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Compensating Wage Differentials for Workplace Accidents: Evidence for Union and Non-union Workers in Tunisia

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This paper estimates the compensating wage differentials for job risks for union and nonunion workers. These estimated compensating wage differentials are used to measure the statistical value of life. To avoid a potential problem of a selectivity biais arising if richer people choose safer jobs, we consider RISK as an endogenous variable. The endogeneity of job risk implies that ordinary least squares estimates of the wage equation may be biased and this should be corrected. Accordingly, we use instrumental variables techniques. Using original data from "*la Caisse nationale de la sécurité sociale*", we found evidence of wage differentials for hazardous work. In addition, organizing workers in union generates a value of statistical life (VSL) at least two times higher than for non-union (344,595.2 dinars for non-union and 985,459.7 dinars for union workers). However, these values are much lower than those estimated in developed countries. This study could provide useful recommendations for policymakers to reduce the risk of death in Tunisia.

1. Introduction

Economic evaluation of projects and other interventions to reduce risk in developing countries requires knowledge of the value to place on lives saved. To measure the value of statistical life (VSL), several methods have been proposed in the literature to estimate the implicit prices for the reduction of risks to life and health. They understand the approach of the cost of disease, the human capital approach, the willingness to pay approach to save a human life. However, the latter approach is considered as the most appropriate method. Infect, cost–benefit studies

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undertaken in developing countries show biased results because they ignore risk aversion and underestimate the VSL (Rosen, 1988).

Developed countries now use estimates of the value of statistical life. This VSL is calculated either from reports by survey respondents of how much they would be willing to pay to avoid risks (or how much they would need to be paid to accept risks) or from market-based, revealed preference studies. The theoretical superiority of VSL measures is recognized in Harris (2000).

Several empirical studies have been made in recent years to estimate the value of a statistical life, but most of them deal with developed countries (Viscusi, 1993; Viscusi and Aldy, 2003). The studies on this aspect are rare when it comes to developing countries (Miller, 2000) mainly because of data constraints.

Thaler and Rosen (1976) and Viscusi (1983) support the hypothesis that unionized workers receive a wage premium for risky job. Indeed, union workers are better informed than the other workers about the firm's risk because they have better access to information for institutional reasons. The dissemination of such information to union workers results in a higher risk premium required for risky jobs. In addition, unions often act by putting pressure on employers to improve working conditions or to pay a wage risk premium for higher risk jobs.Therefore, union workers earn a larger premium for exposure to workplace hazards than similar nonunion workers (Thaler and Rosen, 1975). The effect of unionization[2] on the compensating wage differential may reflect union's concern with workplace safety or a larger proportion of unionized workers in high-risk industries. If unions negotiate contracts with workplace hazards in mind, then a highly unionized worker would have a higher estimated wage premium for injury risk than the other.

It is particularly important to study the effect of unionization in developing countries since the unionization rate in Tunisia is much lower than in developing countries and then the estimated compensating wage differentials for workplace accidents could be different. In addition, there may be fundamental differences in the value of risk

[2] For a more complete review of studies analyzing the impact of unionization, see Sandy et al. (2001) as well as Viscusi and Aldy (2003).

reduction between developed and developing countries, because information about occupational risks may be less accessible to workers in developing countries. Differences in labor market structures, institutional factors, cultural influences on risk preferences and magnitudes of industrial risk may also explain variations in the estimates. However, the most likely dominant cause is that developing countries are poorer, and safety is a normal good (Viscusi and Aldy, 2003).

In Tunisia, no study has evaluated the role of the union on the compensating wage differentials for risky job. The objective of this work is to study the effect of unionization of workers on the compensating wage differentials for risky job.

To estimate the implicit prices for the reduction of risks to life and health, we use the willingness to pay approach. The principle of this method is to use people's preferences as a basis for the measurement of increase (or reduction) in human well-being related to the reduction (or increase) of mortality risk.

However, there are two main methods to measure the willingness to pay for risk reduction. The first, the contingent valuation method, based on data generated by questionnaire (Alberini et al, 1997). In this approach, individuals are asked directly how much they would be willing to pay to reduce the risk of death at work. The second method is the hedonistic approach based on the wage premiums. The latter approach is more popular because of the availability of data.

In this paper, we use the hedonistic approach based on the analysis of wage premiums for risk trades to determine the willingness to pay to save a human life. Our estimates show that the effect of the risk of accidents on the wage variable is two times higher in the case of unionized workers. This is mainly due to the fact that the union membership increases the bargaining power of workers. Indeed, the union shall inform the workers of hazardous work which encourages them to demand a higher risk premium. This shows the importance of unionizing in improving workplace safety.

The second section briefly discusses the compensating wage differentials theory. The empirical model is exposed in the third section.

The description of the data and the empirical results are presented in the fourth and the fifth sections, respectively. The last section concludes.

2. The Compensating Wage Differentials Theory

The compensating wage differentials theory back to Adam Smith[3]. He noted in 1776 that workers must be compensated through higher wages relative to that determined by the market to encourage them to take up jobs with disadvantages in terms of working conditions, other things being equal.

Thaler and Rosen (1976) contributed to the development of this theory by referring to the concept of the wage premium related to the probability of being a victim of an accident at work or occupational disease. They analyzed the behavior of the worker in the labor market. The worker can choose between higher wages and less secure employment or less pay and a safer environment. For its part, the employer will choose between higher labor costs and higher security costs. The main result of the compensating wage theory is that the workers require a wage premium risk in order to keep the same level of utility of a safer job than the high-risk job, all things being equal.

Smith (1979) presents a review of studies looking at the risk premium. The justification of the risk premium is that the worker would choose a job that maximizes his utility not only in respect of wages earned, but also in respect of the working conditions associated with the job. Therefore, in the case of an unpleasant working condition, for example, the existence of a high risk of accident, the worker would require in addition to salary, a risk premium to compensate for the disutility suffered. This risk premium depends on the preferences of the worker to risk, that is to say, the degree of aversion to risk. A worker whose degree of risk aversion is low chooses a job with a high risk and requires a higher salary. Contrariwise, a risk aversion worker would prefer a safer job and would be satisfied with low wages.

The results of these empirical studies (Blomquist, 2004 ; Alberini and Krupnick, 2003 ; Hammit and Liu, 2003 ; Matsuoka, 2005 and

[3] Smith, A., The Wealth of Nations

Madheswaran, 2007) support the hypothesis of the existence of a risk premium, and show that it plays a regulatory role for the market to determine the optimal combination of wage-risk.

The theory of compensating wage differentials assumes perfect information for workers. In addition, according to Dionne and Lanoie (2004), workers' mobility is essential to the wage-risk analysis. However, in reality, workers are poorly informed about job hazards in each firm. The worker may be unable to distinguish between jobs with low risk and high-risk jobs.

Thaler and Rosen (1976) and Viscusi (1983) support the hypothesis that unionized workers receive a wage premium for higher risk than others. Indeed, union workers are better informed than the other workers about the firm's risk because they have access to information for institutional reasons. The dissemination of such information to union workers results in a higher risk premium required for risky jobs. In addition, unions often act by putting pressure on employers to improve working conditions or to pay a wage risk premium for higher risk jobs.

3. The Empirical Model

The empirical model requires data on workers' wages, job risks and other characteristics. The wage that the worker is willing to accept reflects the utility expected from the job characteristics. A worker's indifference curve shows his tradeoffs between the wage rate and the risk of death in the workplace, as described above. Since workplace safety influences firm productivity and costs, the isoprofit curve measures the tradeoffs between job risk and wages. The hedonic wage function is the envelope of mutual tangencies between firm isoprofit curves and worker indifference curves.

The reduced form of the hedonic wage function can be specified as follows:

$$Log(W_i) = f(X_i, Y_i) + \varepsilon_i, \qquad (1)$$

where Log (W_i) = the natural logarithm of the ith individual worker's wage rate, X_i = ith individual worker's characteristics (These include EDUCATION, EXPERIENCE, GENDER, PERMANENCE STATUS, MARITAL STATUS, and UNION), Y_i = ith individual worker's job

characteristics. These also include RISK (mortality rate measured at the firm level) MANUFACTURING INDUSTRY and location; SHORE, INTERIOR, SOUTH-WEST, Tunis area is default), and ε_i = random error term.

In our case study, theoretically, there is a double causality between wage and the risk variable. The risk is not only an explanatory variable but also an endogenous variable that is explained by the wage. The error orthogonality assumption is violated and OLS is inappropriate. The simultaneity problem arises because the explanatory variable, the risk is itself endogenous and therefore likely to be correlated with the error term. In the presence of simultaneity, the OLS estimators will be biased. In this case, the method of instrumental variables provides effective and unbiased estimators.

Therefore, we consider RISK as an endogenous variable. because the individual's choice of job riskiness and safety should be considered as a normal good. Consistent with this notion is that individuals with greater human capital and earning potential will experience an income effect and select jobs with less risk. If disturbances reflect unobserved heterogeneity among individuals, then those with unobserved characteristics which enable them to earn higher wages will also lead them to find safer jobs. Consequently, the endogeneity of job risk implies that ordinary least squares estimates of the wage equation may be biased and this should be corrected. Accordingly, we use the delayed RISK variable as an instrument.

4. Data Source

The data in this study are taken from one main source, the *Caisse nationale de la sécurité sociale*. This organization is in charge of workplace accidents in Tunisia. It compensates the victims of accidents, administers an experience rating scheme to finance the system, and is responsible for accident prevention (monitoring and enforcement of safety regulations, training, subsidies for protective equipment, etc.).

We have data on a random sample of 7978 employees working in the private sector for the year 2002. This year is chosen because it is the last year that was made available to us. Definitions and descriptive statistics of the variables are presented in Table 1.

Table 1: Descriptive Statistics of the Sample

Dependant variable	Definition	Mean			Standard deviation
		All workers	Union	Non-union	
Log (WAGE)	Logarithm of the monthly average wage rate	5.75	5.76	5.75	0.19
Independents variables					
RISK	The fatal injuries per 1000 workers	8.77	8.72	8.78	0.33
SHORE	Dummy for Shore location	0.58	0.60	0.584	0.49
INTERIOR	Dummy for Interior location	0.086	0.087	0.086	0.28
SOUTH-WEST	Dummy for South-west location	0.018	0.019	0.018	0.13
MANUFACTURING	Dummy for Manufacturing industry	0.51	0.50	0.516	0.49
MARITAL STATUS	Dummy for married worker	0.64	0.64	0.64	0.47
EDUCATION	The number of educated years	7.18	7.21	7.17	2.41
PERMANENCE STATUS	Dummy for a permanent status worker	0.43	0.44	0.43	0.49
EXPERIENCE	Number of years of experience	4.81	4.93	4.78	6.64
GENDER	Dummy for men	0.91	0.91	0.91	0.27
UNION	Dummy for unionized worker	0.18	1	0	0.38

Table 1 shows that the average fatal risk is 8.77 per 1000 workers and that most workers covered in our sample are men (91%) with a permanence status (43%) in the manufacturing sector (51%). Only 8.6% of victims are located in the interior of Tunisia. Furthermore, just 64% of compensated workers are married. While, only 18% are unionized.

Dependent Variable

The dependent variable used in this study is the natural logarithm of the monthly average wage rate. The average number of fatal injuries should affect positively the wages based on the theoretical foundations of the compensating wage differentials.

Independent Variables

The Independent variables here include the risk, age, status and work experience, gender, marital status and educational variables which serve as control the characteristics of the job offer. Dummies on sectors and administrative regions, allow considering the characteristics of the demand for labor.

Risk Variable

In Tunisia, occupational injuries are classified into three categories. First, injuries that do not involve a work stoppage beyond the day of work. Second, other injuries are relatively serious and require work stoppage and compensation to victims. This accident category is divided into two types; accidents with temporary disability and accidents with permanent disabilities. Third, the last category includes fatal injuries. We will use in this study the fatal injuries per 1000 workers as the measure of the risk variable. Accordingly, to the theory of compensating wage differentials, a worker in a risky job requires a higher wage.

Union Variable

The interest variable, UNION, defined as the percentage of unionized workers, takes into account for the market labor forces interaction. The main objective of the union is to defend the interests of workers, improves the working conditions and guards the workers' standards of living.

The unionization rate in Tunisia is about 22%, but it is much lower in private industries (18%). This can be explained by the fact that some private companies are laying off union leaders to get rid of the pressure resulting from their presence in terms of defending the interests of workers and the requirements of good working conditions. Theoretically, UNION variable should positively influence the perceived wage premium.

Other Variables

We use controls variables (STATUS and EXPERIENCE, GENDER, MARITAL STATUS and EDUCATION) that serve as control characteristics of the labor supply.

EDUCATION and EXPERIENCE variables are used to account for the effect of human capital on wage disparities. We expect that wage increases with the level of education so that workers with a high level will have higher wages.

Similarly, the experience variable should vary positively with wages because the “learning by doing” is an important explanation of the increase in the productivity resulting in higher wages. We expect that a married, experienced worker and male should have a higher wage.

We control for industries and areas location to take account of the characteristics of the labor demand. Three dummies variables for the area location (SHORE, INTERIOR and SOUTH-WEST) were introduced. We use also a dummy variable for the MANUFACTURING industry[4].

6. Empirical Results

The hedonic wage equation (1) can be written in more detail by:

$$Log(W) = \beta_0 + \beta_1^{'} X + \beta_2^{'} Y + \varepsilon \qquad (2)$$

Six variants of the equation (2) have been estimated (the complete model, one without industry dummy, one without location dummies, one without industry and location dummies, one without PERMANENT STATUS, one without EXPERIENCE), and results are reported in Table 2. The explanatory power of the regressions is fairly good.

The coefficients are stable and significant, and the control variables are most significant with the expected sign. The risk coefficient varies from 0.0919 to 0.181. The determination coefficient is between 0.27 and 0.45. The high statistical values of the endogeneity test for all models tend to support the alternative hypothesis of endogeneity of the dependent variable. This justifies the using of the instrumental variables technique.

The first model gives the highest coefficient of determination. Married, experienced, well educated, male, working in a manufacturing industry and located workers in the area of the interior of Tunisia or southwest requires a higher wage premium for hazardous work.

Thus, according to all estimated models, the risk of accidents affects significantly the increase of wage. Thus, the compensating wage differentials theory is empirically confirmed in the case of Tunisia which implies the existence of a risk premium for hazardous work.

[4] The "Transport" industry is used as a reference variable.

Similarly, the effect of the union variable is important in determining the wage premium according to all models. The coefficient variable is robust and statistically significant at 1%.

Estimated Premiums risks are used to estimate the value of the implicit life. For example, according to the first model, the effect of a unit increase in fatality risk on the worker's gain is 0.135. Evaluate the wage premium to the average salary of 314.19 dinars provides an estimate of the willingness to pay to avoid a fatal accident of 42.41 dinars. A unit increase in fatal accidents increases actually the risk of annual deaths by 1/1000. Multiplying by 12 to annualize the figure, and by 1000 to reflect the scale of the variable "fatality risk", the result of estimating the value of statistical life is 508988.86 dinars. According to Table 2, the value of statistical life in Tunisia is between 504,717.3 and 558,994.2 dinars.

To further discuss the effect of the union on the wage premiums, we can extend the model (2) by introducing the cross variable RISK-UNION in the following equation:

$$Log(W) = \beta_0 + \beta_1^{'} X^{*} + \beta_2^{'} Y + \beta_3 [RISK \times UNION] + \beta_4 \left[RISK \times (1 - UNION) \right] + \varepsilon \quad (3)$$

where X* does not contain the UNION variable in this equation. In Table 3, we distinguish between unionized and non-unionized workers. The effect of the risk variable on the wage is more than twice for unionized workers. This is mainly due to the fact that the union membership increases the bargaining power of workers. Indeed, the union shall inform the workers of hazardous job which encourages them to require a higher risk premium. This shows the main role of union in improving workplace safety.

Table 4 shows that the behavior of workers is different when we distinguish between experienced and non-experienced workers. Experienced workers have a higher VSL (644,073 dinars) than the other.

The value of life for experienced workers (Table 5) is almost one third if we are not unionized. Thus, prevention is affected by two factors; work experience and membership of a trade union.

Being unionized generates a higher VSL, especially in the manufacturing industry. Contrariwise, the VSL gap between unionized and non-unionized workers is lower in the other industries.

Delire and Levy (2004) supports our results, workers prefer high wages for riskies jobs. However, for Sandy and Elliott (2005), the hypothesis of the existence of a wage premium is rejected.

To compare our results with those in developed countries, we must convert our estimates in dollars. When we convert 508,988.86 dinars in dollars, the VSL is about $ 364,228.45. As expected, this value is lower than the estimates conducted in developed countries. Blomquist (2004) identified several studies that have determined the value of a statistical life in the United States during the period 1990-2002. This value is between 1.7 million and 7.2 million (US $ 2000). In Taiwan the value of statistical life ranges between 2.61 million and $ 7.18 million dollars (Hammit and Liu, 2004).

Table 2: Estimation of Equation 2 by Instrumental Variables

	Model (1)	**Model (2)**	**Model (3)**	**Model (4)**
VARIABLES				
RISK	0.135***	0.134***	0.148***	0.146***
	(0.0218)	(0.0219)	(0.0219)	(0.0219)
UNION	0.255***	0.255***	0.256***	0.255***
	(0.00882)	(0.00884)	(0.00887)	(0.00888)
MARITAL STATUS	0.0776***	0.0769***	0.0788***	0.0781***
	(0.00722)	(0.00724)	(0.00726)	(0.00727)
GENDER	0.479***	0.477***	0.480***	0.479***
	(0.0124)	(0.0124)	(0.0125)	(0.0125)
EXPERIENCE	0.0885***	0.0894***	0.0899***	0.0903***
	(0.00979)	(0.00981)	(0.00981)	(0.00983)
PERMANENCE STATUS	0.112***	0.113***	0.111***	0.112***
	(0.00745)	(0.00747)	(0.00749)	(0.00750)
EDUCATION	0.994***	0.990***	0.990***	0.986***
	(0.0251)	(0.0251)	(0.0251)	(0.0251)
SHORE	0.00578	0.00930	-	-
	(0.00773)	(0.00773)	-	-
INTERIOR	0.0534***	0.0507***	-	-
	(0.0133)	(0.0133)	-	-
SOUTH-WEST	0.227***	0.224***	-	-
	(0.0262)	(0.0263)	-	-
MANUFACTURING	0.0421***	-	0.0386***	-
	(0.00693)	-	(0.00693)	-
CONSTANT	5.268***	5.289***	5.279***	5.300***
	(0.0145)	(0.0141)	(0.0138)	(0.0133)
OBSERVATIONS	7978	7978	7978	7978
R-SQUARED	0.367	0.365	0.360	0.358
ENDOGENEITY TEST	54.593***	44.953***	42.959***	39.937***
VSL	508,988.86	504,717.3	558,994.2	552,274.6

Standard deviation in parentheses, VSL: Value of Statistical Life
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Table 3: Estimation of Equation 3 by Instrumental Variables

	Model (1)	Model (2)	Model (3)	Model (4)
VARIABLES				
RISK×(1-UNION)	0.111***	0.110***	0.122***	0.120***
	(0.0260)	(0.0260)	(0.0261)	(0.0261)
RISK×UNION	0.248***	0.245***	0.269***	0.266***
	(0.0477)	(0.0478)	(0.0479)	(0.0480)
MARITAL STATUS	0.0772***	0.0766***	0.0785***	0.0778***
	(0.00759)	(0.00761)	(0.00763)	(0.00764)
GENDER	0.477***	0.476***	0.479***	0.477***
	(0.0130)	(0.0131)	(0.0131)	(0.0131)
EXPERIENCE	0.0882***	0.0891***	0.0893***	0.0898***
	(0.0103)	(0.0103)	(0.0103)	(0.0103)
PERMANENCE STATUS	0.112***	0.114***	0.112***	0.113***
	(0.00783)	(0.00784)	(0.00787)	(0.00788)
EDUCATION	0.997***	0.993***	0.992***	0.988***
	(0.0263)	(0.0264)	(0.0263)	(0.0264)
SHORE	0.0102	0.0135*	-	-
	(0.00812)	(0.00811)	-	-
INTERIOR	0.0569***	0.0542***	-	-
	(0.0139)	(0.0140)	-	-
SOUTH-WEST	0.231***	0.227***	-	-
	(0.0276)	(0.0276)	-	-
MANUFACTURING	0.0405***	-	0.0372***	-
	(0.00728)	-	(0.00728)	-
CONSTANT	5.314***	5.335***	5.329***	5.349***
	(0.0152)	(0.0148)	(0.0144)	(0.0138)
OBSERVATIONS	7978	7978	7978	7978
R-SQUARED	0.301	0.299	0.294	0.292
ENDOGENEITY TEST	53.54***	41.98***	40.78***	40.89***
NON-UNION VSL	419,221.2	415,130.7	459,316.2	453,907.16
UNION VSL	933706	925,239.3	1,013,697.3	1,003,406

Standard deviation in parentheses, VSL: Value of Statistical Life
*** p < 0.01, ** p < 0.05, * p < 0.1

Table 4: Estimation of Equation 2 Depending on the Worker Experience[5] and Industry

VARIABLES	All workers	Experienced workers	Inexperienced workers	Manufacturing	Other industries
RISK	0.135***	0.181***	0.128***	0.124***	0.143***
	(0.0218)	(0.0614)	(0.0232)	(0.0268)	(0.0336)
UNION	0.255***	0.240***	0.259***	0.247***	0.263***
	(0.00882)	(0.0231)	(0.00950)	(0.00977)	(0.0148)
MARITAL STATUS	0.0776***	0.130***	0.0669***	0.0609***	0.0946***
	(0.00722)	(0.0197)	(0.00772)	(0.00791)	(0.0123)
GENDER	0.479***	0.431***	0.498***	0.510***	0.438***
	(0.0124)	(0.0259)	(0.0143)	(0.0133)	(0.0218)
EXPERIENCE	0.112***	0.0985***	0.114***	0.0817***	0.143***
	(0.00745)	(0.0243)	(0.00776)	(0.00815)	(0.0127)
PERMANENCE STATUS	0.0885***	-	-	0.103***	0.0707***
	(0.00979)	-	-	(0.0106)	(0.0169)
EDUCATION	0.994***	1.020***	0.987***	0.953***	1.019***
	(0.0251)	(0.0546)	(0.0285)	(0.0309)	(0.0385)
SHORE	0.00578	0.0301	0.00125	-0.00137	0.0131
	(0.00773)	(0.0201)	(0.00834)	(0.00864)	(0.0129)
INTERIOR	0.0534***	0.0539*	0.0552***	0.00781	0.0845***
	(0.0133)	(0.0308)	(0.0148)	(0.0162)	(0.0206)
SOUTH-WEST	0.227***	0.222***	0.229***	0.224***	0.233***
	(0.0262)	(0.0741)	(0.0278)	(0.0333)	(0.0396)
MANUFACTURING	0.0421***	0.0354*	0.0434***	-	-
	(0.00693)	(0.0185)	(0.00744)	-	-
CONSTANT	5.268***	5.363***	5.257***	5.313***	5.274***
	(0.0145)	(0.0384)	(0.0161)	(0.0157)	(0.0239)
OBSERVATIONS	7978	1402	6576	4103	3875
R-SQUARED	0.367	0.364	0.356	0.451	0.323
ENDOGENEITY TEST	39. 98***	38.78***	37.78***	36.85***	33.76***
VSL	508,988.86	644,073	445,100.4	466,468.15	543,633.9

Standard deviation in parentheses, VSL: Value of Statistical Life
*** p < 0.01, ** p < 0.05, * p < 0.1

[5] Experienced worker is one with more than 10 years of experience.

Table 5: Estimation of Equation 3 Depending on the Worker Experience and Industry

VARIABLES	All workers	Experienced workers	Inexperienced workers	Manufacturing	Other industries
RISK×(1-UNION)	0.111***	0.175**	0.102***	0.0919***	0.127***
	(0.0260)	(0.0770)	(0.0274)	(0.0324)	(0.0399)
RISK×UNION	0.248***	0.263**	0.246***	0.263***	0.235***
	(0.0477)	(0.112)	(0.0529)	(0.0618)	(0.0713)
MARITAL STATUS	0.0772***	0.127***	0.0669***	0.0611***	0.0935***
	(0.00759)	(0.0204)	(0.00814)	(0.00850)	(0.0128)
GENDER	0.477***	0.424***	0.498***	0.507***	0.439***
	(0.0130)	(0.0269)	(0.0151)	(0.0143)	(0.0226)
EXPERIENCE	0.112***	0.0990***	0.114***	0.0802***	0.146***
	(0.00783)	(0.0252)	(0.00818)	(0.00876)	(0.0132)
PERMANENCE STATUS	0.0882***	-	-	0.102***	0.0712***
	(0.0103)	-	-	(0.0114)	(0.0176)
EDUCATION	0.997***	0.998***	0.999***	0.955***	1.023***
	(0.0263)	(0.0566)	(0.0301)	(0.0332)	(0.0401)
SHORE	0.0102	0.0279	0.00702	0.00228	0.0178
	(0.00812)	(0.0208)	(0.00880)	(0.00928)	(0.0134)
INTERIOR	0.0569***	0.0630**	0.0565***	0.00414	0.0927***
	(0.0139)	(0.0320)	(0.0156)	(0.0174)	(0.0214)
SOUTH-WEST	0.231***	0.245***	0.229***	0.227***	0.235***
	(0.0276)	(0.0774)	(0.0293)	(0.0358)	(0.0411)
MANUFACTURING	0.0405***	0.0314	0.0424***	-	-
	(0.00728)	(0.0192)	(0.00785)	-	-
CONSTANT	5.314***	5.418***	5.302***	5.360***	5.318***
	(0.0152)	(0.0394)	(0.0169)	(0.0167)	(0.0247)
OBSERVATIONS	7978	1402	6576	4103	3875
R-SQUARED	0.301	0.315	0.283	0.366	0.268
ENDOGENEITY TEST	38. 67***	38.88***	37.45***	36.45***	33.55 ***
NON-UNION VSL	419,221.2	621,549	354,806	344,595.2	481,480
UNION VSL	933,706	933,506.5	856,959.1	985,459.7	891,481.2

Standard deviation in parentheses, VSL: Value of Statistical Life
*** p < 0.01, ** p < 0.05, * p < 0.1

Cropper and Freeman (1991) investigated 17 studies, and argue that the value of a statistical life is between $ 1.9 million and $ 6.4 million (in US dollars 1990). Viscusi (1993) and Viscusi and Aldy (2002) find that recent estimates of the value of life are clustered in the range of 3-7 million (US $ 1990).

Similarly, the value of life in Tunisia is lower than the values of life in developing countries like India, 0.8 million (Madheswaran, 2007). The value of statistical life in Thailand is of the order of $ 1.48 million (Vassanadumrongdee and Matsuoka, 2005). However, the value of statistical life in Iran is relatively low, 0,066,750 USD (Brajer and Rahmatian, 2004).

7. Conclusion

In this paper, we investigated the effect of worker unionization on the compensating wage differentials for risky job in Tunisia. The empirical results support the hypothesis that workers make rational decisions taking into account the jobs-related risks. Indeed, higher job risks are associated with higher required wage. Thus, the assumption that the Tunisian workers receive positive wage premiums for work risks is strongly supported.

The effect of the risk of death on the wage variable is two times higher in the case of unionized workers. In fact, organizing workers in union generates a value of human life at least two times higher than for non-union (344,595.2 dinars for non-union and 985,459.7 dinars for union).This is can be explained by the fact that the union membership increases the bargaining power of workers. Indeed, the union shall inform the workers of hazardous work which encourages them to require higher risk premium. This shows the interesting union role in improving workplace safety.

The most important implication for economic policy makers is that security incentives created by market mechanisms, such as the union, has a great effect on the workplace safety. Therefore, policy makers should give more importance to the union to reduce the risk of death in Tunisia.

References

Alberini A. and A.J. Krupnick (2003), Valuing the health effects of pollution, in: T. Tietenberg and H. Folmer (Eds.), *International Yearbook of Environmental and Resource Economics* 2002/2003: A Survey of Current Issues, Edward Elgar Press, Northampton, pp. 233-277.

Alberini A., M. Cropper, T. Fu, A. Krupnick, J. T. Liu, D. Shaw and W. Harrington (1997), Valuing health effects of air pollution in developing countries : The case of Taiwan, *Journal of Environmental Economics and Management*, 34, 107-126.

Blomquist G. C. (2004), Self-Protection and Averting Behavior, Values of Statistical Lives, and Benefit Cost Analysis of Environmental Policy, *Review of Economics of the Household*, 2, 89-110.

Brajer V. and M. Rahmatian (2004), From Diye to Value of Statistical Life: A case Study for the Islamic Republic of Iran, Victor California State University, Fullerton 2004.

Cropper, Maureen L., and Freeman, A. Myrick (1991), Environmental health effects. In John B. Braden, & Charles D. Kolstad (Eds.), *Measuring the Demand for Environmental Quality*. (pp. 165–221). North-Holland, New York.

Deleire T. and H. Levy (2004), Worker Sorting And The Risk Of Death, On The Job *Journal of Labor Economics*, 22, 925-953.

Dionne, G. and Lanoie, P. (2004) How to make a public choice about the value of a statistical life: The case of road safety, *Journal of Transport Economics and Policy* 38, 247 274.

Gunderson M. and D. Hyatt (2001), Workplace Risks and Wages, Canadian evidence from Alternative Models, The *Canadian Journal Of Economics / Revue Canadienne D'économique*, 34, 377-395.

Hammit J. K. and J. T. Liu (2004), Effects of disease type and Latency on the Value of Mortality Risk, *Journal of Risk and Uncertainty*, 28, 73-95.

Hammit, J. K. and J. T. Liu. (2003), Effects of disease type and latency on the value of mortality risk, Working Paper 10012, *National Bureau of Economic Research*, Cambridge.

Harris, G. (2000), The economics of landmine clearance: case study of Cambodia. Journal of International Development, 12(2), 219–225, *Journal of Risk and Uncertainty* 28, 73–95.

Madheswaran, S. (2007), Measuring the value of statistical life: Estimating compensating wage differentials among workers in India, *Social Indicators Research*, 84, 83-96.

Miller, T.R. (2000), Variations between countries in value of statistical life, *Journal of Transport Economics and Policy*, 34: 169-188.

Rosen, S. (1988), The value of changes in life expectancy, *Journal of Risk and Uncertainty*, 1(3), 285–304.

Sandy R. and Robert E. Elliott (2005), Long-Term Illness and Wages: The Impact of the Risk of Occupationally Related Long-Term Illness on Earnings, *The Journal of Human Resources*, Vol. 40, No. 3, pp. 744-768.

Sandy, R., Elliott, R. F., Siebert W. S. and Wei X. (2001), Measurement error and the effects of unions on the compensating differentials for fatal workplace risks *Journal of Risk and Uncertainty*, 23, 1, 33-56.

Smith A. (1776), The wealth of nations. *University of Chicago Press*, Chicago.

Smith, Robert S. (1979), Compensating Wage Differentials and Public Policy: A Review *Indus. and Labor Relations Rev*. 32, 339-52.

Thaler, R., and S. Rosen (1976), The Value of Saving a Life: Evidence from the Labor Market, *In Household Production and Consumption*, edited by Nestor E. Terleckyj, New York: Columbia Univ. Press (for NBER).

Thaler, R., and S. Rosen, (1975), The value of saving a life: evidence from the labor market. In *Household production and consumption*, ed. N.E. Terleckyj, 265–300, New York: Columbia University Press.

Vassanadumrongdee, S. and Matsuoka, S. (2005), Risk perceptions and value of a statistical life for air pollution and traffic accidents: Evidence from Bangkok Thailand, *Journal of Risk and Uncertainty* 30, 261-287.

Viscusi, W. K., and Aldy, J. E. (2002), The value of a statistical life: A critical review of market estimates throughout the world. *Harvard University Discussion Paper* No. 392, http://www.law.harvard.edu/programs/olinecenter.

Viscusi, W. K., (1983), Risk by Choice: Regulating Health and Safety in the Workplace Cambridge: Harvard University Press.

Viscusi, W. K., and Aldy J. E. (2003), The value of a statistical life: a critical review of market estimates throughout the world. *Journal of Risk and Uncertainty*. 27(1): 5–76.

Viscusi, W.K. (1993), The value of risks to life and health" *Journal of Economic Literature*, 31, 1912–1946.