

A Hedonic Wage Regression Model for Vulnerable Workers in Malaysia: The Use of Exclusion Restriction as a Remedy for Self-Selection Bias

(Model Regresi Gaji Hedonik untuk Pekerja Terancam di Malaysia: Penggunaan Sekatan Pengetepian sebagai Remedi untuk Bias Pilihan Sendiri)

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ABSTRACT

This paper uses an exclusion restriction variable as the key to resolve an identification problem in self-selection bias of a wage regression model. The study basically utilizes Hedonic Wage Theory (Rosen 1986, 1974) to test the relationship between vulnerable workers and wage. Analysis was made using the Mincerian semi-log earnings function (Mincer 1974) specified in the tradition of Becker's Human Capital Model (Becker 1964) with a correction for self-selection bias. A total of 1705 private sector employees were selected and the result showed that the coefficient for predicted vulnerable worker variable was significant but non-positive. The implication of this result is that no adjustments in wages are made to compensate workers for undesirable job conditions. A third party, namely government interventions, is therefore needed in order to protect and enhance the well-being of the vulnerable workers.

Keywords: Bias; self-selection; vulnerable; wage

ABSTRAK

Kajian ini menggunakan pemboleh ubah sekatan pengetepian untuk menyelesaikan masalah bias pilihan sendiri dalam model regresi gaji. Secara prinsipnya, kajian ini menggunakan Teori Gaji Hedonik (Rosen 1986, 1974) untuk menguji hubungan antara pekerja terancam dan gaji. Analisis dijalankan dengan menggunakan fungsi pendapatan Semi log (Mincer 1974) yang diterangkan dalam Model Sumber Manusia Becker (Becker 1964) yang memperbetulkan bias pilihan sendiri. Sejumlah 1705 pekerja sektor swasta telah dipilih. Keputusan menunjukkan pekali kepada pemboleh ubah pekerja terancam adalah signifikan tetapi negatif. Implikasinya, tiada pembedaan gaji dibuat sebagai pampasan kepada pekerja yang terlibat dalam persekitaran pekerja yang tidak sihat. Pihak ketiga iaitu campur tangan kerajaan diperlukan untuk melindungi dan meningkatkan kebajikan pekerja terancam ini.

Kata kunci: Bias; gaji; pilihan sendiri; terancam

INTRODUCTION

Self-selection bias occurs when the observations in the sample are not randomly selected from the population from which one would like to draw inferences (Heckman 1979). In the typical self-selection model, the parameter of an outcome equation is estimated from observations on individuals who self-selected into the sample on the basis of a criterion that is correlated with the dependent variable of the outcome equation (Heckman 2010; Lavrakas 2008).

The interest of this study is to estimate the expected income of a randomly chosen individual if he or she is a vulnerable worker. Computing the average income of those who actually are vulnerable workers is likely to be biased because those observed as vulnerable or non-vulnerable perhaps chose their occupation because of their own unobserved characteristics and expect to earn a relatively high income.

This is due to the fact that the difference in the nature between vulnerable and non-vulnerable occupations is

likely to induce workers to self-select based upon their observable and unobservable characteristics such as risk and monetary benefits. Vulnerable occupations are expected to be more common among male, young, and high-skill workers.

Sources of selection bias are derived from the Hedonic wage theory. Specifically, all individuals select their own desired job. Workers often avoid working in vulnerable occupations that feature 3Ds characteristics (i.e. Dirty, Dangerous, Difficult). Although this type of job offers higher salary, it is often associated with a high risk, unpleasant and uncomfortable working environment. Failure to consider this problem may result in a self-selected sample rather than a random sample which at the end produces a bias in estimation.

The Hedonic wage theory basically suggests that wages should be equal to labour productivity. Labour exploitation takes place in the market if the labour is being paid lower than its productivity. This standard labour market model is based on assumptions of homogeneity

of workers and firms, perfect competition, and profit maximization. Under such circumstances, a single wage equalizes the quantities of labour supplied and demanded. If the wage is too low, the excess demand for workers drives the wage up, while if the wage is too high, the excess supply of workers drives the wage down. Contrary to the basic model, there are clearly differences among the wages of individuals. Most of them accept these different wage levels as the natural result of living in a competitive capitalist market economy.

One of the main neoclassical theories explaining wage differentials among workers is the theory of equalizing differences, often referred to as compensating differences. In the theory of equalizing differences, wage differentials are identified as a result of intrinsic properties of specific occupations that require wage compensation for negative job traits or are compensated for with non-pecuniary positive traits. The theory of equalizing differences can be traced to Adam Smith's *The Wealth of Nations* (Smith 1776). Adam Smith explained that labourers receive different wages due to five factors that are associated with job characteristics, such as a worker's willingness to accept a job, level of job difficulty, job sustainability, job responsibility, and career prospects. To illustrate, if wage is the only criterion for a worker's willingness to accept a job, there are three things that could make the wage differ across labour. These factors are level of job difficulty, job risk, hygiene, and social status of the job. The workers should be paid higher than their counterparts if their jobs are challenging, dangerous, and have low levels of hygiene and social status. Theoretically, those who are willing to work in this kind of environment must receive high compensation in the form of higher wages. In principle, a labourer prefers to work in a less difficult and dangerous occupation.

The goal of this paper is therefore to use an exclusion restriction variable as the key to resolve an identification problem in self-selection bias of a wage regression model. Therefore, the study applies the Hedonic wage model (Rosen 1986, 1974) to test the relationship between vulnerable workers and wage based on Mincer's semi-log wage function (Mincer 1974). The Hedonic wage model is based on a traditional human capital Becker model (Becker 1984) with corrected self-selection bias. Ultimately, the study decomposes wage differentials between vulnerable and non-vulnerable workers to identify the extent to which observable and non-observable characteristics contribute to the wage gap.

The paper is structured as follows. In the next section, the discussion on the Hedonic wage theory is presented. In the following sections, the methods and the data used in the paper are examined. Subsequent section contains the analysis and discussion of the results. The final section concludes the paper and outlines some of the possible implications of the results.

HEDONIC WAGE THEORY

The relationship between unpleasant job characteristics and wage produces the Hedonic wage model (Frank 1999; Hwang et al 1998; Rosen 1986, 1974). Instead of a single wage, a wage function equilibrates the quantity of labour supplied to the quantity demanded at or near possible values of the attribute. The fundamental theory of Hedonic wage function argues that the difference in wages is due to different job characteristics. In particular, the Hedonic model of wages corresponds to the idea that there are compensating differentials that workers would get higher wages for job that were more unpleasant. Unpleasant jobs in the Hedonic wage theory feature a specific occupational risk. This condition is very similar to workers who are in vulnerable occupation. The main assumption of the theory is that every worker is biased against risk or vulnerability. To be able to attract workers to work to an unpleasant job, an increase in risk is associated with an increase in wage as well. Similar relationships can also be found in employer preference. Since a firm's main objective is to maximize profit, for every decrease in risk, there will be a reduction in wage so that the production cost does not change. As a result, those who receive high wages are those workers who are involved in risky or highly unpleasant jobs.

The existing literature, however, does not totally support that labourers who work in unpleasant jobs earn high wages (Brown 1980; Elliott & Sandy 1998). Liu et al. (1997) for example found that there was clear evidence that labour wage depends on the risk of the job in the Taiwan's labour market. In contrast, Bocquier et al. (2010) found that there was no wage compensation for labourers who worked in riskier jobs in seven capital cities in West Africa. They concluded that labourers are still receiving low wages despite their hazardous working environments.

Excess labour supply could be a potential reason to explain why research findings have been contradicted by the Hedonic wage theory. The excess labour supply occurs because workers have no job options due to lack of education and skill. In addition, the influx of legal and illegal foreign workers into the labour market, at least for the case of Malaysia, worsened the scenario. These foreign workers, who have at least the same productivity level as locals, are preferred due to their low reservation wage. Thus, the labour market is in favour of foreign workers in terms of employment and job opportunities. Economic Planning Unit, Prime Minister Department of Malaysia reported that there were more than 2 million foreign workers in Malaysia during 2015. Majority of them concentrated in the construction sector. Therefore, to establish a positive relationship between wage and job risk, workers should have been given choices to select their own occupation.

Many studies (ILO 2013; Law Commission of Ontario 2012; Pollert 2007 & 2008; Pollert & Charlwood 2009; Saunders 2006, 2003; TUC 2006) have shown that

vulnerable workers existed in the workplace. Its current number is about half of the world's labour force and it is expected to keep increasing (ILO 2013). Vulnerable workers are identified based on specific characteristics from selected occupational groups considered as 'vulnerable'. For example, low-skill foreign workers and self-employed workers are often associated with vulnerability. In fact, low-skill foreign workers are very likely to be vulnerable due to the dirty, remote, and dangerous nature of their jobs. The unconducive and unsafe working environment, along with long working hours, insecure jobs, and limited employment benefit can result in a negative effect to the worker's welfare and job security. All characteristics of vulnerable workers have been mentioned in many studies (BERR 2008; DTI 2006; Pollert 2008, 2007; Pollaert & Charlwood 2009; Saunders 2003 & 2006; TUC 2007).

Most of the studies on vulnerable workers highlighted several important points on the significant existence of vulnerable workers and their wage effect in the labour market (Julia & John 2013; Lamm 2014; Sgobbi 2015). Meanwhile, there are particularly a few studies on vulnerable workers that are related to the Malaysian labour market (Shamsulbahriah 2016; Zulkifly & Hazrul 2017, 2014). Nevertheless, none of the studies addresses the problem of self-selection bias in estimating the wage effect of vulnerable workers. As a result, the estimation could skew in a large way. Specifically, the self-selection bias is a type of non-sampling error in which the individual observations in a sample are demographically or behaviorally different than the intended random sample.

Therefore, the present study contributes to the literature by taking into account the problem of workers that are self-selected into vulnerable occupations in estimating the wage effect. In particular, this study uses an exclusion restriction variable as the key to resolve an identification problem in self-selection bias of a wage regression model. The use of exclusion restriction therefore eliminates the bias caused by the workers who are self-selected into vulnerable and non-vulnerable occupations.

METHODS

SPECIFICATION

The model employed in the present study applied the switching regression models with endogenous switching developed by Maddala and Nelson (1975) and Nakosteen and Zimmer (1980). Two separate income equations were utilized for vulnerable and non-vulnerable workers. In addition, the model also included an equation describing the dichotomous decision to select vulnerable jobs. The decision equation served as an endogenous selectivity criterion that determines the strategy adopted to find employment.

A person chooses vulnerable occupation if

$$(W_{i1} - W_{i0}) / W_{i0} > \beta_i \quad (1)$$

where W_{i1} is the wage received if the individual engages in a vulnerable occupation; and W_{i0} if the individual does not. β_i represents direct and indirect costs as a proportion of income incurred by individual i if they engage in a vulnerable occupation (direct costs include cost of purchasing safety or health equipment, while indirect costs could include health and safety risk incurred). The proportionate costs are represented as a function of individual personal characteristics (X_i) and a random disturbance term as follows:

$$\beta_i = g(X_i) + \varepsilon_i \quad (2)$$

Thus, individual i chooses a vulnerable occupation if

$$I_i^* > 0 \quad (3)$$

and, does not choose a vulnerable occupation if

$$I_i^* \leq 0 \quad (4)$$

where,

$$I_i^* = \alpha_0 + \alpha_1 [(W_{i1} - W_{i0}) / W_{i0}] + \alpha_2 (g(X_i)) - \varepsilon_i \quad (5)$$

and,

$$W_{i1} = \theta_{01} + \theta_{11} X_i + \varepsilon_{i1} \quad (6)$$

$$W_{i0} = \theta_{00} + \theta_{10} X_i + \varepsilon_{i0} \quad (7)$$

The vector of explanatory variables in the income equations does not necessarily have the same elements as those which appear in the decision equation above. Furthermore, ε_{i1} and ε_{i0} are assumed to be normally distributed with variances σ_{12} and σ_{02} , respectively.

Therefore, I_i^* , W_{i1} and W_{i0} are endogenous variables. I_i^* is not observed, but only the choice of I is observed as follows:

$$I_i = 1 \text{ if } I_i^* > 0 \quad (8)$$

$$I_i = 0 \text{ if } I_i^* \leq 0 \quad (9)$$

Furthermore, $(W_{i1} - W_{i0}) / W_{i0}$ is approximated by $\log W_{i1} - \log W_{i0}$. Thus, the model is stated as follows:

$$I_i^* = \alpha_0 + \alpha_2 [\log W_{i1} - \log W_{i0}] + \alpha_3 (g(X_i)) - \varepsilon_i \quad (10)$$

ESTIMATION

First, the analysis began by running a probit regression model of the vulnerable worker;

$$P(Y_i = 1 | X_i) = 1 - \Phi(-X_i' \beta / \sigma) \\ = \Phi(X_i' \beta / \sigma) \quad (11)$$

Second, an inverse Mills ratio (IMR) is obtained from the probit model. The IMR is used to account for the self-selection bias in selecting vulnerable occupation. The IMR can be written as

$$\lambda_i = - \frac{(\phi(X_i' \beta))}{(\Phi(X_i' \beta))}$$

and for $Y_i = 0$

$$\lambda_{oi} = \frac{(\phi(X_i' \beta))}{(1 - \Phi(X_i' \beta))} \quad (12)$$

This study used the Hedonic wage theory (Rosen 1986, 1974) to explain the effect of vulnerable workers on wages. This theory was then strengthened by an empirical analysis using Mincer wage equation model (Mincer 1974). The model was initially based on Becker human capital model (Becker 1964). Based on the Hedonic theory, a vulnerable variable should yield a positive sign. That is, vulnerable workers receive higher wages, compared to their non-vulnerable counterparts.

Mincer wage equation starts with a standard Ordinary Least Square regression incorporated with inverse mill ratio to control for self-selection bias as following;

$$\ln W_i = \zeta_0 + \zeta_1 S_i + \zeta_2 EXP_i + \zeta_3 (EXP_i)^2 + \zeta_4 G_i \\ + \zeta_5 Vul_i + \zeta_6 Tenured_i + \zeta_7 Contract_i + \zeta_8 North_i + \zeta_9 \\ Central_i + \zeta_{10} South_i + \zeta_{11} Union_i + \zeta_{12} Foreign_i + \zeta_{13} \\ Inverse\ Mills\ Ratio + \varepsilon_i \quad (13)$$

with,

$\ln W_i$ is the natural logarithm of hourly wages; S_i is the years of schooling; EXP_i is the years of experience $\{(age) - (years\ of\ schooling + 6)\}$; G_i is the Male = 1 and = 0 otherwise; Vul_i is the vulnerable worker = 1 and = 0 otherwise; $Tenured_i$ is the tenured position = 1 and = 0 otherwise; $Contract_i$ is the contract worker = 1 and = 0 otherwise; $North_i$ is the North zone = 1 and = 0 otherwise; $Central_i$ is the Central zone = 1 and = 0 otherwise; $South_i$ is the South zone = 1 and = 0 otherwise; $Union_i$ is the Union member = 1 and = 0 otherwise; and $Foreign_i$ is the presence of foreign worker = 1 and = 0 otherwise.

The interested variable is vulnerable worker (Vul) with a value of 1, otherwise zero (0).

IDENTIFICATION

An 'exclusion restriction' is the key to solve an identification problem in this selection model by

incorporating variables that influence an individual's decision in selecting vulnerable or non-vulnerable jobs during the first stage regression of the probit model; but they are excluded in the second stage of wage regression. This exclusion restriction variable is the contract of service's status. This variable contributes to determining the propensity score at searching for vulnerable or non-vulnerable jobs, but not related to wages obtained. Contract of service does not affect labour wage. In particular, those who have the service contract are not being paid higher than those who do not. According to Section 2(1) Work Act 1955, contract of service is defined as 'All verbal and written agreements between employer and employee to serve and work in respective employer's firm'. The service contract is a very important document for workers to refer to in the event their employers deny their labour rights stated in the document. Indirectly, the document serves as a worker's protection from being vulnerable in the workplace. Unfortunately, there is no legal channel that monitors a proper submission of service of contract to the labour. As a result, many of them do not have their service contracts. In addition, since the contract of service is given at the start of the workers' employment, many have forgotten its content and how it should be used when their employers violate the agreement.

WAGE DECOMPOSITION

The present study further decomposed a wage differential between vulnerable and non-vulnerable workers. Thus, to estimate the wage differentials between the two groups, a standard Oaxaca Decomposition (Oaxaca 1973) incorporating self-selection bias was employed.

$$\ln \bar{W}_1 - \ln \bar{W}_0 = \bar{X}_1 (\hat{\beta}_1 - \hat{\beta}_0) + (\bar{X}_1 - \bar{X}_0) \hat{\beta}_0 + (\hat{\theta}_1 \bar{\lambda}_1 - \hat{\theta}_0 \bar{\lambda}_0) \quad (14)$$

The first term in the right hand side is the wage gap attributable to difference in unobserved characteristics. The second term is the wage gap attributable to difference in characteristics. The third term of the decomposition accounts for the contribution of selection bias due to the wage differential between vulnerable workers and non-vulnerable workers.

DATA

2012 LABOUR SURVEY

This paper utilized the 2012 Labour Survey (LS) as a sample of Malaysian workers. The data was collected for the Department of Higher Education, Ministry of Education, Malaysia under the Fundamental Research Grant Scheme (FRGS). The main objective of this survey was to provide comprehensive information and national-level estimates for Malaysia's labour force behavior and other information such as demographic status and

human capital characteristics, employment background, individuals' attitudes and satisfaction at work, and a number of geographical dimensions. The LS was conducted on a sample of currently employed workers between 15 and 80 years of age distributed nationwide. It included workers from all regions of Peninsular Malaysia. It intended to obtain information from private sector employees who earned a monthly income of less than RM2000.

For the present paper, the 2012 LS is particularly suitable because it serves as a national sample of interviews with workers across all sectors. Moreover, it is also the most recent dataset that provides relevant information on the current trends among labour in the Malaysian labour market (Osman-Rani 1980; Zulkifly & Ishak 1998) that were analyzed with different datasets. In the analysis, this study concentrated solely on private sector employees, the largest sector subgroup. In addition to this, this study also restricted the original 2012 LS dataset to salaried workers between the age of 15 and 65, so that self-employed and unpaid family-employed workers are not included in the sample. This is because data gaps will make the calculation of their wages impossible. Thus, we were left with a sample of 1,117 private sector workers.

DESCRIPTIVE STATISTICS

With regards to the Malaysian labour market, some aspects of the data are worth noting at this point. Table 1 presents simple descriptive statistics from the sample used in the analysis. In panel *A*, male workers accounted for about 42.4% of the population sample. Overall, females were the dominant group in this study. In panel *B*, temporary workers were dominated by females while the number of males was higher among contract workers. Furthermore, panel *C* shows educational background of workers along with their income. The average labour years of schooling was 12, thus implying that most of the workers had at least a high school certificate. On average, most of the respondents were young workers with an income of about RM1100 per month. Apart from that, males received higher wages than females although females had slightly higher years of schooling. This finding could be due to a gender wage discrimination; and this scenario has taken place in the labour market since a while ago (Chua 1984; Latifah 1998 & 2000; Rahmah 2011; Rahmah & Zulridah 2005; Rahmah et al. 2013).

TABLE 1. Descriptive statistics

Variables	Male	Female	Total
Sample size (Observation)	723	982	1,705
Panel <i>A</i> : Region:			
North	71	80	151
Central	182	254	436
South	250	316	566
East	220	332	552
Panel <i>B</i> : Job Status:			
Permanent	517	719	1,236
Contract	142	137	279
Temporary	64	279	190
Panel <i>C</i> : Socio-Economic Status:			
Mean years of schooling	12.2	12.5	12.4
Mean age	29.0	27.4	28.2
Mean income (RM)	1,192.2	1,033.3	1,112.8

Source: 2012 Labour Survey

RESULTS AND DISCUSSION

Table 2 shows a probit regression model of vulnerable worker's status on all individual characteristics. All the factors associated with vulnerable workers are consistent with previous study (Zulkifly & Hazrul 2014). In addition, the present study finds that older workers are positively associated with being vulnerable at a 1% significance level. As the labour gets older, productivity is expected to diminish. This is associated with the law of diminishing product of labour which states labour production declines after reaching a threshold level. Level of education significantly reduces the likelihood of being vulnerable at 1%. Those who attend longer schooling are expected to have better jobs. These jobs typically feature good working condition which possibly limits the likelihood of being vulnerable. Therefore, being an older worker and possessing a minimum education level are likely associated with low productivity. There is a huge possibility for employers to employ these low-productivity workers on a temporary basis which increases their likelihood of being vulnerable. On the other hand, foreign workers who complement domestic workers could be a good explanation of the negative relationship with the unintended choice of being vulnerable. The 'exclusion restriction' variable, contract of service, has a negative coefficient. It explained that those who do not have a contract of service are very likely to be vulnerable workers. In other words, those who have a contract of service are more aware of their rights in the workplace. Therefore, having a service contract reduces the likelihood of being vulnerable.

Table 3 shows the OLS regression of log wage for all workers. Years of schooling, experience and experience square show expected coefficients sign at a 1% significance level as in human capital theory (Becker 1964). The results were consistent with other studies such as Psacharopoulos and Patrinos (2004) and Zulkifly et al. (2010). In the meantime, the coefficient of the worker vulnerability status was significantly positive at a 1% level. In particular, a vulnerable worker received about a 15% lower wage than a non-vulnerable worker. This result contradicted the Hedonic wage theory which states that vulnerable workers should receive wage compensation in the form of higher salaries (Rosen 1986, 1974). This phenomenon arises due to the concentration of vulnerable workers in low-skill occupations. This is in addition to high unemployment rates and the restriction of workers to specific types of jobs due to skill, sociological preferences and nature of job. Therefore, they have to compete in a very limited number of jobs. As a result, the vulnerable workers in the labour market suffer from working in unsafe and unpleasant conditions as well as earning low wages.

Due to the small likelihood of being vulnerable, male workers earned about 16.2% (1% significance level) more than their female counterparts. Male gender

preference is a key advantage for male worker to obtain higher wages. This also contradicted the Hedonic theory on wage distribution of vulnerable workers. On the other hand, although non-union workers increase their likelihood of being vulnerable workers, they earned about 6.4% (5% significance level) more than those union workers. This result seems to be consistent with the Hedonic wage theory. As non-union workers are very likely to be vulnerable, the Hedonic wage theory argues that they should be paid higher than union workers as to compensate for their unpleasant working conditions. In the meantime, the presence of foreign workers reduces the wage of domestic labour. The present study has proven through the probit model that workers are less likely to be vulnerable in the presence of foreign workers. However, firms may take advantage from the foreign workers' low reservation wage to offer slightly lower wages to domestic labourers since they have limited choices in selecting occupations. Nonetheless, the employers who take the advantage of not compensating the domestic workers with sufficient wages for working in unpleasant jobs (vulnerable) could have another possible explanation to this phenomenon.

Vulnerable workers yield higher return than non-vulnerable workers both in experience at a 10% significance level and years of schooling at a 1% significance level. As the Hedonic wage theory argues that those vulnerable workers should be paid high wages, their compensation to education and experience working in an unpleasant condition should also be higher than those who enjoy working in safe and comfortable environments. Furthermore, working in such unsafe conditions typically requires certain types of training. In general, this type of training is relatively difficult and long. Therefore, there is no doubt that the compensation to education and experience is higher for vulnerable workers. Additionally, they should have invested significant amounts of money and time to gain extra education and training. In contrast, non-vulnerable workers are expected to spend less on training given their current skill and capability.

Table 4 shows Oaxaca wage decomposition with self-selection bias corrected. On average, vulnerable workers received about 10% lower wages than their non-vulnerable counterparts. The finding confirmed the result by Sgobbi (2015) on the wage premium of non-vulnerable workers over vulnerable workers. Yet, this finding contradicted the Hedonic wage theory (Rosen 1986, 1974). This phenomenon could be explained by the high concentration of vulnerable workers in low wage occupations. As a result, it causes a wider wage gap with non-vulnerable workers. About 41% of the wage gap between vulnerable and non-vulnerable workers was explained by individual observed characteristics. In particular, non-vulnerable workers have some individual characteristics advantage over vulnerable worker in wage distribution. These observed characteristics could be education, skill, and experience advantages possessed

by non-vulnerable workers that are translated into higher productivity performance. On top of individual advantages, there are unobserved characteristics among the non-vulnerable workers who are able to raise their wage prospect. Oaxaca wage decomposition showed that the unobserved individual characteristics contributed to about 29% of the wage differential between these two groups. This indicates that employer preferences and labour non-quantitative characteristics have significant effects on wage differential. In the meantime, one cannot ignore the significance of self-selection bias in the wide gap between these two groups. In particular, about 29

percent of the wage differential between vulnerable and non-vulnerable was due to the workers' self-selection into vulnerable and non-vulnerable occupations (the present study follows all the estimation procedures in order to avoid multicollinearity. Its existence could cause some serious problem in validation and interpretation of the model (Abdullah 1996; Muhammad et al. 2019). In other words, observed and unobserved characteristics only account for about 70% of the wage differential between vulnerable and non-vulnerable workers. Therefore, failure to include selection bias could overestimate the contribution of observable characteristics.

TABLE 2. Probit estimates of vulnerable worker status

Variables	Coefficients	Standard errors
Gender	-0.111	(0.100)
Age	0.017	(0.005)***
Foreign Worker	-0.585	(0.117)***
Permanent Worker	-0.656	(0.139)***
Contract Worker	-0.373	(0.193)*
Years of Schooling	-0.059	(0.020)***
North	-0.807	(0.285)***
Central	-0.025	(0.136)**
South	0.277	(0.125)**
Non-Union Member	0.183	(0.139)
Pay Slip	-2.032	(0.105)***
Service Contract	-0.170	(0.124)
Constant	1.154	(0.311)***

Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1

TABLE 3. OLS regression of log wage on individual characteristics for all workers

Variables	All workers	Vulnerable workers	Non-vulnerable workers
Vulnerable status	-0.147*** (0.022)		
Experience	0.012*** (0.003)	0.019* (0.007)	0.011*** (0.003)
Experience square	-0.000*** (0.000)	-0.000 (0.000)	-0.000*** (0.000)
Years of schooling	0.044*** (0.003)	0.049*** (0.008)	0.041*** (0.004)
Permanent worker	0.205*** (0.026)	0.271*** (0.058)	0.142*** (0.031)

Contract worker	0.203*** (0.031)	0.188*** (0.070)	0.156*** (0.037)
North	0.080*** (0.030)	0.114 (0.124)	0.035 (0.035)
Central	0.318*** (0.021)	0.417*** (0.060)	0.295*** (0.023)
South	0.113*** (0.019)	0.140*** (0.050)	0.104*** (0.021)
Foreign Worker	-0.008 (0.017)	-0.069 (0.063)	-0.024 (0.019)
Male	0.163*** (0.016)	0.208*** (0.043)	0.148*** (0.017)
Non-union member	0.061*** (0.021)	-0.007 (0.063)	0.063** (0.022)
Inverse Mills ratio	-	0.026 (0.038)	0.042 (0.017)
Constant	0.630*** (0.053)	0.282* (0.120)	0.667*** (0.062)
Number of observation	1,705	274	1,431

Standard errors in parentheses: ***p<0.01, **p<0.05, *p<0.1

TABLE 4. Wage decomposition between vulnerable and non-vulnerable workers

Panel A: Wage differentials			
Mean prediction of log hourly wages (RM)	Vulnerable workers		4.860
	Non-vulnerable workers		5.389
Log wage differentials			-0.529
Panel B: Wage decomposition			
Decomposition methods	$\bar{X}_1(\hat{\beta}_1 - \hat{\beta}_0)$	$(\bar{X}_1 - \bar{X}_0)\hat{\beta}_0$	$(\hat{\theta}_1 \bar{\lambda}_1 - \hat{\theta}_0 \bar{\lambda}_0)$
Standard Oaxaca	-0.156 (29.56%)	-0.219 (41.33)	-0.154 (29.10 %)

CONCLUSION

After correcting for selection bias, this study concluded that vulnerability does not necessarily increase labour wage; thus, contradicting the Hedonic wage theory. In particular, those who work in unpleasant jobs do not receive any wage compensation. This is because these unpleasant jobs seemed to be treated as low-skill jobs. The employers in the meantime took this to their advantage by offering lower wages to selected workers. Non-vulnerable workers, on the other hand, are found to work mainly in high-skill jobs. Hence, as a result of occupation segregation, a wage gap between these two groups exists. This study concluded that wage differential mainly exists due to worker observable characteristics. Nevertheless, labourers who self-select to work in vulnerable or non-vulnerable occupations cause a wider gap between these groups.

Therefore, there is a need for policymakers to take appropriate actions in order to protect and safeguard all vulnerable workers in Malaysia's labour market. Policy review must consider various aspects of labour welfare such as working hours, number of paid leaves and types of paid leaves. This review would be able to reduce the labour risk of being vulnerable. Vulnerable workers could appear in both low-skill and unpleasant jobs. Thus, there must be a clear direction in differentiating 3Ds (dangerous, difficult, dirty) jobs from low-skill jobs. Workers who are vulnerable and worked in low-skill job must remain with their current wage. In contrast, vulnerable workers who are not in low-skill jobs should be compensated with higher wages. The supply of labour in 3Ds jobs will continue to drop if vulnerable workers in this type of occupation are not properly compensated.

The present study has several limitations. First, the information on vulnerable workers is observed in one single period. Therefore, it will be interesting for future research to address the issue of self-selection bias when independent variables could change over multiple periods. Second, the present data lacks information on firm's characteristics. Thus, the inclusion of variables such as firm size, type of industry, and turnover rate is crucial for a better estimation as well as to increase the goodness of fit of a linear regression model. Third, the observations in the sample are concentrated to all workers in the Peninsular of Malaysia only. Therefore, one must consider in the future to collect data for workers in West Malaysia as well in order to represent a comprehensive national sample.

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