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An Investigation into the Statistical Significance of Labor Force Longevity in Brick Kilns and Marble Industry: A Case Study of Peshawar

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Abstract

Government agencies and policy makers are increasingly tasked with the imperative of implementing health and safety regulations. A crucial concern for them lies in determining the quantifiable value of the benefits stemming from these safety regulations. This entails ascertaining the measurable worth attributed to the reduction of mortality and health risks. This complex endeavor is rooted in the nuanced understanding of how individuals financially indemnify themselves for the hazards they willingly undertake. This analytical framework is commonly known as the compensating wage differentials method. This method entails the estimation of a wage premium that a worker necessitates in order to assume a marginal escalation in the likelihood of mortality or injury. Similarly, it explores the monetary amount a worker would be willing to expend to curtail the hazards to their health and life, or to secure a marginal enhancement in their personal safety. The derivation of the wage premium emanates from the dynamic interplay within the labor market and the calculation of the value of statistical life—a metric that encapsulates the financial quantum a population is willing to disburse to avert a solitary fatality within their cohort. This research endeavor undertakes the estimation of the value of statistical life and injury for laborers engaged in brick kilns and the marble industry within the locale of Peshawar, Khyber Pakhtunkhwa. The foundation of this valuation rests upon the compensating wage differential approach. The sample size for this study comprises 200 individuals, encompassing both internationally recognized annual work hours as well as those pertinent to the Pakistani context. In the context of 2000 annual work hours, the computed Value of Statistical Life (VSL) for marble industry workers amounts to PKR 54.6 million (USD 0.3412 million), accompanied by a perceived injury valuation of PKR 5460. Concomitantly, for brick kiln laborers, the VSL is estimated at PKR 43.7 million (USD 0.2731 million). Upon transitioning to the annual work hours applicable within Pakistan (2800), the VSL for marble industry workers escalates to PKR 76.44 million (USD 0.4777 million), accompanied by a corresponding perceived injury valuation of PKR 7644. Analogously, for brick kiln workers, the VSL is projected to be PKR 61.18 million (USD 0.3823 million). In summation, this study contributes to the quantification of the intricate interplay between occupational risks, wages, and the broader notion of human life's monetary value. The estimations achieved herein serve as pertinent inputs for policy formulation, resource allocation, and decision-making processes, equipping stakeholders with empirical insights into the tangible worth attributed to health and safety enhancements within the brick kiln and marble industries.

***Keywords*:** Compensating Wage Differential, Informal Sectors, Value of Statistical Life/injury, Perceived Risks, Marble Factories, Brick kilns, Safety Regulations

1. Introduction

Economic development may have a significant impact on the environment (Costantini & Monni, 2008). Exposure to environmental contaminants may cause hazardous risks to human health, which actually occur in adverse environmental conditions (Damalas & Eleftherohorinos, 2011). So, to regulate such risks government undertakes a wide variety of environmental policy projects which involve costs and benefits to human health. The key component of benefit is the improvement of human health due to improvement in safety and environment. The health benefits stemming from enhanced environmental policies and programs encompass a reduction in accidents and illnesses linked to environmental factors, ultimately benefiting human health. These policies and programs seek to improve working conditions, mitigate health risks, and diminish the likelihood of fatalities. The implementation of such environmental safety initiatives, even with marginal risk reductions, can yield substantial health advantages for society. Literature underscores that these advantages are estimated through the aggregation of the societal willingness to pay for risk reduction across all affected individuals. Additionally, when workers consistently reveal their preferences for trading wages against risks, researchers can extrapolate the "value of statistical life (Viscusi & Masterman, 2017).

According to the studies of (Landefeld & Seskin, 1982); (Moore & Viscusi, 1988); and (Black & Kniesner , 2003) the value of statistical life represents the total amount of wages that the labors willingness to forgo the health risks,

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the value of statistical life used as a tool to estimate the individual's willingness to pay to reduce the risks and provides benefited information for the policy makers to evaluate the safety programs for labors better health.
But the price paid (willingness to pay) for reductions of risks and death risks and for the improvement of safety regulations are not directly obtained because such risks reduction cannot directly be purchased in the market.
Willingness to pay for safety goods can be measured indirectly through consumer decisions, like purchasing seatbelts, where people value the reduction in risks more than the cost.(Hersch, & Viscusi, 2015). So in the literature several revealed preference theories of environmental valuation such as travel cost, contingent valuation method household hedonic function, and hedonic prices estimating the possible value of environmental risk reduction and the value of the benefits taking from the reduced health risks(Sunstein & Nash, 2013), (Viscusi, 2012).
The "value of statistical life" is the tradeoff between money and a small risk of death or injury. It is used by government agencies to value small changes in risk, and in the labor market to determine compensation for risky jobs. The concept has controversies among economists as it defines the monetary value of small mortality risks reduction and should not be interpreted as society's willingness to pay for saving one identified life.(Andersson & Treich, 2009). In short, how much compensation the labors are agreed to take a riskier job.
Background of the Study
Government agencies use WTP estimates to adopt safety measures worldwide. Cost-benefit analysis is done on health, environmental issues, public safety measures, roads, highways, and disasters like floods.(Bockarjova, Rietveld, & Verhoef, 2012). So the economists term this tradeoff between fatality risks or any health risks with money the value of statistical life. (Thomas Schelling, 1968) first used the term (VSL) Value of Statistical Life in his essay titled 'The Life You Save May Be Your Own'.
Three approaches are used to estimate the value of human life (VSL). The compensation wage differential approach measures how much workers are paid for taking on job-related risks used by (W. K. Viscusi & Aldy, 2003). The second approach examines public behavior towards cost and risk used this approach by (Blomquist, 2004). The third, contingent valuation approach estimates VSL by allocating WTP for reducing health and death risks used by used this approach by (Blomquist, 2004).
However, there is only one study conducted in Pakistan for the blue color workers in Lahore city, that study is generally implied for formal sectors in Pakistan conducted by (Rafiq & Shah, 2012). But for labors working in marble factories and brick kilns in Peshawar have a lot of problems of occupational risks and health hazardous problem are facing. There is a need for the value of statistical life (VSL) to be implied for blue-collar workers in the marble and brick industries in Peshawar, Pakistan, as they face occupational risks and health hazards. These industries contribute significantly to the country's socio-economic development, but also have negative impacts on the environment and people's health. Lack of safety arrangements during extraction, transportation, and processing can lead to irreversible accidents. Accidents in these industries are usually fatal, disturbing the ecosystem and hampering productivity. A scientific and systematic analysis is necessary to assess claims of organizations and government agencies providing safe environments. Moreover, the brick-making process involves subjecting bricks to intense fires, often using rubber for combustion, which releases hazardous and toxic chemicals into the environment. These chemicals significantly affect the health of laborers and result in incidents, injuries, fatalities, and property damage. Workplace safety directly influences workers' morale (Akhtar, 2014). Thus, this study aims to ascertain the statistical value of life and injuries for laborers in Peshawar's marble factories and brick kilns. Objectives encompass assessing environmental safety regulations, quantifying risk monetarily, and distinguishing risk values between marble and brick industries. The research investigates the impact of environmental deterioration on worker health and productivity, as well as estimating the value of human life for those employed in Peshawar's marble and brick sectors.

2. Literature Review

The estimation of statistical values of human life holds paramount significance in informing policy decisions across diverse sectors in Pakistan. As a developing nation characterized by a complex socioeconomic landscape and a diverse array of industries, understanding the quantifiable value attributed to human life is indispensable for effective resource allocation, risk assessment, and regulatory frameworks. The literature surrounding statistical values of human life in the Pakistani context encompasses a multifaceted exploration of how these values are conceptualized, calculated, and applied to various domains such as occupational safety, environmental preservation, and public health interventions. This chapter delves into the existing body of literature, offering a comprehensive overview of methodologies, findings, and implications related to the assessment of the value of human life in Pakistan. Through a critical synthesis of previous research, this chapter aims to illuminate the nuanced interplay between economic considerations, societal norms, and ethical considerations that underpin the valuation of human life in the Pakistani context. By elucidating the evolution of thought, key debates, and methodological advancements in this realm, this literature chapter sets the stage for a deeper understanding of the intricacies surrounding the statistical values of human life and their implications for policy formulation and decision-making in Pakistan.

2.1. Value of Statistical Life

The value of statistical life and injury for Indian workers using the hedonic model are 10.28 million and 4876, respectively (Shanmugam, 2016). Using compensating wage differential and hedonic wage models, the value of statistical life for India ranges from 15 million rupees (Majumder & Madheswaran, 2017). The value of statistical life for Pakistan ranges from PKR 27.67 million to 66.67 million (Rafiq, n.d.-a), and the value of statistical life for Taiwan workers ranges from S$413,000 to US$461,000 (Liu, Hammitt, & Liu, 1997). The value of statistical life for the United States ranges from US$235,000 to US$325,000, and the value of statistical injury ranges from US$3,500 to US$11,000 (James K. Hammitta, 2006). A study on Chilean workers found that econometric problems can arise in estimating the value of statistical life (VSL) due to bias selection and endogeneity. The initial estimation of VSL using a hedonic log wage equation, the human life was US$ 4,625,958, but after correcting for endogeneity, the estimated value increased to US$12,826,520 (Contzen, Won, &Lavin, 2013). Herzog & Schlottmann, (2018) used the hedonic wage model and Adam Smith's intuition about wage differentials compensation to estimate the value of statistical life in England. They found that the reduction in risk resulted in a wage or earnings premium of over 2.5 million pounds. Kim, (1999) studied compensating differentials for workplace accidents and risks in the South Korean labor market, identifying two main institutional changes that affected compensating differences. (Majumder & Madheswaran, 2017) conducted a meta-analysis of 30 studies using the hedonic wage model to estimate the value of statistical life, finding that the heterogeneity among the studies was the main cause of variation in VSL estimates.

(Weitzman, 2007)analyzed the econometric and age-related issues in estimating the value of statistical life, as well as the impact of structural uncertainty in low probability high impact catastrophes. The meta-analysis suggests an elasticity in income of the VSL from 0.5 to 0.6 approximately. W. Viscusi, (2003) used robust techniques to estimate VSL for developing countries based on income, risk, education, and age, and applied it to assess willingness to pay for reduction in death risks linked to air pollution in Santiago city, Chile. The value estimated ranged between $519,000-$675,000. Implicit labor market and revealed preference approach also affect VSL, which vary with differences in ages of labor (Aldy & Viscusi, 2007) .

Authors used hedonic approach and found that the value of statistical life is higher for younger age labor. (Krupnick et al., 2002) estimated the value of life for Canadian workers ranging from C$1.2 to C$3.8 million and found that willingness to pay was constant for workers aged 40 to 75. (Blomquist, 2004) suggested that the value of life for children and seniors is not less than that of middle-aged and young people in the US. Hersch & Viscusi, (2010) found that Mexican immigrants receive less compensating wage differential for high-risk jobs compared to native US workers due to language barriers affecting safety training information and productivity. They concluded that VSL can also be applied to a specific group of people.

2.2. Safety Provision or Risk Reduction

Adam Smith's theory states that high-risk jobs demand high wages, while the hedonic wage equation assumes that workers are willing to pay for safety improvements or risk reductions in the workplace through lower wages. The equation values the price of these safety improvements as equivalent to the reduction in risk (Press & Review, 2018). A study in Taiwan found that there is a compensating wage differential in the chemical industry, and that there is a positive relationship between quitting intentions and perceived risk. The study also estimated the statistical value of life and injury, which are $624,000 and $44,000 (1995 dollars) respectively(Yang, Liu, & Xu, 2016).

2.3. Health Hazards in Marble Industry

(Akhtar, 2014)studied the small and large scale marble industries and identified various occupational hazards such as hazardous chemical use, unguarded machinery, excessive noise, and respiratory diseases. The study also provided potential measures to reduce these risks.

Khan et al, (2015) examined the material handling and unsafe working conditions in the marble industry that can impact the morale and productivity of workers. They suggested the use of personal protective equipment and regular modification of the material handling system to reduce the risk of tuberculosis and skin burns. They also proposed mandatory reuse and recycling measures in each marble zone.

2.4. Brick Kilns

A study found that brick kilns in Pakistan are a major contributor to air pollution, making Peshawar the seventh most polluted city in the world. These kilns are responsible for 36% of the country's air pollution, and are the main cause of pollution in Peshawar (Shandana, Rahim, 2016). Each brick kiln consumes 60 to 80 tons of coal, 6 to 8 tons of rubber, and 12 to 17 tons of wood, despite the ban on rubber use according to the Environmental Protection Act of 1997. The resulting pollution causes various diseases such as asthma, heart disease, cancer, high blood pressure,

and bronchitis. Moreover, due to extreme heat, laborers are at risk of heart attacks and fatalities, as observed in brick kilns by (Shandana, Rahim, 2016).
Employing the Hedonic Wage Model, this research examines safety demand and establishes the nexus between occupational hazards and remuneration within Peshawar's marble industry and brick kilns. Notably, Peshawar serves as the provincial capital and economic focal point of Khyber Pakhtunkhwa, being a pivotal contributor to marble and brick production. This investigation illuminates the dynamic interplay wherein workers' wages reflect their implicit valuations of safety attributes. Given Peshawar's significance in regional industries, comprehending wage-risk associations therein holds broader implications for labor policies and occupational welfare.

3. Theoretical Framework

From the perspective of life insurance policies, the study delves into laborers' willingness to allocate funds for mitigating the risk of mortality within the labor market, thereby illuminating the intricate interplay between risk and wages. The underpinning theoretical framework draws inspiration from Adam Smith's insights, which posit that labor wages adapt to the level of ease, cleanliness, and honor associated with the job, a concept also explored in previous works such as (Viscusi & Aldy, 2003); (Michaud & Wiczer, 2018).
Within this context, the equilibrium of hedonic considerations emerges as wages offered to laborers correspond to various levels of occupational risk, with laborers making choices amidst an array of employment opportunities. In this dynamic, firms factor in the costs associated with establishing safer work conditions, prompting them to adjust compensation in relation to risk. Consequently, as risk diminishes, the compensatory offerings from employers also decrease, seeking to balance profitability with safety enhancements.
The laborer, operating within this framework, selects a configuration of wages and risk in accordance with their individual risk acceptance threshold. This delicate balance defines the market equilibrium, signifying the optimal blend of wages and risk for each laborer. The relationship between risk (p) and wage (w) is encapsulated within the function w(p), wherein wages are a manifestation of risk. The slope of this risk-wage relationship embodies the laborer's incremental readiness to invest in risk reduction, while the firm's corresponding slope mirrors the extra cost incurred for ensuring a safer work milieu. The functional form w(p) mirrors laborers' collective willingness to trade off risk for wages, representing a harmonized perspective on this dynamic trade-off.
In the realm of labor economics, the utilization of logarithmic transformations for wage models is prevalent. Yet, the establishment of an analogous functional form that specifically links logarithmic wage to mortality and injury risk within the workplace remains an ongoing exploration. In line with (Gentry & Viscusi, 2016), (Madheswaran & Change, 2015) the study opts for the logarithm of wage (lnwage) as the dependent variable. This selection aligns optimally with the data while quantifying the benefits derived from risk reduction. By embracing this comprehensive theoretical construct, the study endeavors to deepen our understanding of the interwoven dynamics shaping labor market choices and insurance perceptions concerning laborers' lives.

4. Data and Methodology

4.1. Data of the Study

The research was systematically conducted through the acquisition of primary data via questionnaires and interviews, encompassing laborers within both the marble and brick kiln sectors of Peshawar. Employing a convenience sampling technique, the study engaged with 450 brick kilns situated in the vicinity of Peshawar. Among these, 80 kilns were operational and prominently contributed to brick production, catering to the needs of construction firms and households alike. With an approximate labor force of 500-600 within the brick industry, each kiln employed 6 to 9 workers, and 100 laborers were judiciously selected for inclusion in the study's sample. In the marble and granite sector, Peshawar's landscape accommodates around 120 sizable factories, each sustaining 10 to 13 laborers. Esteemed insights from industry proprietors and the marble industry president affirm an estimated labor force of approximately 1000 individuals. The study meticulously amassed a robust dataset comprising 200 observations, evenly distributed with 100 instances emanating from each sector, facilitated through a meticulously designed questionnaire. It is noteworthy that certain brick kilns, due to the depletion of brick soil in their immediate environs, were found to be functioning at suboptimal levels. This comprehensive approach, involving both operational and contextual factors, ensures the study's thoroughness and enhances its capacity to deliver valuable insights for stakeholders and policymakers within these crucial industrial domains.

4.2. Methods

This study used the hedonic wage model with compensating wage differential to estimate the wage-risks equation. The econometrics technique of Ordinary Least Square (OLS) was applied to obtain the expected results. The study aimed to investigate the wage-risk relationships in the two different sectors in Peshawar and to estimate the value of statistical life and injury for marble factory and brick kiln workers. The value was monetized through the hedonic wage model, separately for the marble industry and brick kilns, and then compared. In this study hedonic wage model based on compensating wage differential applied to estimate the wage-risks equation. The econometrics technique, Ordinary Least Square (OLS) applied to the hedonic wage model to get the expected results. And for the estimation to investigate the wage risk relationships in the two different sectors in Peshawar, to value the risks in money form, the value of statistical life and injury have also been estimated for marble factory workers as well as monetized this value for the brick kiln workers in district Peshawar, through hedonic wage model. It has implied separately for marble industry and for brick kilns as well and then both the values have been compared.

4.2.1. Econometric Model

$$W = \beta_0 + \beta_1 AGE + \beta_2 EDU + \beta_3 SKLD + \beta_4 EXP + \beta_5 REGH + +\beta_6 DSTN + \beta_7 MIST + \beta_8 LPM + \beta_9 CHESD + \beta_{10} BACKPAIN + \beta_{11} INTRDMY + \beta_{12} INCOG + \beta_{13} INTRDMY\_B + \beta_{14} PINJ + \beta_{15} PFATL + \varepsilon_t$$

The above variables mentioned in the econometric model are defined below in the table. B_0 is the constant term in the model and others, such that the labor personal's characteristics and the job's characteristics are clearly mentioned in the below variables table. B_{is} are the coefficient of the variables in the model; ε is the error term in the study. On the other hand, this study also measures the perceived risks of injury and fatal, these risks based on labor perception about the risks at the two different industries to labor health.

4.2.2. Computation of Value of Statistical Injury and Life

This study further computed the value of statistical injury and value of statistical life via using the standard hedonic equation used in the literature:

VSI = β_{14}PINJ*W_m*2000*100

VSL = β_{15}PFATL*W_m*2000*10,000

B_{14}PINJ is the coefficient of the injury in the model will be multiplied to the mean of hourly wages and it then will be multiplied to international standard hour time (2000) of labor work, and then to the 100 which is the standard scale kept for an injury frequency same method used to value the injury by (Shanmugam, 2016).

β_{15}PFATL is the coefficient of fatal risk in the econometric model, multiplied it with hourly mean wage to standard hours 2000 and then to fatal measured as per 10,000 to finalize the value of statistical life.(Rafiq, 2011.)

4.2.3. Variables Explanation

This study collected data on job risks from workers in the marble factories and bricks kiln industry through a questionnaire using a convenient sampling approach. The workers provided information on the total number of workers, the number of perceived death and injury accidents they experienced annually, and their past experiences with fatal and injury risks in these industries. The study computed the average probability of perceived job-related fatal risks per 10,000 workers (FATAL) and the average probability of perceived injury risk per 100 workers (INJURY) over the last three years, which were then matched to the workers' perceptions about risks. However, there is a measurement problem in this type of study as not all workers face the same level of risks. This study covers full-time workers who are exposed to pollution and risks, and the perceived level of risks is a subjective perception variable that indicates whether or not the worker's job exposes them to environmental risks/problems and unnatural conditions. The study used Perceived fatal to denote the perceived fatality with a scale of 10,000 and injury to denote the probability of perceived injury per 100 workers in both industries, which were collected from workers through long discussions and proper questionnaires. The expected signs of the risk variables, including perceived injury and perceived fatal, are positive in the literature, indicating a positive relationship with workers' earnings and wages. If the risk increases, the wages would also increase (Madheswaran & Change, 2015). The study used take-home daily wages as the dependent variable for the Hedonic Wage Equation followed by (Rafiq, 2011). The wages were obtained directly from the workers, but since there was no uniform rule for drawing wages, the researchers calculated the monthly wages based on the information given and converted them to daily wages, which were then confirmed by the workers. Due to non-uniform working hours in the industry, the study will use both Pakistan's average annual regular hours (2800) and standard annual hours (2000) for the estimation of the value of statistical life (VSL) and value of statistical injury (VSI). The literature used an annualized working hours of 2000, but the annual average working hours in the industry were far more than that due to no uniform rules for working hours. Some workers worked 13 hours, some 12 hours, while others worked 10 and 8 hours. The study includes 200 observations.

The independent variables in this study include risk measures, worker capital variables (age, education, experience, leaves per month, etc.), and job attributes (distance from the workplace, job-related diseases, mistakes in the workplace, etc.). There are also dummy variables, such as skilled (1 if worker skilled, otherwise 0) and mistakes effect wages (1 if there is an effect on wages, otherwise 0). Additionally, there are four diseases frequently faced by workers: chest infection (coughing, pain in breath, headache), back pain, and cognitive ability (mostly found in brick kiln workers).

The interaction dummy variable consists of two types: one for the marble industry (INTRDMY) and the other for the brick kiln industry (INTRDMY_B). INTRDMY considers the diseases chest disease and back pain, while INTRDMY_B considers chest disease and in cognitive ability. These variables were chosen after reviewing related literature, and the expected signs were taken from previous studies. The diseases variables were used for the first time in this study to evaluate the value of statistical life. Previous studies that used similar variables include (Shanmugam, 2016) for India blue-collar workers, (W. K. Viscusi & Aldy, 2003)for meta-analysis, and (Rafiq, 2011) to estimate the value of statistical life and limb for Pakistan.

Table 1: Variables Definitions and their Expected Signs

Variables	Definitions	Expected Signs
Worker level variables		
WAGE	Hourly basis wages	Dependent variable
AGE	No of year	Negative (+)
EDU	Years of schooling	Positive (+)
SKLD	If the workers are skilled = 1, otherwise 0	Positive (+)
EXP	Counted in number of years	Positive (+)
REGL	Regular hours of works in numbers	Positive (+)
DIST	Distance from the work place in minutes	Negative (+)
MISTKS	If the worker job requires mistakes=1, 0 Otherwise	Positive (+)
LPM	How much the worker leaves per month	Negative (-)
Worker Diseases		
CHESTD	If worker has a chest disease infection=1 Otherwise 0	First time used in VSL
BACKPAIN	If worker feel back pain=1 Otherwise 0	First time used…
INTRDMY	If the worker face both diseases=1 otherwise 0	First time used…
INCOG	If the worker face in cognitive ability=1 otherwise 0	First time used…
INTRDMY_B	If the worker face chest disease and in cognitive=1 otherwise 0	First time used…
Risks variables		
PERINJ	Job related perceived injury risk per 100 workers per annum measured on 1-5 Likert scale	**Positive (+)**
PERFATL	Job related perceived fatal risk proportions measured on a 1-5 Likert scale per 100,000	**Positive (+)**

5. Results and discussion

5.1. Descriptive statistics

The data analysis shows the summarization of the data through tables, statistical analysis of the observation.

Table 2: Descriptive Analysis of Mistakes

	Marble factories		Brick kilns	
	Frequency	Cumulative	frequency	Cumulative
No (0)	50	50	69	69.0
Yes (1)	50	100	31	100.0
No. Observation	100		100	

Table 3 explains the perceived injury that what the labors/respondents think about risk in their work, the perception were totally based on the past experiences of the workers in the working field that what they had seen in the last three years and what they think about their job risk to their health that might face by them in the coming future the next six months so herein what are their perceptions regarding risks that how much is the probability of getting injury in the specific field of work for both sectors

Table 3 explains the same as explained in table 2, but additional point that this is the perceived fatal injury that what the labors/respondents think about risk in their work, the perception were totally based on the past experiences of the workers in the working field that what they had seen in the last three years and what they think about the occupational risk to their life that might face by them in the coming future.

Table 3: Descriptive Analysis of Perceived Injury

		Marble factory		Brick kiln	
Scaling		percent	Cumulative	Percent	Cumulative
1	Minimal	11	11	32	32
2	Below Average	19	30	24	56
3	Average	22	52	26	82
4	Above Average	31	83	12	94
5	Maximum	17	100	6	100
No. obs		100		100	

Table 4: Descriptive Analysis of Perceived Fatal Injury

		Marble factory		Brick kilns	
Scaling		Percent	Cumulative	Percent	Cumulative
1	Minimal	3	3	3	3
2	Below Average	19	22	19	22
3	Average	39	61	39	61
4	Above Average	25	86	25	86
5	Maximum	14	100	14	100
No. obs		100		100	

5.2. Empirical results

Table 5 displays the OLS estimation of the hedonic wage model, showing the relationship between explanatory variables and the dependent wage variable for both sectors. The coefficients indicate a mostly negative relationship between the variables and wage. The 4th and 8th columns display the steric sign, indicating the level of significance of each variable. Some variables are significant at 1%, some at 5%, and a few at 10%. Variables with no steric signs are insignificant and have no impact on labor earnings. Age is insignificant and has no impact on earnings for both marble and brick kiln workers. Education is also negative and insignificant in both sectors, indicating that more years of schooling lead to lower wages, and less education results in higher wages.

Experience is a crucial factor in earning higher wages, with a 5% significance level in marble factories and 1% significance in brick kilns. As expected, the literature shows that experience is significant in both industries, with a 1-year increase resulting in a wage increase of 1.3% in marble factories and 1.6% in brick kilns. Skill is also significant in both industries, with skilled workers earning 27% (marble) and 17.7% (brick kilns) higher wages than their unskilled counterparts at a 1% significance level.

Regular hours have a positive and significant impact on wages in the marble industry, with a 1-hour increase resulting in a 6% increase in wages. However, regular hours are insignificant and have a negative impact on wage rates or earnings in the brick kiln industry due to labor bondage with factory owners who lend money to their workers. Distance from the workplace to the worker's residence has a negative and significant impact on wages in the stone industry, as workers mostly live in the same factory where they work, resulting in their wages being reduced by living expenses. However, in the brick industry, distance is insignificant. Mistakes at work are insignificant for both industries.

Diseases break into two main sub-diseases that workers are majorly affected by, and reduced their productivity as well that eventually effect their earnings, chest infection which includes coughing, pain in breath, wheezing or breathlessness, and headache(Chirgwin, et.al, 2019) according to medical science(Linden, et.al, 2014) and second is back pain both the disease found in marble workers are significant but have negative coefficients which makes their earning negatively affected and losing their productivity of marble workers, dummy interaction is also negatively significant. In addition, in the parallel industry such that brick kilns two common diseases were taken, so do consequently that chest disease is also insignificant in brick kilns and in cognitive disability has been significant for bricks because the owners consider the cognitive disable workers are the poorer ones so they compensated them, leaves per month is also insignificant equally in kilns and marble factories.

Perceived injury and perceived fatal are the interest of this study. And we expected these 2 variables to have positive impact on the earnings. And as expected in marble factories both are significant and positive influence on workers

wage rate, the results show that risks in the marble industry effect earnings positively both significant on 5 percent confidence interval. For marble industry 5.7 table shows us that the effect of a unit increase in perceived injury and perceived fatal risk on the value of workers earning is 2.6% in each, both have the same coefficients but different t-values and standard errors. And have a positive impact on labor earnings.
Moreover the perceived injury for the kilns is insignificant while perceived fatal injury is significant on 5 percent. Increase in fatal means if they are on 'average' risk, and one unit increase in risk means 'above average' or 'maximum level' of risk, same as the case of injury.

Table 5: Result of Linear Regression Hedonic Wage Model

lnwage_hour	Coef.	t-value	p-value	Sig	Coef.	t-value	p-value	Sig
	Marble factories (model 1)				Brick kilns (model 2)			
AGE	0.003	0.71	0.482		0.001	0.15	0.879	
EDU	-0.007	-1.32	0.192		-0.004	-0.56	0.575	
EXP	0.010	2.18	0.032	**	0.016	3.24	0.002	***
SKILL	0.275	6.25	0.000	***	0.177	5.94	0.000	***
REGLR	0.066	5.00	0.000	***	-0.001	-0.09	0.925	
DIST	-0.010	-2.04	0.045	**	-0.004	-1.13	0.262	
MISTKS	-0.032	-1.10	0.274		-0.037	-0.82	0.415	
CHESTD	-0.080	-1.79	0.077	*	0.012	0.27	0.789	
BACKPAIN	-0.101	-1.94	0.055	*				
INTRDMY	-0.187	-3.08	0.003	***				
INCOG					0.019	0.35	0.023	**
INTRDMY_B					-.010	-0.15	0.885	
LPM	0.000	0.04	0.965		0.001	0.45	0.653	
PERINJ	0.026	2.22	0.029	**	0.008	0.81	0.423	
PERFATL	0.026	2.01	0.047	**	0.023	2.40	0.018	**
Constant	3.876	27.66	0.000	***	4.407	36.53	0.000	***
R-squared		0.803					0.690	

Note: ***, ** and * indicated the level of significance at 1%, 5% and 10% respectively.

5.3. Computation of Value of Statistical Life and Injury

For the computation of statistical value of life and injury we have used the following standard equations are as:
VSL= β PERFATL *W*2000*10,000`
VSI= β PERINJ*W*2000*100
Where β is the coefficient of the lethal injury risk measured as the number of fatal per 10,000 in case of value of statistical life, W is mean hourly wage rate that is multiplied by annual hours 2000 that is international standard to annualize the figure and multiplied by the scale of the variable which is 10,000 workers for the perceived fatal risk variable.

Table 6: Value of Estimated Statistical Life and Injury

	Marble Factory	Brick kiln
Value of Statistical life (2000 Standard annual hours)	Rs54.6 million per life (USD 3,41,250)	Rs43.7 million per life (USD 2,73,125)
Value of Statistical injury (2000 Standard annual hours)	Rs5460 per worker (USD 34.12)	
Value of Statistical life (2800 Pakistan annual hours)	Rs76.44 million (USD4,77,750)	Rs61.18 million (USD3,82,375)
Value of Statistical injury (2800 Pakistan annual hours	Rs:7644 (USD47.7)	

Note: USD 1 = 160 Pakistani rupees during the estimation of VSL, August,, 2019

Value of statistical life is estimated for marble workers in consideration of international standard annual hours (2000) is PKR 54.6 million equal to USD 0.341 million simultaneously it is estimated for brick kiln workers are PKR 43.7 million per statistical life which is equal to US$ 0.273 million in the context of 2000 annual hours. The same calculation goes for the computation of injury but will not be calculated the injury value for brick kilns because it became insignificant. On other hand Value of statistical injury or limb consider 2000 annual hours is calculated for workers in marble industry, 5,460 Pakistani rupees are differential compensation for worker per year to receiving risks of injury that is almost negligible amount to pay to the workers against confronting an enormous risk to health. And in consideration of Pakistan's annual hours (2800) value of life estimated for marble workers is Rs 76.44 million equal to (USD 0.4775 million) and for brick kilns, the estimated value of life is Rs 61.18 million equal to (USD 0.382 million). The coefficient of perception about the injury is significant but still, they are not compensating properly in the said industries, because the companies are providing a weak bargaining environment for labors to accept high risk with less compensation. Job quitting risk, and temporary work are large contributors to small differential and it explains the inadequate wage premium for risky jobs.

6. Conclusion

The value of benefits of reducing risks or hazardous risks to health and life, in environmental economics has always been debatable however, this paper argues that workers always make decisions between risks and money or earnings, in the two different industries. So in our study, we found that workers make a decision about their rationale and the workers are rational, and on the other side the owners also take rational decisions. So both parties are using bargaining but remain underrated because the workers mostly want an environment for better bargaining to accept a riskier job on higher wages. The study estimated the wage-risk relationships for workers in the marble and brick kiln industries. The value of statistical life for marble factory workers was found to be Rs 54.6 million (USD 0.3412 million), while the value of statistical injury was computed to be Rs 5460 per worker per year. However, the workers were not properly compensated for wage differentials in the marble industry. The value implied for brick kilns was Rs 43.7 million (USD 0.2731m) in consideration of 2000 annual hours and Rs 61.180 million (USD 0.3823m) in consideration of 2800 annual hours. The study did not attempt to value the statistical injury for brick kilns because the perceived injury was statistically insignificant. The study concludes that wage compensation differential does not exist in brick kilns either because the market does not compensate workers for risks

6.1. Policy Recommendation

The values that have been evaluated in this study for the perceived injury and perceived death can be used for the cost and benefit analysis projects, like pollution control, it can also be used by the insurance companies for settling claims, furthermore it can also be implied on the ongoing war on terror in Pakistan. This study will further help the policy makers to devise better and improved policies which will benefit the labors in the health context of the two industries.

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