

**WORKPLACE SAFETY AND WAGE EARNINGS IN KENYA: AN ESTIMATION OF A
HEDONIC WAGE EQUATION**

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DECLARATION

I declare that this research paper is my original work in which I am the sole author and neither part nor whole of it has ever been presented for any academic award in any other university.

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APPROVAL

The research proposal has been submitted for examination with my approval as university supervisor

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DEDICATION

I dedicate this work to my sweet late mommy Nancy Muthoni for encouraging me to pursue further education and believing in me from a very young age. I also dedicate this work to my loving Dad, Benson Muriithi, my brother David Mwaniki, my grandparents Njagi, Nyaga, Rwamba and Rebecca, my uncles Padre Martin, Ndwiga, Gasue and Waweru, aunt Irene and my loving cousins Murimi, Fundi, Vinnie and Elvis. My gratitude goes out to each one of you for the love, prayers, support and motivation towards the realization of my academic dreams. May God bless you all.

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LIST OF ABBREVIATIONS

ILO	International Labor Organization
GOK	Government of Kenya
DOSHS	Directorate of Occupational Safety and Health Safety
HWF	Hedonic Wage Function
CWD	Compensating Wage Differential
OSHA	Occupational Safety and Health Act
WIBA	Work Injury Benefits Act
OSH	Occupational Safety and Health
KIHBS	Kenya Integrated Household Budget Survey
OLS	Ordinary Least Squares
CFOI	Census of Fatal Occupational Injuries
SOII	Survey of Occupational Injuries and Illnesses
VIF	Variance Inflation Factor

ABSTRACT

The research paper aimed at carrying out an empirical estimation of the Hedonic Wage Function for the Kenyan Labor Market. Specifically, the relationship between workplace safety and wage earnings in the labor market was determined. To achieve the objective of the study, cross-sectional data obtained from the 2015-2016 KIHBS dataset was used to carry out the empirical analysis using Ordinary Least Squares.

The empirical findings indicate that individuals who sustain work-related injuries earn more compared to those who do not sustain injuries. Wage earnings were found to increase with the level of education. On average, males earn more compared to females while married individuals earn more than unmarried ones. Earned wages were higher among members of trade unions compared to non-members.

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CHAPTER ONE

INTRODUCTION

1.1 Background

In the real world, it is almost impossible for workers to accurately quantify the amount of health risk they get exposed to when they accept a job offer. In reality, workers are more likely to be deriving a lower level of utility for any given wage level than they actually perceive. The implication is that, more often than not, workers are more likely to underestimate the true probability of injury while at work because they do not reliably have access to all the job-related information before accepting a job offer. Even after accepting a job, it is less practicable that a worker would fairly be aware of the nature and type of risks the job and the work environment would predispose them to in the future. This creates a scenario where workers consistently underestimate the eminence of the true risks associated with jobs and work environments at any given point in time.

The history of occupational safety and health in Kenya dates back to 2004 when the country compiled its profile for the first time (ILO, 2013). The profile provides labor market insights necessary for creating a safe and healthy workplace ecosystem in the country. The section on bill of rights in the constitution of Kenya (2010) provides that every citizen has right to fair labor practices, reasonable working conditions, and a clean and healthy environment.

The Occupational Safety and Health Act (2007) was created with an objective of promoting safety of workplace, preventing work-related injuries and sickness while protecting third party individuals from being predisposed to higher risk of injury associated with activities of people at places of work. The Work Injury Benefits Act (2007), on the other hand, was established to ensures workers sustaining injuries and contracting diseases that are work-related, got compensated.

In Kenya, inspection and enforcement systems exist with a bearing to OSH and labor inspections. Inspections related to the environment at work, that mostly capture safety of places of work, general health and basic welfare of workers, are executed by Directorate Occupational Safety and Health Safety to ensure compliance with OSHA (2007). The Ministry of Labour, Social Security and Services, carries out inspections of working conditions that capture working hours and wages.

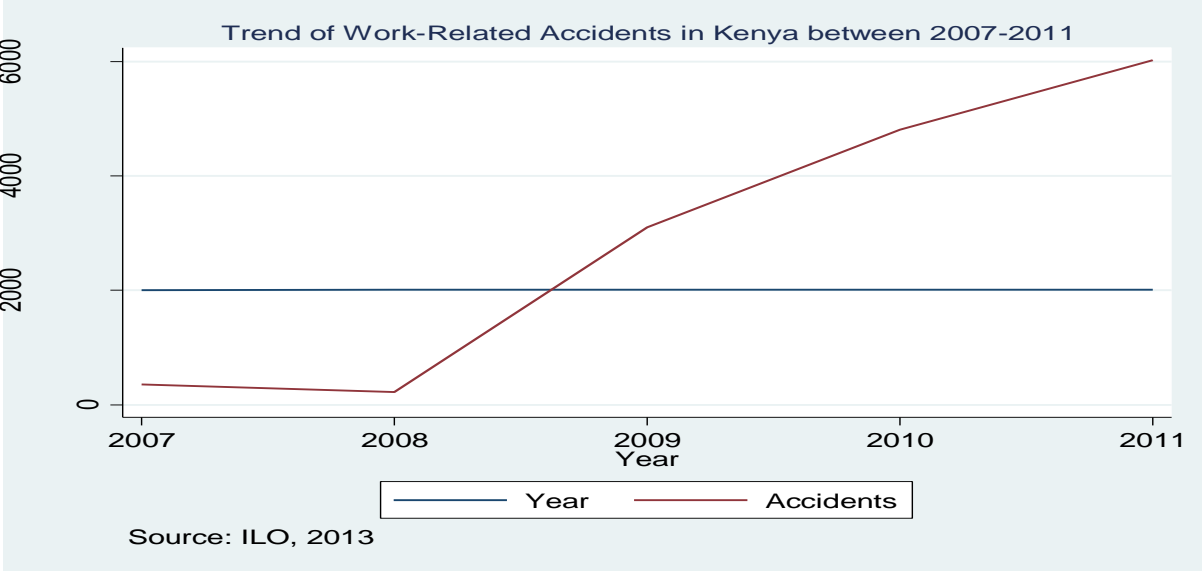
Workers spend much of their time at work than they do at any other place. Just like any other environment, the workplace is prone to health risks and hazards. Work-related injuries or diseases are eminent in any work environment. The International Labour Organization (2010) reports an average of 6,300 workers die daily on average due to exposure to injuries or diseases that are related to work. This translates to an average of 2.3 million fatalities in each year. Fatal and non-fatal on-the-job accidents that result from poor occupational safety and health practices are 337 million per year (ILO, 2001). The effect of these accidents is workers being absent from work for prolonged time. Similarly, there are over 160 million cases of occupational diseases, with a third of the cases associated with at least four days absence from work.

As of 2012, Kenya had an estimated population of over 36.8 million people (ILO, 2013). Out of the total population, over 2 million had jobs in the country's formal sector while over 8.8 million were working in the country's informal sector. The DOSHS, being the only organization legally mandated to carry out national investigation of occupational diseases, accidents and dangerous occurrences, is currently incapable of undertaking holistic inspection of the 140,000 workplaces in the country as it has only 71 officials (ILO, 2013). Additionally, out of the 140,000 workplaces in the country that are liable to inspection, only about 4,000 are inspected annually, leaving a huge chunk comprising of 97.1% uninspected each year. Without sound enforcement of ratified occupational safety and health policies and standards, informational asymmetry between employers and workers pertaining the magnitude of the actual work-related risk that employees are predisposed to is immense. If the legal and institutional framework that should enforce enacted and ratified occupational safety and health standards is weak, employers are likely to exhibit disincentive in undertaking investments to make the workplace safe. Employers, in the pursuit of cost minimization objective, are more likely to exercise adverse selection by being unwilling to disclose information related to risk embedded in a job before a worker accepts an offer. Declaring information on actual risks embedded in a job may result to workers either declining the job offer or negotiating for a slightly higher wage in order to get compensated for the risk they are predisposed to. The scenario leaves workers prone to occupational safety and health hazards that they are unaware of and which the employers may not effectively be compelled to address due to weak institutional inspection, investigation and enforcement of occupational safety and health standards. According to ILO (2013), the clause in OSHA (2007) that had mandated employers in Kenya to have insurance policy for employees underwent nullification in court and has yet not

been reviewed. This makes the case for informational asymmetry manifested through adverse selection to be exercised by employers in failing to declare all risks associated with a job before a worker accepts it.

In *Figure 1*, the number of work-related accidents reported in Kenya for the five-year period spanning between 2007-2011 was rising. The reason for the observed scenario may be the fact that despite the country having ratified ILO workplace safety standards and enacted domestic occupational safety and health laws, enforcement is poor as evidenced from the poor inspection and investigation of compliance to the safety standards in the country (ILO, 2013).

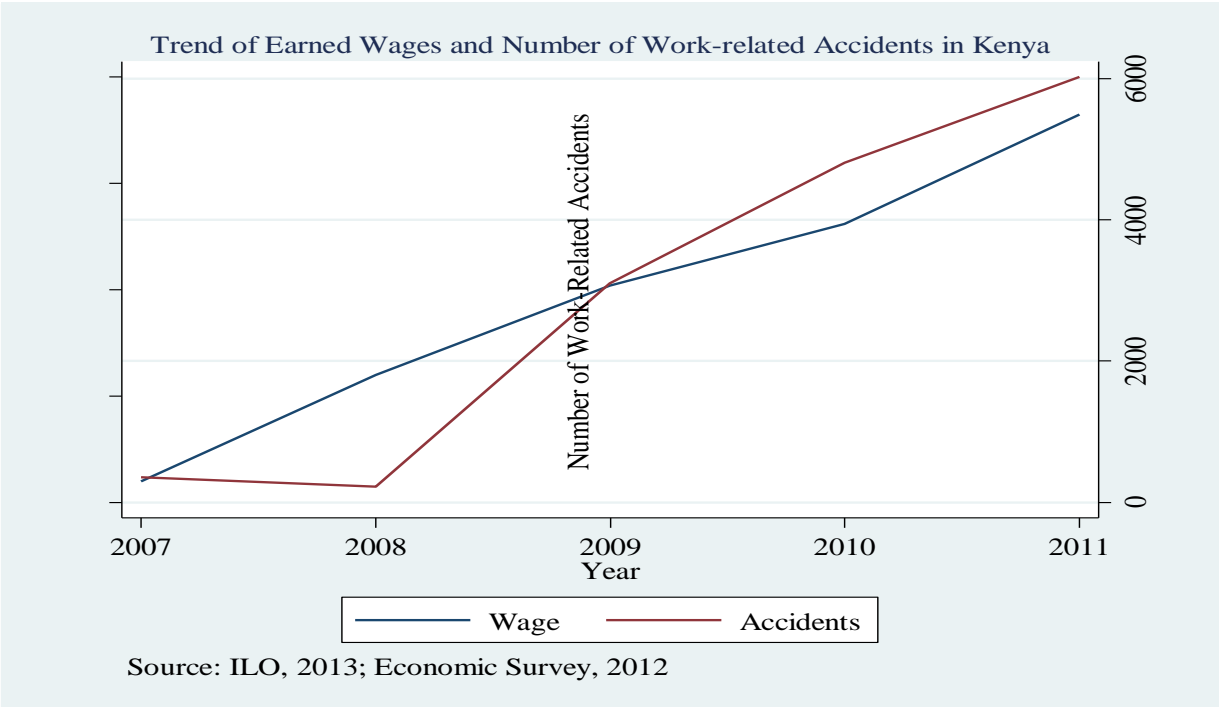
Figure 1: Trend of work-related accidents in Kenya between 2007-2011



In *Figure 2*, both the number of work-related accidents and earned wages had a general upward trend. Whereas the average annual earned wages were steadily increasing between 2007-2011, the number of work-related accidents remained relatively steady between 2007-2008, before sharply and steadily increasing between 2008-2011. An equilibrium point was arrived at in 2009 when the earned wages and the number of work-related accident curves crossed. After 2009, the number of work-related accidents increased at a higher rate than earned wages. The graph in *Figure 2* shows there exists a strong positive correlation between earned wages and average number of accidents related to work reported in the country between 2007-2011. The study seeks to estimate the Hedonic Wage Function which postulates that risk of work-place injury influences wages earned positively. If the Hedonic Wage Theory is empirically supported by data, a conclusion will be

arrived that the theory actually holds and that appropriate policy should be created to inform wage compensation based on risk of injury that workers in the country are exposed to in the labor market.

Figure 2: Trend of Wages and Number of Work-Related Accidents between 2007-2011



1.2 Research Problem

If the increasing number of work-related accidents in the Kenyan labor market, as presented in Figure 1, is not addressed with urgency, firms are likely to not achieve their growth objectives. As more and more workers become unproductive and spend time absent from work nursing sustained work-related injuries, firms incur losses stemming from decreased performance. When workers spent much time seeking medical care for work-related injuries may altogether end up losing their jobs as employers are likely to replace the injured workers with new employees. That scenario can be hurtful to injured workers if there is no compensation for the sustained work-related injuries and if their job contracts do not guarantee job security. The injured workers may completely become incapacitated to continue working after recovering from the sustained injury, a situation which may lead to the workers becoming dependent on other people for survival for the rest of their lives. With decreased firm performance and job losses due to work-related accidents, the Kenyan government is likely to lose tax revenues that could have accrued had work-related accidents and diseases prevented.

Given the current state of workplace safety and its eminent adverse effects to individual workers, employing firms, and the government, this research study seeks to provide evidence-supported policy solutions to the problem of earned wages not matching the risks embedded in a job. Specifically, the study seeks to examine whether workers could be motivated to take riskier jobs if they offer higher wage.

Additionally, there is scanty empirical evidence on examination of the Hedonic Wage Function in Kenya. The theory posits that workplace safety is positively correlated with wage earnings. The study will endeavor to carry out an empirical test that the coefficient of workplace safety is positive and non-zero.

1.3 Research Questions

The research questions for the study are:

- i. Does workplace safety have an effect on wage earnings in Kenya?
- ii. What are the policy implications from the results of the study?

1.4 Research Objectives

The objective of this research paper is to carry out an empirical estimation of the effect of workplace safety on wage earnings in Kenya.

1.4.1 Main objective

The main objective of this research study is to find out the relationship between workplace safety and wage earnings in the Kenyan labor market. The study seeks to achieve this objective through undertaking an empirical estimation of the Hedonic Wage Function.

1.4.2 Specific objectives

The specific objectives of the research study are:

- i. To analyze the effect of workplace safety on wage earnings in Kenya;
- ii. On the basis of the results provide policy implications.

1.5 Hypothesis

The following set of falsifiable hypotheses will be tested:

H₀: Workplace safety has no effect on wage earnings in Kenya;

H₁: Workplace safety has an effect on wage earnings in Kenya.

1.6 Justification

The findings of the study are expected to enrich the existing scanty literature on the relationship between workplace safety and wage earnings in Kenya. The results will benefit policy makers, scholars and learners striving to understand the linkage between what the theory postulates and what actual empirical evidence provides. It is expected that the findings will inform policy debates on wage compensation based on workplace safety in the country. Government policymakers, trade union officials and workers will greatly benefit from the findings and policy recommendations of the research study.

CHAPTER TWO

LITERATURE REVIEW

2.1 Introduction

This chapter is divided into three sections. The first section is the theoretical review, followed by the empirical review and the lastly the summary of the literature.

2.2 Theoretical Review

2.2.1 Compensating Wage Differentials

The theory is attributable to Adam Smith (1776) who argued that workers should be compensated for being exposed to risky non-wage characteristics of a job. According to the theory, entities that predispose workers to risky and undesirable conditions at the place of work should offer offsetting advantages such as paying their workers higher wages.

Higher wages play the role of providing compensation to workers for being exposed to working conditions that are undesirable. In most instances, unsafe places of work affect the health of workers and diminish the utility derived from engaging in a particular job. The most notable undesirable characteristics of a job are work environments that are unsafe and unhealthy, long hours of work, harsh environmental conditions, unfamiliar and isolated geographical locations and in some instances, long commuter hours.

Wages also compensate workers for desirable working conditions by driving wages lower than they would be if working conditions were safer, more flexible and pleasant. The argument is thus higher wages should be paid to compensate workers for exposure to higher probability of injury and illness related to work. The theory thus postulates that workers in unsafe and reasonably unhealthy work environments should be rewarded with higher wages to cater for the lost utility. On the side of firms, investing in safety of the workplace comes with cost. If firms undertake to invest in making the work-environment safer, then the utility workers derive from the safe work environment is higher and they are willing to take lower wages in return.

Workers reveal their preferences for earned wages and workplace safety that can be illustrated through indifference curves showing combinations of wages and safety that yield the same level of utility. From the indifference curves, workers exhibit diminishing marginal rate of substitution

between workplace safety and earned wages. Employees thus prefer places of work that predispose them to higher risk of injury if they encompass higher wages.

Based on this theory, the research endeavors to investigate if data supports it by having workers in riskier workplaces given higher wages. The relationship between workplace safety and earned wages will be determined if it is positive and statistically significant for Kenya.

2.2.2 Hedonic Wage Function

Adam Smith (1776) said that workers with the same level of education should be paid different wages if their working conditions are different. The Hedonic wage function, as proposed by Rosen (1974), accounts for wage heterogeneity brought about by the compensating differentials. The Hedonic Wage model assumes two types of job; a risky job and a safe job. Another assumption is that all workers dislike risk but have different preferences for risk such that they all lie on their own indifference curves with the slope showing the reservation price that a worker. The model assumes there are many firms in the market and the probability of injury on the job lies between 0 and 1. Some workers are risk averse and have the highest reservation price for wages and other are less risk averse- do not mind risk and they have the lowest reservation price for risk. All firms aim at maximizing profits. Each firm has an isoprofit curve illustrating locus of combinations of earned wages and risk that is involved on each isoprofit curve. All points along the same isoprofit curve yield the same amount of profit. Isoprofit curves are upward upward sloping because it costs the firms money to produce safety. Higher isoprofits curve represent lower profits for firms.

The estimation method used to predict the hedonic theory of wages is a basic OLS which involves estimating the natural logarithm of wages received by an individual worker as a function of his or her personal characteristics which include age, sex, gender, education, ethnicity, union status, experience and marital status and the other variable is a non-wage characteristics which may include the following; number of working hours, risk of injury, level of ambient noise, cost of health insurance cover among others. Taking into consideration of the non-wage job characteristics brings two problems on board. One of the problems is the unobserved individual characteristics, which, if they affect the productivity positively, will result in the model underestimating the non-wage characteristics effect on the wages. The second problem of non-wage characteristics arises from the heterogeneity of individual preferences. This research, therefore, will do an estimation model on the Hedonic Wage Function in Kenya.

2.2.3 Human Capital Theory

The Human Capital theory dates to Adam Smith (1776) in his book *Wealth of the Nations* where he argued that an educated man is as much worth as the machines used in the production process. In the early 1960s studies were done on investment in accumulation of acquired human capital through formalized education and specialized training. Becker (1964) viewed education as an investment generating income in the future. Since then human capital theory has been widely used especially in neoclassical analysis relating to labor markets and more specifically in wage determination and economic analysis of education. The human capital theory seeks to investigate the relationship between education and earnings. Assuming a perfectly competitive market, therefore, any additional non-compulsory education increases the productivity of labor meaning the reward for this labor is strictly dependent on its productivity. Education, therefore, is an investment that produces knowledge acquisition and productivity which in turns leads to higher earnings. The theory therefore suggests that any wage differentials is caused by the differences in productivity brought about by differences in the amount of human capital that emanate from differences in the amount of non-compulsory education undertaken. Assumption used under this theory is that individuals are homogeneous with respect to age, sex, ability, wealth and experience and only the difference among individuals is human capital.

A major concern is why would any individual want to invest in non-compulsory education given that it comes with additional costs. An investment in education increases the productive capacity for an individual which in turn yields high potential earnings after education. Therefore, a higher earning in an individual's working life can be attributed to the initial investment in acquiring human capital. In this regard, higher wages earned in the Kenyan labor market may not necessary be attributed to workplace safety but also to the specific individual's level of education attainment as this also determines the productivity capacity of the individual.

2.2.4 The Classic Theory: Marxian View of Capital

Karl Marx, a revolutionary German economist, predicted the fall of Capitalism. In his argument, the capitalists earned surplus value from the profits received from the production and exchange of commodities in the market. The production of commodities engaged labor, rent, land and materials which included technology and use of machines. There were two social classes: the bourgeoisie (who owned capital) and the proletariat (who were the laborers). In that social set-up, the

proletariat sold their labor to cater for their daily basic needs. On the other hand, the capitalists paid just enough subsistence wages to the proletariat to cover their daily necessities and to make sure that the latter depended on the former for survival. However, while a laborer was paid a fixed daily, weekly or monthly wage, the laborer worked for more than the necessary working hours and thus the final commodity produced carried less cost of labor for the capitalists. This was the ultimate exploitation of the workers and it resulted to surplus value (profits) for the capitalists. Long working hours is one of the undesirables/disagreeable work characteristics. Exploitation of workers through long hours of working pre-exposes them to more unsafe working conditions such as extreme fatigue, ill-health or work-related diseases. This exploitation of workers is still a rampant practice in most parts of the world and even more specifically here in Kenya. In the Bill of Rights, in the Constitution of Kenya (2010), the constitution provides that every citizen has right to labor practices that are fair, working conditions that are reasonable and as well as work environment that is clean and healthy. As a country, through the respective institutions entitled with the implementation of these provisions, we should ensure that such provisions within the constitution are adhered to. In light of this, the study endeavors to empirically determine the effect of workplace safety on earned wages and propose appropriate policy recommendations.

2.3 Empirical Literature Review

Bender et al. (2006) undertook a study to investigate whether working in a high-risk work environment contributes to high wage rates for hospital janitors in the United States. The study used data on janitors obtained from the 1985-2001 Current Population Survey with a sample size of 1137 individuals. Data on industrial injuries were obtained from the Bureau of Labor Statistics. The response variable was measured using hour wages while the key independent variable was measured using number of lost workdays to injury or illness following the criterion by Viscusi and Moore (1987). Marital status, race, education attainment, region of residence, age, and hours worked per week were used as control variables. The two-stage instrumental variables criterion was used in carrying out the empirical estimation of the model after controlling for endogeneity inherent in people selecting safer jobs with improvement in wealth. The findings indicated that after controlling for endogeneity, compensation for risk of injury and illness increased wage rates by 13.4% for union hospital janitors. This was found to be the main source of advantage in earned wage compared to those not in a trade union.

Leeth and Ruser (2003) undertook research to examine compensation for risk by race and gender using fatal and non-fatal rates that are specific to gender, race and occupation in the United States. The study estimated the reduced-form hedonic wage function using data obtained from the Census of Fatal Occupational Injuries (CFOI) and Survey of Occupational Injuries and Illnesses (SOII) covering the period between 1979-2000. The research used a sample size of 81,425 individuals. The response variable was measured as log of hourly wages. The risk variable was measured in terms of rates of occurrence of fatal and non-fatal injuries among full-time workers. Age measured in years, level of educational attainment, marital status, race, occupation and membership to trade unions were used as control variables in the hedonic equation estimated. The hedonic wage function was estimated using Ordinary Least Squares criterion. The findings of the study indicated that males were compensated for exposure to risk of non-fatal and fatal work-related injury while females obtained compensating wage differentials for exposure to non-fatal risk of injury. Specifically, female wage premiums for exposure to risk of non-fatal injury were found to exceed wage premiums for males by a factor of over three. Further, compensation for risk of non-fatal injury was found to be widespread across the various demographic categories. Compensation for risk of exposure to fatal injury was found to be statistically significant among white and Hispanic males as they earned higher wages for exposure to higher risk of fatal injury. The findings of the study support Bender et al. (2006) in that workers exposure to higher risk of injury at the workplace earn higher compensating wage differentials than workers working in safer work environments.

Donnie and Lanoie (2004) undertook to examine the hedonic wage function and value of life in an African country (Tunisia) using national data from the *Caisse nationale de la sécurité sociale* (an organization in charge of workplace accidents in Tunisia) in 2002. The data used was for 48371 employees in the private sector all covered by *Caisse*. The purpose of this paper was to test the existence of wage-risk premiums in the country. The basic framework of the paper used data on workers' wages, job risks and other individual worker characteristics for example education, education², experience, experience², gender, age, area of residence and union status. They further considered risk as an endogenous variable and safety as a normal good. The endogeneity of the job risk implied that the OLS estimates of the wage equation would be biased, but a Hausman test run on the data set also rejected the exogeneity of the job risk variable. The empirical model was analyzed using the Instrumental Variable regression for the risk variables and the results were

strong, positive and significant. The control variables were mostly significant with the expected sign.

Gunderson and Hyatt (2001) estimated using three models the effect of risk on wages: the OLS regression model which entails a two-stage instrumental variable process in which the risks are endogenized and instruments from the risk variables are included as the regressors, endogenous risk model that accounted for simultaneity that would occur if workers with potential of earning higher wages prefer safe jobs and a self-selection model which allows for the possibility that the productivity in dangerous environment maybe different among individual and therefore these unobserved worker characteristics may affect his decision on how much risk to expose himself to. These individual unobserved characteristics makes the error term to be more complicated. The data used was from the *Survey of Ontario Workers with Permanent Impairments* and the dependent variable was expressed in form of a natural logarithms of the wage in hours. Results from the basic model show that the compensating wage premium for any work-related injury was positive and significant. From the endogenous risk model results, the compensating wage premiums was five times more of the results from the basic model implying that compensating wage premium for work place injuries is understated in the models that do not factor in the endogeneity of risk.

Siebert and Wei (1994) on their paper on compensation for workplace risk of injury for union and non-union workers followed the footsteps of Moore and Viscusi (1990) and in their model estimation they made the risk variable endogenous to avoid a downward biasness of OLS since people with high unobserved ability and should have higher earnings end up choosing less risky jobs. They also assumed safety to be a normal good. The dataset they used was the 1983 General Household Survey. Level of education and experience are used as some of the control variables. In their model they used OLS and used the two stage least squares approach to replace risk chosen by a worker with the risk predicted by an equation which only includes measured abilities. The results from OLS indicated a significant positive wage compensation for fatal risks.

Purse (2004) in his review on neoclassical compensating wage differentials based on econometric findings for over three decades concurs with the theory that some jobs have some degree of disagreeableness in terms of geographical isolation, long working hours and most importantly dangerousness of the work. He embraced (Ehrenberg and Smith, 1997, p.263) theory that wages are higher for riskier jobs after controlling for factors like skills or level of education and other

variables that have impact on earnings. Purse assumes a perfect competitive market and where the demand for and supply of labor clears. He also highlights concerns by (Viscusi, 1993) that past studies faced a limitation of insufficient data. Findings from his review found out that most studies formulated estimation equations sought to establish the type of relationship that exists between wages and the risks of fatality at work after controlling for variables that have effect on wages. Some of these variables include years of education and experience, regional wage variations and union status. Most studies sought to use the logarithms of hourly wages rate as the dependent variable to investigate the impact of risk on wages. From his review, most of the studies established positive relationship between workplace safety as measured by fatalities and obtained wages for example the works of (Rosen and Thaler,1976), (Viscusi 1980), (Oslo 1981), Dorsey and Walzer (1983) and Dillingham (1985). Most studies defined risk as an exogenous variable but on closer examination risk could be correlated with earnings and more specifically wealth. As the workers' wage or wealth increases the more likely they are to turn down job offers with high levels of risk exposure. In this sense, risk of injury at workplace is treated as endogenous and the use of a simple OLS estimation would generally give biased estimates. A more appropriate regression included the use of two-stage least square method to control for the biasness. Results from re-estimated equations showed a relatively higher compensating differential associated with earned wages in 2SLS than reported under the OLS estimation. This meant there was underestimation of the impact of workplace safety on wages.

On their study on Compensating wage differentials (Rosen & Thaler, 1976) used insurance data which provided information on occupational deaths for the period spanning 1955-64 obtained from the US Society of Actuaries. The data had personal and industrial variables capturing characteristics of male workers. It was obtained from the Survey of Economic Opportunity. Approximately, a sample of 900 individuals were interviewed. Rosen and Thaler (1976) developed a wage estimation equation that examined compensation for risk of injury employing OLS technique. The variables used to explain wage earnings were education attainment, age, marital status and membership to trade unions.

The study found out that the relationship between earned wages and risk of injury at workplace was positive and statistically significant. Informed by the findings of the study, several estimations were done on the statistical value of life. Their study, however, received some strong critic which

highlighted that risk variable was incorrectly specified. Nevertheless, their study has been widely used to formulate more compensating wage differentials in many areas of the world.

Cousineau et al (1992), in their paper on occupational hazards and wage compensating differentials backed up Viscusi (1978) and Rosen and Thaler (1978) work that workers will demand to be compensated with more wages for the disutility derived from unsafe workplaces and the market will correspondingly offer higher wages for risky jobs. This study estimated the wage functions expressed as a natural logarithm of the hourly wage and the independent variables included gender, level of education qualification, industry, gender, union status and basis of pay. The data used was sourced from Labor Canada (1979) and from the Quebec Compensation Board data bank. An OLS estimation was done, the control variables had positive coefficients which were significant, and the risk variable was also positive and significant.

Kniesner and Leeth (1991) examined the effect of risk of fatal injury at workplace on wage earnings of manufacturing workers in Japan, United States and Australia. The data for United States was obtained from the Current Population Survey for 1978. The key independent variable was measured in number of industry workdays lost due to injury. The dependent variable was measured using logarithm of weekly average wages for full-time workers in the manufacturing industry. In Australia, data covering 1984-1985 was used in carrying out the empirical estimation. The dependent variable was measured as logarithm of average annual earnings while exposure to risk of injury was measured in form of average rates of work-related injuries and disease prevalence. In Japan, the dependent variable was measured using logarithm of average monthly earnings. Work place safety was measured using injury and fatality rates related work. Control variables used in the empirical estimation were race, gender, marital status, education, religion, age, size of industry and membership to trade unions. The empirical estimation of the Hedonic Wage Function was done using multiple regression. The results for Japan indicate that there exists significant effect of exposure to work-related risk on wage earnings. Specifically, exposure to fatality risk in Japan was associated with compensating wage differential of 1.4%. In Australia, workers exposed to work-related risk of injury were found to have a statistically significant compensating wage differential of 2.5% higher compared to workers working in safe work environment. In United States, workers exposed to higher risk of work-related fatality were found to have a statistically significant wage compensating differential of 1% compared to those not exposed to work-related fatalities. The findings reflect those obtained by Bender et al. (2006).

2.4 Overview of Literature

The review of theories and empirical literature has laid the foundation for the study. From the review of literature, most studies estimated the Hedonic Wage Function using the natural logarithms of hourly wages for an individual as the dependent variable. Other individual characteristics were used as control variables. They include; age, gender, sex, level of education, years of experience, membership to trade unions, race, size of industry, marital status and exposure to work-related risk of injury. Most of the studies reviewed used cross-sectional data and the OLS estimation model gave results that were positive and statistically significant. This study, similarly, will use cross sectional data for estimation of the Hedonic Wage Function for Kenya using the OLS method which minimizes sum of squared residuals.

Studies like that by Bender et al. (2006) assumed risk of injury to be endogenous and a normal good. In those studies where risk of injury was endogenous, the variable was continuous. Since endogeneity was a major problem in those studies, the two-stage least squares estimation criterion using instrumental variables was used. In this study, risk of injury, which is measured as a dummy variable with 1 if a worker sustained work-related sickness or injury and 0 if otherwise, is taken to be exogenous. The reason is that workers, at least in the real world, are unable to estimate with certainty the amount of risk embedded in a job before they take it. Even after they have taken the job, workers can't accurately estimate the amount and nature of risk the job will predispose them to in the future, as work environment and other industry parameters evolve. This makes workers to have no control over the choice on the type and nature of the job to take due to informational asymmetry and inability to accurately anticipate future industry developments that may expose them to increased risk of getting disease or sustaining injury. The findings of the empirical studies reviewed established a positive and statistically significant relationship between risk of injury at the workplace and earned wages. Similarly, this study anticipates that the coefficient of work-related risk of injury will be positive and statistically significant.

CHAPTER THREE

METHODOLOGY

3.1 Introduction

In this section, the concept governing the research is presented. Data to be used in carrying out the empirical estimation is described. The dependent variable, the key independent variable and control variables, and the way they are measured, are explained. Diagnostic tests such as the test for normality and heteroscedasticity are undertaken. The model to be used in carrying out the estimation is also documented.

3.2 Theoretical Framework

The worker supplies labor to the market. Her objective has to do with maximizing utility derived from engaging either in wage-earning activities or leisure subject to income and time constraint. Workplace safety is a shift factor on the labor supply curve¹. Mathematically, the objective is to:

$$\text{Maximize } U = \mu(Y, L_H) \quad \dots(1)$$

$$\text{Or Maximize } U = YL_H \quad \dots (2)$$

Where U is utility, Y is income, and L_H is hours spent on leisure.

Subject to:

(i) *Income constraint;*

$$Y = wY_H + N \quad \dots(3)$$

Where w is monthly wage, Y_H is hours devoted to wage-earning activities, and N is non-wage income.

(ii) *Time constraint;*

$$T = Y_H + L_H \quad \dots(4)$$

Where T is total 24 hours available to the worker in a day, Y_H , is hours spent on wage-earning activities, and L_H is hours spent on leisure.

¹ Workplace safety shifts the labor supply curve either rightward or leftward. If the place of work is unsafe, the supply curve shifts rightward if the offered wage is above the equilibrium wage but the employer does nothing to improve workplace safety. Similarly, the supply curve shifts leftward when the offered wage is below the equilibrium wage but the employer invests towards making the workplace safer.

Substituting equations (3) and (4) to equation (2) I get:

$$U = wY_H T - wY_H^2 + NT - NY_H \quad \dots(5)$$

Taking the first order conditions of U with respect to Y_H I get:

$$\frac{\partial U}{\partial Y_H} = wT - 2wY_H - N = 0 \quad \dots(6)$$

From equation (6), we make w , which is the monthly wage, the subject of the formula to get the wage equation as presented in equation (7).

$$w^* = \frac{N}{(T - 2Y_H)} \quad \dots(7)$$

Where w^* is the optimal monthly wage accruing to a worker. Since leisure is assumed to be a normal good, when non-wage income increases, demand for leisure increases and the number of hours worked in exchange for wage income decreases.

To determine whether w^* is optimal, the second order conditions of equation (6) are obtained and the sign determined whether it is negative. If the sign is negative, then w^* is optimal.

$$\frac{\partial^2 U}{\partial Y_H^2} = -2w \quad \dots(8)$$

3.2.1 Assumptions

A major role of the labor market is to provide signals and mechanisms through which utility maximizing workers can be matched with profit maximizing employers. On the one hand, workers are heterogeneous in terms of skills and preferences pertaining job offers that they would accept. On the other hand, employers offer jobs that differ in descriptions, requirements and the safety of the working environment (Ehrenberg & Smith, 2006).

This research assumes that workers strive to maximize utility derived from wages earned and the risk of injury, which embodies workplace safety. The implication is that workers are interested in both the pecuniary and non-pecuniary aspects of a job opportunity. Pay is not all what matters before a worker accepts a job offer as occupational tasks and how workers' preferences mesh with specific job tasks are critical in matching potential workers to potential job opportunities.

The study makes numerous logical assumptions that will underpin the empirical analysis. Firstly, the paper assumes that jobs in the labor market are not exactly alike and are located in different

places. In other words, there are jobs with desirable and undesirable characteristics. Some jobs are located in clean, secure and modern environments, while others are located in noisy, dusty and dangerous environments. Some jobs allow workers to have discretion over the number of hours of work and the pace of working, while others offer less flexibility. The jobs with desirable characteristics are good jobs, while jobs with undesirable characteristics are bad jobs. Secondly, it is assumed that heterogeneity of workers' preferences pertaining magnitude of job risk that they may be willing to take up is real, a factor that plays a significant role in wage negotiations before a job offer is accepted. Thirdly, it is assumed that workers do not only care about the wage characteristics of a job, but also about the non-wage characteristics. Fourthly, the study makes a logical assumption that wages in undesirable jobs should be higher than wages in jobs with desirable characteristics². Firms with unsafe jobs should pay an extra wage, known as compensating wage differential, in order to attract workers. Although workplace safety is a non-wage job characteristic, workers should be compensated³ with higher wage for being exposed to unsafe work environments. Fifthly, the study assumes that if wages for safe and unsafe job were the same, workers would rationally choose the safe job. The logical reason for this would be that whereas the wage rate is the same, the probability of injury at work is different for the two jobs. Sixthly, the study assumes that workers who are indifferent to workplace risk are too few to fill all the available unsafe job opportunities in the labor market. The seventh logical assumption is that, in real world, it is almost impossible for a new worker to establish with certainty the actual probability of injury before they have accepted a job offer and signed a binding job contract. They may realize some of the inherent risks that the job they took predisposes them to when they have actually started working. Even when they establish the real risks that they face in the current job, they may not be able to ascertain the nature and magnitude of risks they are likely to be predisposed to in the future. The implication in the last assumption is that the utility of workers may be improved if the government intervenes with occupational safety and standards that require employers, who are better informed about the real risks that new workers may face in the firm, to make investments to make workplaces safe or compensate workers for working unsafe work environments.

² Positive differentials accompany jobs with undesirable non-wage characteristics while negative differentials accompany job with desirable non-wage characteristics (Ehrenberg & Smith, 2006).

³ Compensating wage differentials can be viewed as the prices at which working conditions can be purchased by, or sold by workers (Ehrenberg & Smith, 2006).

3.3 Econometric model

Selection of variables into the model was guided by theory and observability of variables in the dataset. The Hedonic Wage Theory was estimated using the Ordinary Least Squares regression. The specific econometric model that was estimated is given by:

$$\text{LogWage}_i = \beta_0 + \beta_1 \text{Work related injury} + \beta_2 \text{Education} + \beta_3 \text{Gender} + \beta_4 \text{LogAge} + \beta_5 \text{Marital Status} + \beta_6 \text{Union} + \mu ; \quad \dots (9)$$

Where μ is a stochastic error term measuring the effect of other variables that affect wage earned but are unobservable in the dataset used to carry out the analysis. β_i is vector of parameters being estimated.

3.4 Definition of Variables

The following table shows definition of variables and expected signs.

Table 1: Definition of variables

Variable	Definition	Expected Signs
Natural log of wage	Salary earned in the last one month in Ksh	
Injury—Work related	1 if work-related, 0 if otherwise	+
Education—primary	1 if primary, 0 if otherwise	+
Education—Secondary	1 if secondary, 0 if primary	+
Education—Diploma	1 if diploma, 0 if primary	+
Education—University	1 if undergraduate, 0 if primary	+
Gender	1 if male, 0 if female	+
Natural log of age	Measured in years (15-64)	+
Marital status	1 if married, 0 otherwise	+
Trade unions	1 if a member, 0 otherwise	+

Source: Own Construction

3.5 Data

Data obtained from the 2015/16 Kenya Integrated Household Budget Survey (KIHBS) was used to undertake the analysis. This was the most recent dataset. The survey was conducted over a 12-month period by the Kenya National Bureau of Statistics (KNBS) to obtain data on a range of socioeconomic indicators. This dataset has information on household characteristics, household demographics information, education and labor. Indeed, the dataset also captures the most recent developments in the Kenyan labor market. Specifically, it captures information on work-related injuries. By this virtue, it was the most appropriate dataset for use in carrying out the empirical analysis.

The individual was the unit of analysis for the study. The entire dataset had 92, 846 individuals whose information was captured by the survey. Some 10,992 individuals had zero wage in the last one month while 27, 689 had non-zero wage. 921 individuals had sustained work-related injuries. There were 45,908 males and 46,938 females. 1,688 individuals were members of trade unions while 32,872 were not. 48,922 individuals were aged between 15-64 years. This is the conventional labor force participation age. 28,560 individuals were married while 37,458 were unmarried. 48,520 individuals had schooled up to primary, 14,836 secondary, 3,967 college, and 1,714 university level. Disparities were due to missing values.

However, this paper used a sample of 6,086 individuals. The sample comprised of employed individuals who earned a basic minimum monthly wage of at least Ksh 13,600. The minimum wage was informed by the 2018 Legal Notice on Regulation of Wages which set the basic minimum monthly wage at Ksh 13, 572 for general workers (Government of Kenya, 2018). The individuals were within the labor force participation age of 15-64 years (ILO, 2010), were either married or unmarried, had primary as the lowest level of education and university has the highest level, were either members or non-members of a trade union, either male or female, and had either sustained injuries related to work or had not sustained injuries.

3.6 Diagnostic tests

3.6.1 Summary statistics

Table 2: Descriptive Statistics

Variable	Observations	Mean	Standard deviation	Min	Max
WAGE	6,086	31287.81	34457.05	13600	999999
Injury_ work-related	6,086	.0167598	.1283807	0	1
Gender-male	6,086	.7226421	.4477314	0	1
Gender-female	6,086	.2773579	.4477314	0	1
Education-primary	6,086	.3197502	.466418	0	1
Education-Secondary	6,086	.3023332	.4593066	0	1
Education-College	6,086	.2446599	.4299207	0	1
Education-University	6,086	.1332567	.3398798	0	1
Marital status-unmarried	6,086	.185672	.3888737	0	1
Marital status-married	6,086	.814328	.3888737	0	1
Trade union-member	6,086	.7932961	.4049745	0	1
Trade union-non-member	6,086	.2067039	.4049745	0	1
AGE	5,939	38.4063	10.34586	15	64

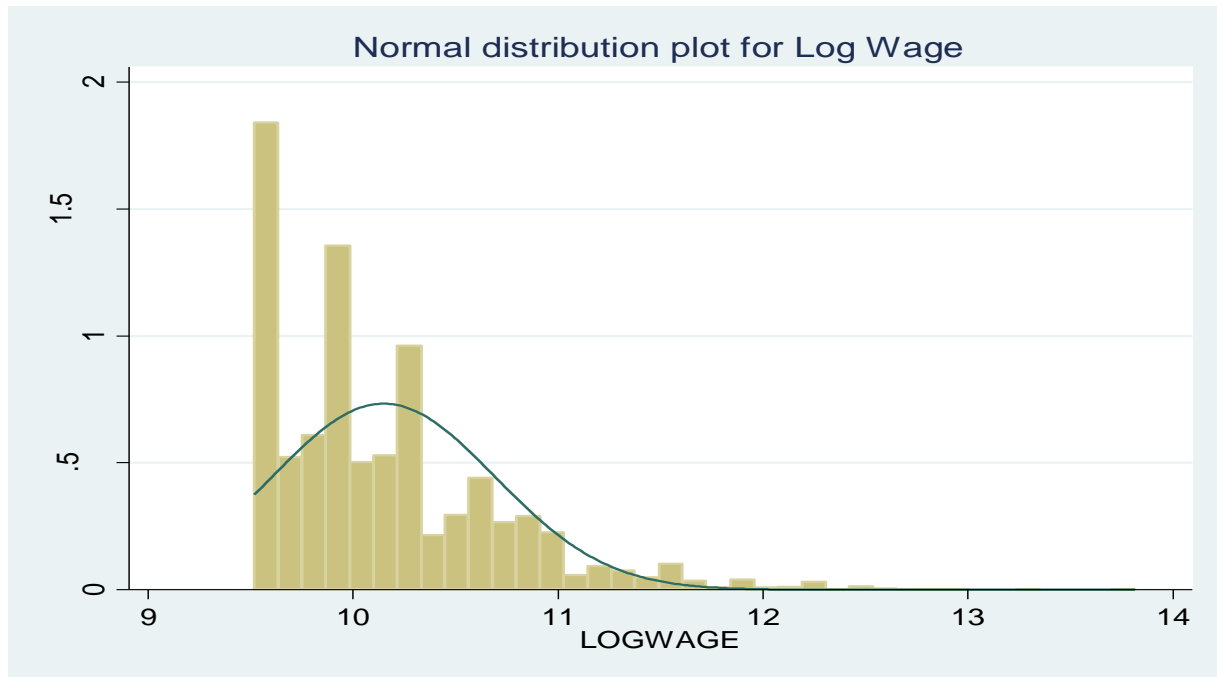
Source: Own Construction

Table 2 presents the summary statistics. On average, an individual earned a basic monthly wage of Ksh 34,457, which is more than double the basic minimum monthly wages for a general laborer of Ksh 13,572. The average age for individuals within the labor force participation age was 38 years. Most of the individuals participating in the labor force were males (72%) compared to females (28%). Of the individuals earning a monthly wage, 79% were members of a trade union while 21% were non-members. Most of the individuals (32%) had schooled up to primary level while 13% had at least a university degree.

3.6.2 Normality test

Table 3 presents results for normality test. Log wage, log age, education, marital status, injury and membership to trade unions followed a normal distribution ($p\text{-value} < .05$). Only gender was not normally distributed.

Figure 3: Normality plot for log wage



Source: Own Construction

Table 3: Shapiro-Wilk Normality Test

Variable	Observations	W	V	Z	Prob>Z
Log Wage	6,086	0.89017	354.299	15.495	0.00000
Work-Injury	6,086	0.98048	62.981	10.936	0.00000
Education	6,086	0.99726	8.840	5.753	0.00000
Gender	6,086	0.99966	1.104	0.261	0.39708
Log Age	6,086	0.52981	1516.738	19.333	0.00000
Marital Status	6,086	0.99908	2.982	2.884	0.00197
Trade Union	6,086	0.99898	3.274	3.131	0.00087

Source: Own Construction

3.6.3 Heteroscedasticity

Table 4 presents the Breusch-Pagan test for heteroscedasticity. The OLS regression was first estimated after which the test for heteroscedasticity was undertaken. A p-value of .0000, which is less than the 5% level of significance ($p < .05$), was obtained. The null hypothesis of homoscedasticity was thus rejected implying the error terms were non-constant. The presence of

heteroscedasticity meant that the obtained parameter estimates were unbiased, but inferences were inefficient. Since the cause of heteroscedasticity was unknown, the OLS regression model was estimated to obtain unbiased parameter estimates, after which robust standard errors were obtained to aid in carrying out hypothesis testing on significance of the estimated parameter estimates.

Table 4: Test for Heteroscedasticity

Chi2(1)	245.19
Prob>chi2	.0000

3.6.4 Multicollinearity

Table 5: Variance Inflation Factor for Multicollinearity

Variable	VIF	1/VIF
Education-Secondary	1.38	0.726982
Education-College	1.49	0.672411
Education-University	1.37	0.727924
Log Age	1.04	0.963322
Injury_ work-related	1.00	0.997615
Marital status	1.20	0.836091
Union	1.06	0.940271
Gender	1.06	0.944927
Mean VIF	1.20	

The mean VIF was 1.20. Since it was less than the conventional VIF mean of 10 that is considered acceptable, multicollinearity was not a serious problem for the study.

CHAPTER FOUR

RESULTS

4.1 Introduction

In this chapter, the empirical results obtained from the estimated model are presented. The results are interpreted in light of the research problem and hypotheses tested.

4.2 Empirical Results

Here, the study presents the results for empirical test of the Hedonic Wage Function using multiple OLS regression model.

The OLS regression model estimated was a good fit ($F=156.37$, $p=.0000$). The R^2 was .1989 meaning the proportion of variation in earned wages explained by the independent variables was 19.89%. The R^2 is reasonably acceptable given the study used cross-sectional dataset. It is common to have small R-squared⁴ for studies using cross-sectional data (Liliana & Antonija, 2005).

Table 6 shows the independent variables have the expected signs. For every 1% increment in an individual's age within the labor force participation age, earned wage increased by .051%, on average, holding the effect of other explanatory variables constant. The effect was statistically significant. An explanation for this observation could be that individuals earn more as they advance in age within the 15-64 labor force participation age because they become more experienced and specialized in executing their duties, a factor that should translate to increased productivity.

Individuals who sustained work-related injuries earned 4.1% more compared to those who did not sustain injuries. The effect of work-related injuries on earned wages was, however, not statistically significant. This is supported by Ehrenberg and Smith (2006) who note that workers exposed to work-related injuries should be offered a compensating wage differential to compensate them for utility lost due to being predisposed to unsafe work environment.

Education had statistically significant effect on earned wages. The higher the level of education one attained, the higher earned wages were. Specifically, individuals with secondary level of education earned 11.5% more compared to those with primary level. Individuals with college education earned 26.0% more compared to those with primary level. Those with university

⁴ The R^2 for cross-sectional studies does not have to be very high. Small R^2 in cross-sectional analysis are not abnormal. The R^2 for this study, which uses cross-sectional data, is deemed adequately high.

education earned 73.5% more compared to those with primary education. The explanation is that education is a signal of a worker's skills which translate to actual productivity (Ehrenberg & Smith, 2006). The higher the level of education attainment, the stronger the signal on a worker's potential productivity and the higher the wage rate commanded in the labor market. Indeed, individuals with university education level have spent more years schooling and have thus accumulated more stock of human capital which translates to worker productivity (Hunter & Leiper, 1993). Subsequently, higher productivity is compensated with higher wage.

Table 6: OLS Regression Results (Robust t-statistics)

Variable	Coefficient	Robust SE β	P-Value
Constant	9.52891 (204.68)	.0465558	0.000
Natural log of Age	.05097** (4.45)	.011442	0.000
Work-related injury	.0411125 (0.68)	.0601492	0.494
Education—Secondary	.1150188** (7.88)	.0145881	0.000
Education—College	.2603047** (14.63)	.0177949	0.000
Education—University	.7352893** (28.01)	.0262517	0.000
Gender	.075923 (5.50)	.0137934	0.000
Marital status	.0813018** (5.14)	.0158109	0.000
Trade union	.0339112*** (1.93)	.0175845	0.054
Number of observations	6,086		
R ²	0.1989		

Source: Own construction, ** means significant at 5% while *** means significant at 10%

On average, males earned 7.6% more compared to females. This could be explained by differences in education attainment between males and females which translates in differentials in productivity. Acquired skills signal productivity of a worker and thus the wage earned. Another explanation could be that women are more likely to work part time or take up jobs with less demanding schedules in order to assume the primary role of child-bearing and other household duties. This may translate in women supplying fewer hours in market jobs and thus lower earned wages.

Married individuals earned 8.1% more compared to unmarried ones. This observation is in agreement with Korenman and Neumark (1991) who note that married individuals earn substantially more than unmarried ones. Marriage may serve as a signal of responsibility which attracts a marriage premium.

Members of trade unions earned 3.4% more compared to non-members. Trade unions engage on wage bargaining with employers on behalf of their members (Kornfeld, 1993). This factor translates to members of trade unions earning more than non-members.

CHAPTER FIVE

CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Introduction

This chapter provides a brief overview of the findings and discussions in accordance with the objectives stated in chapter one. It also presents conclusions, recommendations and suggestions for future research.

5.2 Summary of findings

The empirical findings support the Hedonic Wage Theory. The coefficient for workplace safety was positive, meaning there is a positive relationship between workplace safety and wage earnings. A compensating wage differential should be provided for workers in environments that predispose them to risk of injury.

Wage earnings for individuals within the labor force participation age of 15-64 years increased with advancement in years. On average, individuals who had sustained work-related injuries earned more compared to those who did not sustain injuries.

Wages earned were found to increase with advancement in education level. Individuals with university education earned the highest wages while those with secondary education level earned the least.

Males earned more compared to females. Married individuals earned more compared to unmarried ones while earned wages were higher among members of trade unions compared to non-members.

5.3 Conclusion

The empirical findings indicated that workplace safety has positive effect on wage earnings. The implication is that the Hedonic Wage Theory is supported by data from the Kenyan labor market. All the explanatory variables were found to have positive effect on wage earnings. Education, gender, marital status, age, and membership to trade union had significant effect on wage earnings. Despite having positive coefficient, work-related injuries had insignificant effect on wage earnings. One of the reasons for this observation could be the fact that it was looked at from the point of work-related injuries only, excluding work-related diseases. Considering workplace safety as comprising both the former and the latter could return significant effect on earned wages.

5.4 Recommendations

From the empirical findings, a number of policy recommendations are drawn. The first policy recommendation is that employers should remunerate workers on the basis of safety of workplace. Employers whose work environment is unsafe and predisposes workers to risk of injury should offer workers a compensating wage differential to ensure they are compensated for the utility lost by working in a riskier environment. In cases where employers are unwilling to offer a compensating wage differential that is commensurate to the amount of risk workers are exposed to, they should invest towards ensuring the workplace is safe for workers.

To ensure employers take the responsibility of ensuring safety of the workplace, the Occupational Safety and Health Act should be enforced to prevent work-related injuries while protecting third parties from being predisposed to higher risk of injury associated with activities of people at places of work. Further, the Work Injury Benefits Act should be reviewed and enforced to ensure workers who sustain work-related injuries get compensated adequately. The Directorate of Occupational Safety and Health Safety should additionally be empowered to ensure it has the necessary capacity to undertake safety inspections at all places of work. This should be done because absence of sound enforcement of ratified occupational safety and health policies and standards, informational asymmetry between employers and workers pertaining the magnitude of the actual work-related risk that workers are predisposed to can be immense. Further, the clause on the Occupational Safety and Health Act that mandated employers in Kenya to have insurance policy for employees needs to be reconsidered and reviewed after it underwent nullification in court. The review would help ensure informational asymmetry is mitigated and that employers do not exercise adverse selection by failing to declare all risk embedded in a job before a worker accepts an offer.

5.5 Suggestions for future research

The current study succeeded in providing empirical evidence in support of the Hedonic Wage Theory. The data indicated that workers in unsafe places should be offered higher compensating wage differential to compensate them for the lost utility and vice versa. Despite this success, the study looked at workplace safety from the point of work-related injuries only. Due to absence of data, the study did not consider work-related diseases in the estimation. Future studies should thus endeavor to include work-related diseases in the estimated model in addition to work-related injuries in order to have a conclusive feedback on the effect of workplace safety on earned wages.

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