activity, and firms’ personnel strategies. Second, economic theory demonstrates that the overall division of income between wage and non-wage (profit and interest) payments cannot be derived from prior information about productivity. (Harcourt, 1972) This latter result makes it difficult to interpret cross-national comparisons, since the labor share of income often differs substantially.
6. For a recent survey of European workers compensation statutes, see European Agency for Safety and Health at Work (undated).
7. Strictly speaking, *all* true economic costs are either opportunity costs or the costs of “disutility” (discomfort) that arise due to the use of resources, including human labor, in production or other activities. The reason we would single out some opportunity costs for special attention is that they are visible only in this way.
8. See Lanoie and Tavenas (1996) for a careful recent study that arrived at ratios of approximately 1:1.
9. The technique of cost-benefit analysis is predicated on the view that s_1 is the ideal level of safety. A less rigid application of economics would attach a net economic cost to any level of safety greater than s_1 , but leave the question of whether the noneconomic gains outweigh the economic costs to the political system.
10. The assumption that a worker’s wage equals his or her individual impact on output is based on the economic principle that the profit-maximizing firm in a perfectly competitive world would pay each worker the value of the marginal (incremental) product of labor, but this result can be established only under highly stringent and unrealistic assumptions.
11. See, for instance, Lunde-Jensen and Levi (1996), who chose to assign equal values of productivity to male and female workers despite their wage differences.

12. The main reason for the low British estimate is the much lower incidence rates of occupational injury and disease in Britain (2000), using the HSE's general HSE (1999) methods (with no detail concerning specific cost effects), find a negative growth effect of "only" 0.25% per year, still a sizeable level.

14. Not only is the prevalence of occupational injury and disease likely to be underestimated; its economic effect per DALY is likely to exceed that of malaria due to its universal and immediate relationship to production.

15. For a representative examples, see US Congress, General Accounting Office (1997) and HSE (1999).

16. For further discussion of cost internalization as a preventive strategy, see Dorman (1998).

17. See, for instance, the position taken by the World Bank in its 1995 *World Development Report* (p. 77). Unfortunately, the same views are often held by developing country governments themselves.

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