

Valuing Life and Limb: Understanding the Risk-return Trade-off

Across the developing world improvements in public health and environmental safety are becoming an ever-greater priority. One way to understand how the public values improvements in health is by assessing what individuals are willing to pay or forgo for small decreases in risks that may affect their longevity. For example, workers frequently make decisions that trade-off increased work-place risk and higher wages. This estimate of the financial gain required to take on increased risks can be used to assess public policies that seek to decrease the risk of death from environmental factors such as air pollution.

Relatively little research has been done in South Asia to investigate trade-offs between risks and economic returns. A recent SANDEE study helps fill this information gap. It quantifies the financial trade-offs that workers in two major Indian cities are prepared to make when taking on potentially risky jobs. Thus, this study offers a means for evaluating public health and safety programs in India.

The study finds that workplace risks are reflected in the salaries that people are paid. Workers put considerable value on workplace fatalities and injuries. The author estimates the value of statistical life – a number that can be used for monetizing risks involved in public sector projects or for compensating workplace fatalities – to be on average Rs. 15 million. Policy makers interested in programs to decrease environmental and health risks can use this estimate of the trade-off between risks and returns as one bench-mark against which costs can be assessed.

VALUING HEALTH AND SAFETY RISKS

India spends large sums of money on health and safety programs. Since resources are scarce, it is essential to evaluate these programs and to allocate funds in the most cost-effective way. The value of health risk reductions cannot, of course, be directly obtained because 'risk prevention' cannot be purchased 'over the counter'. However, there are instances when these values can be indirectly observed or measured.

In this study the monetary value placed on reductions in health risks, including risk of death, is estimated by understanding how people are compensated for the different risks they take. This approach estimates the wage premium a worker would need to be paid to accept a small increase in his/her risk of dying, or, equivalently, what a worker would pay to achieve a small reduction in risk of death. Wage premiums can be estimated from observed labor market data and converted to the value of a statistical life (VSL), a number that summarizes what a population may be willing to pay to reduce the risk of one death in a statistical sense.

This policy brief is based on SANDEE working paper No. 9-04, 'Measuring the Value of Life and Limb: Estimating Compensating Wage Differentials among Workers in Chennai and Mumbai' by S. Madheswaran. The full report is available at www.sandeeonline.org



STUDY AREA AND SAMPLE

This study was undertaken in the Chennai and Mumbai metropolitan areas, which have the largest number of registered factories and workers in India. The study focuses on blue-collar male workers in manufacturing industries because the most comprehensive and current information relating to employment injuries (both fatal and non-fatal accidents) is available for this group. This data is not readily available for female workers and workers in other industrial sectors, such as coal mines and railways that do not come under the Factories Act. Similarly, workers in the unorganized sector were not considered because details of accidents in this sector are not available.

Seventeen different manufacturing industries – from the food production sector to the transport sector – are represented in the survey. A cross-section of workers from each sector, with a maximum of four workers from any single factory, was surveyed by the author and his team. Overall, information was collected from 550 workers in Chennai and 535 workers in Mumbai.

A questionnaire was used to get information about workers' social circumstances. Information about wages, allowances, work hours and firm sizes was mainly collected from wage bills and other company records. Data about the risks associated with each type of industrial sector was drawn from the Administrative Report of the Chief Inspector of Factories, Chennai and Mumbai. This report provides annual information on the number of deaths and injuries among male workers in the cities.

While there is considerable debate about whether risks to life and health can be meaningfully evaluated in pure economic terms, it is clear that workers routinely balance potential health risks and economic gains when they decide to accept employment. In this study, Madheswaran bases his analysis on the well-accepted assumption that people demand more money for more dangerous jobs. He attempts to quantify this trade-off by studying wages associated with industries characterized by different levels of risk.

This research is centered on a primary survey of workers in Chennai (in the southern part of India) and Mumbai (located in the western part of India). Madheswaran focuses on blue-collar workers in the manufacturing sector. Workplace injuries and fatalities are not un-common. In the two cities studied, the most risky jobs in terms of fatalities are in the cotton textile industries, followed by the chemicals and metals and alloys factories. As Table 1 shows on average 9% of all workers face some form of work place injury. The fatality rate, as expected, is a lot lower.

TABLE 1: ANNUAL FATALITIES AND INJURIES IN THE MANUFACTURING SECTOR DURING 1999-2001

S. No	Workers in 17 industries in	Fatality rate per 100,000 workers	Injury rate per 100 workers
1	Chennai	11.35	8.67
2	Mumbai	12.55	9.32

Source: Administrative Report of Chief Inspector of Factories 1999-2001

WHAT MAKES PEOPLE ASK FOR HIGHER WAGES?

This study investigates the impact of various factors including risk perception on wages. These factors include the size of different firms, their locations, worker characteristics such as caste, family size and education levels, type of work undertaken, and whether work places are unionized. Screening the data in this way permits the researcher to isolate the actual impact of risk on salaries.

Overall, the study considers three measures of risk – the risk of fatalities; the risk of injuries; and the risk posed by exposure to any environmental problems or unhealthy conditions. Table 2 shows the high correlation between risk of fatalities and injuries and wages. Self-perceived environmental risks are not closely correlated with wages.

TABLE 2: SIMPLE CORRELATION BETWEEN RISK AND WAGES

S. No.	Risks	Wage - Chennai	Wage - Mumbai
1	Fatalities	0.61	0.69
2	Injuries	0.58	0.63
3	Environmental dangers	0.32	0.29



Interestingly, ninety percent of all the employees questioned felt that their job exposed them to danger or unhealthy conditions. However, industrial records show that, on average, there are between 11-13 fatal accidents per 100,000 laborers per year.

THE IMPACT OF RISK ON WAGES

Madheswaran finds that job risk has a significant influence on the wages that a worker is paid. For example, in Chennai, given mean wages of Rs. 7.89 per hour, the analysis suggests that workers on average accept a trade-off of 8% between the hourly wage rate and the risk of a fatality. In other words, after all other factors are taken into account, the more dangerous a job, the more a person is paid for doing it.

Scaled up, the risk-wage trade off suggests a statistical value of life of about Rs.15.4 million for workers in Chennai. Similar calculations show that the value of a statistical life of

workers in Mumbai is about Rs.14.8 million. In other words, based on how workers make employment decisions, workplace fatalities in big cities in India should be compensated by approximately Rs. 15 million. However, this number should not be mistaken for the value placed by any one individual on his or her own life. Notably, the value of a statistical life is over 300 times the annual average wage in the two cities.

The analyses undertaken on non-fatal injuries in the manufacturing sector suggests that a 1% increase in the rate of injuries translates to a 0.4% - 0.5 % increase in wages. Madheswaran estimates the value of a statistical injury to be Rs. 6470 and Rs. 9000 for workers in Chennai and Mumbai respectively. These are average numbers that can be used to compensate workers for the most common type of injuries found in these cities. These numbers also suggest that workers regard the probability of death as being about 3000 times worse than an equal probability of a non-fatal injury.

While these findings may not be free from bias – for example, they fail to include the impact of insurance benefits – they do validate the assumption that the greater the job risks, the higher the wage that must be provided. For instance, the study concludes that an average worker employed in the manufacturing industry must be paid approximately Rs.240 in annual earnings for an 1/100,000 increase in the risk of death at work. They also validate the assumption that workers make rational decisions about their jobs and take job risks into account when deciding on their employment. The estimates provided in Madheswaran's study corroborate findings from a handful of similar studies available for South Asia.

POLICY IMPLICATIONS

Although economic considerations should never be the only criteria used for assessing health and safety issues, the study's findings are important to policy makers for a number of reasons:



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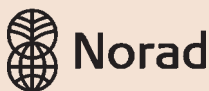
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- Policy makers undertaking benefit-cost analyses of public sector projects that pose potential health risks can use the value of statistical life estimates from this study to evaluate the costs of such projects.
- The wage-risk trade-off estimates can be used to calculate monetary compensation for those involved in industrial accidents. Of particular interest here is the fact that the estimated value of a statistical life exceeds a worker's lifetime earnings. The estimated values also exceed the amounts paid in Employee Insurance schemes and the Workmen's Compensation Act.
- The estimated values of statistical life and injury from this study can be used to value the impact of industrial safety programs or environmental health programs that reduce the risk of death or injury.

Overall, the study suggests that the Indian labour market does, to a degree, compensate workers for work-related accidents. However, it is also clear that the private sector is likely to provide too little information about risks to allow employees to make fully-informed decisions about accepting work and payment. Hence, the best role for the government may be in providing information about job risks to workers and in ensuring that adequate compensation is provided in the event of fatal and non-fatal accidents. This will allow the market to play a more effective role in driving improvements in industrial health and safety.

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