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Occupational Segregation and Discrimination: Revisiting Wage Differential between Native and Foreign Workers in the Malaysian Manufacturing Sector

DU YU HONG[A*] AND HAZRUL SHAHIRI[A]

[A]*School of Economics, Faculty of Economic and Management, Universiti Kebangsaan Malaysia, Malaysia*

ABSTRACT

The present study revisited the native-foreign workers wage differential in the Malaysian manufacturing sector with consideration of occupational segregation using the extended Brown et al. decomposition. The extended Brown et al. decomposition was used to overcome both the index number problems of Type I and Type II and examine relatively more accurate of the impacts of discrimination and composition effects on both within- and between occupation wage differential. The results show that foreign workers are significantly over-represented in "unskilled worker" occupation category and under-represented in others. Overall, the discrimination effect is a relatively major reason contributing to the native-foreign worker wage differential. Specifically, the discrimination effect dominantly accounts for the wage differential of given occupations. Meanwhile, for the between-occupation wage differential, it seems to be relatively insignificant though the effects on the access to each occupation show obvious heterogeneity.

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* Corresponding author: Email: duyuhong@siswa.ukm.edu.my

INTRODUCTION

A previous study by Anees et al. (2011) examined the wage differential between foreign and native workers in the Malaysian labour market using micro-level data from the Second Productivity and Investment Climate Suvery II (PICS II 2007). The study found that foreign workers were indeed being paid lower relative to native workers, and the wage differential between these two groups was mainly attributable to discrimination. Nonetheless, the finding of the paper would be more intuitive if some issues were addressed accordingly. Particularly, the study did not take into consideration the occupational segregation that may depress the wage level of foreign workers and further affect the wage differential between foreign and native workers. Instead, occupational dummies were incorporated into the wage equation like other independent variables, implicitly assuming that these occupational dummies were exogenously given. Thus, when occupational choices are subject to the labour market discrimination, this modelling method is improper (Gunderson, 1989; Liu et al., 2004).

Therefore, the present study will revisit the wage differentials between foreign and native workers in the Malaysian manufacturing sector with the consideration of occupational segregation using the extended Brown et al. decomposition. The extended Brown et al. decomposition will be used to overcome both the index number problems of Type I and Type II and examine relatively the impacts of discrimination and composition effects on both within- and between occupation wage differential.

Wages paid to foreign workers in Malaysia are lower relative to the native workers, which seem to be a common situation for various countries (e.g. Chiswick and Miller, 2008; Bartolucci, 2010; Cabral and Duarte, 2013; Demoussis et al., 2010; Dell'Aringa et al., 2015). Generally, the wage differential between two specific groups usually consists of two parts. The first part is called the composition effect, which is explained by the difference in productivity characteristics (i.e., education, working experience, and other relevant skills); while the other is the unexplained part, which is the discrimination effect. Since foreign workers in Malaysia tend to be low-skilled (Kanapathy, 2008; Han et al., 2008; Abdul-Rahman et al., 2012), the composition effect seems to be the main contributor to the wage differential between foreign workers and native workers.

There are many extant literature concerning wage differential between immigrants and natives; and they demonstrate that discrimination dominates the composition effect in explaining the wage differential between the two groups (Liu et al., 2004; Manacorda et al., 2006; Canal-Domínguez and Rodríguez-Gutiérrez, 2007; Cabral and Duarte, 2013; Demoussis et al., 2010; Aldashev et al., 2012; Vakulenko and Leukhin, 2017). In fact, Manacorda et al. (2006) indicated that foreign workers in Britain received lower wages despite the advantage in observable human capital characteristics. Apparently, neglecting discrimination would overestimate the composition effect. Ultimately, it causes the policies concerning foreign workers to be biased.

Occupational segregation, generally explained by the unequal occupational distributions of two specific groups, exists among foreign workers in the Malaysian labour market; whereby foreign workers take up over 80% low-skilled jobs which are twice as much as their native counterparts. Meanwhile, the access to higher-pay jobs or jobs with more promotional opportunities is commonly limited for foreign workers. The occupational segregation has been an important consideration in analysing the wage differential between gender, ethnic, and region (see Meng, 1998; de Ruijter et al., 2003; Brynin and Güveli, 20012; Banerjee, 2014; Ismail et al., 2015; Campos-Soria et al., 2016; He and Wu, 2017; Zhang and Wu, 2017). However, only a few studies concerning wage inequality between foreign and native workers considered the occupation segregation in their estimations (see Liu et al., 2004; Demoussis et al., 2010; Dell'Aringa et al., 2015). To the best of the author's knowledge, this study is the first that compares wages between foreign and native workers from the perspective of occupational segregation for the Malaysian labour market.

The Brown et al. (1980) decomposition method, which is based on Oaxaca (1973) and Blinder (1973), is widely applied to estimate the between- and within-occupation wage differential, thereby measuring the degree of occupational segregation. However, the Brown et al. decomposition method suffers from both index number problems of Type I and Type II. Type I refers to bias attributable to the non-discriminatory wage structure based on either group, while Type II is the additional bias resulting from the non-discriminatory occupational attainment based on either group. For the Type I index number problem, studies that use the high-earning group's (e.g., ethnic majority, urban workers or males) wage structure as the "non-discriminatory" wage structure undervalue the discrimination effect on the low-earning groups (correspondingly, ethnic minority, migrant workers or females) (Hoang and Roubaud, 2016; Zhang et al., 2016), In fact, the discrimination effect could be also overvalued if the low-earning group's wage structure is used as the "non-discriminatory" wage structure. Similarly, for the Type II, when "within" or "between" occupations are taking into account, the decomposition results may be seriously affected by the subjective selection of non-discriminatory occupational structure based either specific groups. The factors that contributes to the wage differential between native and immigrant workers could be misleading if these problems are not addressed properly. Using the extensions of the Oaxaca-Blinder decomposition by Cotton (1988) and Neumark (1988) as well as Oaxaca and Ransom (1994), the index number problem (Type I) can be overcome to certain extent. However, from the segregation point of view, the index number problem (Type II) goes unheeded, especially in empirical analyses. This study contributes to the literature by applying the extended Brown et al. decomposition developed by Guo et al. (2013) to eliminate both the index number problems of Type I and Type II and examine relatively more accurate of the impacts of discrimination and composition effects on both within- and between occupation wage differentials.

In relation with the within- and between- occupation wage in the present study, the discrimination effect is further divided into two parts, namely nepotism towards native workers and discrimination against foreign workers. Favouritism towards native workers for high skill jobs such as professionals and managerial is due to cost effectiveness. The high skilled native is cheaper than those high skilled foreign counterparts. The two parts will help to discern the extent to which foreign workers in different occupation categories are discriminated against. It is believed that some foreign workers in certain occupation categories enjoy employer's preference in Malaysia. Thus, the unveiling of these heterogeneous discrimination effects on foreign workers employed in different occupations provides more useful information concerning the Malaysian labour market to policymakers when policies involving foreign workers are formulated.

The remainder of this paper is structured in the following sections: Section 2 outlines the methodology, Section 3 describes the data and purpose of the selected variables, Section 4 presents the empirical findings and discussions, and conclusions as well as suggestions for the future research are presented in Section 5.

BRIEF CONTEXT OF FOREIGN WORKERS IN MALAYSIA

The presence of a large number of foreign workers is one of the most distinctive features of the labour market in Malaysia. The Malaysian economy has been receiving a steady influx of foreign workers since the mid-1980s due to its astonishing growth and booming modern sectors (Athukorala and Devadason, 2012; Abdul-Rahman et al., 2012). As of 2010, the amount of legal foreign workers in Malaysia had increased by over 2 million, contributing about 17% to Malaysian workforce (Ministry of Home Affairs, 2011). Over 30% of the total foreign workers are engaged in the manufacturing sector (Ismail and Yuliyusman, 2014). Such large international labour migration, without doubt, plays a crucial role in the Malaysian economy, especially on the labour supply in specific industries (Han et al., 2008; Jones, 2011; Özden and Wagner, 2014). However, most foreign workers in Malaysia tend to be low-skilled (Kanapathy, 2008; Han et al., 2008; Abdul-Rahman et al., 2012). Thus, high dependency on foreign workers in Malaysia has caused inefficiencies in the labour market such as a decline in productivity and suppression of wage growth, as well as social issue namely rising crime rate (Ismail and Yuliyusman, 2014).

For instance, mitigating the over-dependence upon foreign workers seems to be the long-term objective for the Malaysian labour market. This is because foreign workers are cost effective and willing to undertake long working hours. They do not resist 3-Ds (i.e., dirty, dangerous, and disreputable) jobs (Abdul-Rahman et al., 2012) and are able to work under pressure. As a result, many employers tend to hire foreign workers, especially in industries that experience labour shortage such as construction, manufacturing, and the low-end service sectors. The Malaysian government is aware

of the negative impacts stemming from this over-dependency. Thus, the government is currently looking for possibilities to regulate the entry of new foreign workers effectively and efficiently (Ministry of Human Resources, 2013). Meanwhile, as for the existing foreign workers in Malaysia, a non-discriminatory and more conducive environment with regard to the national laws and human rights are always being emphasised and targeted towards foreign workers. Table 1 presents the average monthly wage of native and foreign workers by occupation in the Manufacturing sector. By and large, native workers have higher wages than their foreign counterparts in all four occupations. More specifically, within "Skilled production" and "Non-production/clerical" occupations, the wage ratios of the native workers over the foreign counterparts are 1.845 and 1.873 respectively, which are much higher than other within-occupations wage ratios. This means the discrimination against foreign workers still exists.

Table 1 Average monthly wage (Malaysian Ringgit) of native and foreign workers by occupation

	Average monthly wage (Pooled sample)	Average monthly wage (Native workers)	Average monthly wage (Foreign workers)	The wage ratio (Native/Foreign)
Non-production/clerical	1370.128	1398.344	757.8429	1.845
Management/Professional	2582.246	2595.033	1887.737	1.375
Skilled production worker	1444.82	1510.487	806.2883	1.873
Unskilled production worker	937.9245	1007.994	731.9035	1.377

Source: Productivity Climate Investment Survey 2007 (PCIS II)

METHODOLOGY

Decomposition Process

The wage equations for native and foreign workers in terms of occupation categories are as follows:

$$lnw_j^N = X_j^N \beta_j^N + \varepsilon_j^N, j = 1, \cdots, J \quad (1)$$
$$lnw_j^F = X_j^F \beta_j^F + \varepsilon_j^F, j = 1, \cdots, J \quad (2)$$

where lnw_j^N and lnw_j^F mean the log wages in the j^{th} occupation with the superscripts N and F denoting native and foreign workers, respectively. X denotes a vector of variables representing the characteristics of workers and employers while β is a vector of parameter estimates. ε is the error term. Following Brown et al. (1980), the mean wage differential between native and foreign workers may be expressed as:

$$\overline{lnw}^N - \overline{lnw}^F = \sum_{j=1}^{J} (P_j^N \overline{lnw}_j^N - P_j^F \overline{lnw}_j^F) \quad (3)$$

where P_j^N and P_j^F denote the proportion of native and foreign workers in the j^{th} occupation in the sample, respectively. Equation 3 can be further transformed as:

$$\begin{aligned}\overline{lnw}^N - \overline{lnw}^F &= \sum_{j=1}^{J} P_j^F\left(\overline{lnw}_j^N - \overline{lnw}_j^F\right) + \sum_{j=1}^{J} \overline{lnw}_j^N (P_j^N - P_j^F) \\ &= \underbrace{\sum_{j=1}^{J} P_j^F \left(X_j^N - X_j^F\right)\hat{\beta}_j^N + \sum_{j=1}^{J} P_j^F X_j^F (\hat{\beta}_j^N - \hat{\beta}_j^F)}_{Part\ A} + \\ &\quad \underbrace{\sum_{j=1}^{J} \overline{lnw}_j^N (P_j^N - \tilde{P}_j^F) + \sum_{j=1}^{J} \overline{lnw}_j^N (\tilde{P}_j^F - P_j^F)}_{Part\ B} \end{aligned} \quad (4)$$

Equation 4 consists of two parts representing the Brown et al. (1980) decomposition process. Part A of Equation 4 indicates that the native worker wage structure is treated as the non-discriminatory wage structure. It is used to further assess the wage differential; while $\tilde{P}_j^F$ in part B means the probability of foreign workers who would work in the j^{th} occupation if they are treated as native workers in the same occupation, which is referred to as the non-discriminatory occupational structure. In fact, Equation 4 can be equivalently transformed as:

$$\begin{aligned}\overline{lnw}^N - \overline{lnw}^F &= \sum_{j=1}^{J} P_j^N\left(\overline{lnw}_j^N - \overline{lnw}_j^F\right) + \sum_{j=1}^{J} \overline{lnw}_j^F (P_j^N - P_j^F) \\ &= \underbrace{\sum_{j=1}^{J} P_j^N \left(X_j^N - X_j^F\right)\hat{\beta}_j^F + \sum_{j=1}^{J} P_j^N X_j^N (\hat{\beta}_j^N - \hat{\beta}_j^F)}_{Part\ A'} + \\ &\quad \underbrace{\sum_{j=1}^{J} \overline{lnw}_j^F (P_j^N - \tilde{P}_j^N) + \sum_{j=1}^{J} \overline{lnw}_j^F (\tilde{P}_j^N - P_j^F)}_{Part\ B'} \end{aligned} \quad (4a)$$

In Equation 4a, the non-discriminatory wage structure in part A' is based on the foreign worker wage structure while the non-discriminatory occupational structure in part B' is $\tilde{P}_j^N$, which represents the probability of occupational attainment for native workers when they are regarded as the foreign workers. Differences between decomposition estimates based on Equations 4 and 4a may be significant because the reference groups, non-discriminatory wage structure, and non-discriminatory occupational attainment structure in Equation 4 and 4a are different, which are referred to as the index number problems of Type I and Type II, respectively.

Based on the decomposition structure of Appleton et al. (1999) and technique of predicting the non-discriminatory wage structure developed by Neumark (1988) and Guo and Lu (2009), Guo et al. (2013) improved the decomposition approach to overcome the index number problems of Type I and Type II. Equation 4 or 4a can be rewritten and expanded to:

$$\overline{lnw}^N - \overline{lnw}^F = \underbrace{\sum_{j=1}^{J} P_j^*\left(\overline{lnw}_j^N - \overline{lnw}_j^F\right)}_{Part\ A''} + \underbrace{\sum_{j=1}^{J} \overline{lnw}_j^N (P_j^N - P_j^*) + \sum_{j=1}^{J} \overline{lnw}_j^F (P_j^* - P_j^F)}_{Part\ B''} \quad (5)$$

where Equation 5 is divided into two parts, namely Part A'' and Part B'', which represent within- and between-occupation wage differential, respectively. P_j^* is the proportion of any workers entering the j^{th} occupation under the common non-discriminatory occupational attainment structure.

Within-occupation wage differential, Part A'', can be expanded to

$$\sum_{j=1}^{J} P_j^* \left(\overline{lnw}_j^N - \overline{lnw}_j^F\right) = \sum_{j=1}^{J} P_j^* \left(\bar{X}_j^N \hat{\beta}_j^N - \bar{X}_j^F \hat{\beta}_j^F\right)$$
$$= \sum_{j=1}^{J} \left[P_j^* \left(\bar{X}_j^N - \bar{X}_j^F\right)\hat{\beta}_j^* + P_j^* \bar{X}_j^N \left(\hat{\beta}_j^N - \hat{\beta}_j^*\right) + P_j^* \bar{X}_j^F \left(\hat{\beta}_j^* - \hat{\beta}_j^F\right)\right] \quad (6)$$

where, there are three components at the right side of Equation 6. The first component means the explained part of within-occupation wage differential. The second and third components jointly reflect the unexplained part. $\hat{\beta}_j^*$ is the non-discriminatory wage structure.

Adding P_j^{N*} and P_j^{F*} into the decomposition, the between-occupation wage differential, which individually denotes the probability of native workers and that of foreign workers working in the j^{th} occupation under the common structure. Part B'' will be expressed as:

$$\sum_{j=1}^{J} \overline{lnw}_j^N \left(P_j^N - P_j^*\right) + \sum_{j=1}^{J} \overline{lnw}_j^F \left(P_j^* - P_j^F\right)$$
$$= \sum_{j=1}^{J} \left[\overline{lnw}_j^N \left(P_j^{N*} - P_j^*\right) + \overline{lnw}_j^F \left(P_j^* - P_j^F\right) + \overline{lnw}_j^N \left(P_j^N - P_j^{N*}\right) + \overline{lnw}_j^F \left(P_j^{F*} - P_j^F\right)\right] \quad (7)$$

where, Equation 7 consists of four terms. The first and second terms capture the explained part between-occupation wage differential while the third and fourth terms represent the unexplained part. Thus, Equations 6 and 7 together constitute the complete wage decomposition used in the current study, which is jointly expressed as:

$$\overline{lnw}^N - \overline{lnw}^F = \sum_{j=1}^{J} \left[P_j^* \left(\bar{X}_j^N - \bar{X}_j^F\right)\hat{\beta}_j^* + P_j^* \bar{X}_j^N \left(\hat{\beta}_j^N - \hat{\beta}_j^*\right) + P_j^* \bar{X}_j^F \left(\hat{\beta}_j^* - \hat{\beta}_j^F\right)\right] +$$
$$\sum_{j=1}^{J} \left[\overline{lnw}_j^N \left(P_j^{N*} - P_j^*\right) + \overline{lnw}_j^F \left(P_j^{N*} - P_j^*\right) + \overline{lnw}_j^N \left(P_j^N - P_j^{N*}\right) + \overline{lnw}_j^F \left(P_j^{F*} - P_j^F\right)\right] \quad (8)$$

Parameter Estimation

To calculate P_j^*, the pooled multinomial logit model is used to estimate the coefficients of selected variables assumed to affect occupational participation. The linear model will be expressed as:

$$log\left(\frac{Pr\{Y_i = j|Z_i, G\}}{Pr\{Y_i = reference|Z_i, G\}}\right) = \gamma_{0j} + \gamma_{1j} Z_i + \delta_j G + \epsilon_j, \;\; j = 1, \cdots, J \quad (9)$$

where, $Pr\{Y_i = j|Z_i, G\}$ means the probability of the i^{th} individual entering the j^{th} occupation and $Y_i = reference$ means that one of occupation categories is regarded as the reference. Z_i denotes the vector of independent variables and ϵ_j is the error term. G is a binary variable equal to 1 if the worker is native and 0 if otherwise. The estimated coefficients of the constant term (γ_{0j}) and variables (Z_i) are used to predict the probability under the non-discriminatory occupational attainment structure. However, since the non-unique constant term is caused by the different specification of G (e.g. G = 1 if the worker is foreign and 0 if otherwise), the constant term will be weighted as $\gamma_{0j} + f_N \delta_j$ where f_N

is the percentage of native workers in the sample. Thus, the vector of estimated coefficients is expressed as:

$$\gamma_{Gj}^{*} = \begin{pmatrix} \gamma_{0j} + f_N \delta_j \\ \gamma_{1j} \end{pmatrix} \quad (10)$$

and, the predicted probability of an individual working in the j^{th} occupation under non-discriminatory occupational attainment structure will be:

$$P_{ij}^{*} = \frac{exp(Z_i \gamma_{Gj}^{*})}{\sum_{j=1}^{J} exp(Z_i \gamma_{Gj}^{*})} \quad (11)$$

The non-discriminatory predicted probability P_j^* of being in the j^{th} occupation is the mean of Equation 11 for the full sample, i.e. $P_j^* = \overline{P_{ij}^*}$. Similarly, the non-discriminatory predicted probability of being in the j^{th} occupation for native workers, P_j^{N*}, (or, for foreign workers, P_j^{F*}) is the mean of Equation 11 for the native worker sample (or, for the foreign worker sample).

To calculate the non-discriminatory wage structure, $\hat{\beta}_j^*$, based on the technique developed by Neumark (1988), Guo et al. (2013) incorporated the dummy variable (G) into the pooled sample wage regression model, which is expressed as:

$$lnw_j = \beta_{0j} + \theta_j G + \beta_{1j} X_j + \mu_j \quad (12)$$

where X_j is the vector of selected variables assumed to affect the wage level of workers and G is a binary variable with the same specification as in Equation 6. μ_j is the error term. By analogy to Equation 10 for avoiding the non-unique constant term, the non-discriminatory wage structure is expressed as:

$$\hat{\beta}_j^{*} = \begin{pmatrix} \hat{\beta}_{0j} + f_N \hat{\theta}_j \\ \hat{\beta}_{1j} \end{pmatrix} \quad (13)$$

where f_N is the percentage of native workers in the sample. Similarly, $\hat{\beta}_j^N = \begin{pmatrix} \hat{\beta}_{0j}^N \\ \hat{\beta}_{1j}^N \end{pmatrix}$ and $\hat{\beta}_j^F = \begin{pmatrix} \hat{\beta}_{0j}^F \\ \hat{\beta}_{1j}^F \end{pmatrix}$ can be obtained by using subsample equations as follows:

$$lnw_j^N = \beta_{0j}^N + \beta_j^N X_j^N + \mu_j^N \quad (14)$$

$$lnw_j^F = \beta_{0j}^F + \beta_j^F X_j^F + \mu_j^F \quad (15)$$

Controlling for Selectivity

Since the interaction of demand and supply factors determines the individual employment in an occupation (Brown et al., 1980; Reilly, 1991; Liu et al., 2004), the observed probability of occupational attainment for workers in both groups in the sample may be biased, which reflects that the samples of foreign and native workers may not be observed randomly in each occupation. In this case, the selection bias would cause estimators (e.g. β_j^N and β_j^F) to be biased and inconsistent; hence, affecting the decomposition results. This study follows Lee (1983) to adjust the estimating wage equations for occupational-specific selection bias by using selectivity correction terms, λ_{ij}.

Data and Variables

The data used in this study were obtained from workplace survey data of the PICS II 2007 database. Providing the representative sample of the whole manufacturing and service sectors, the PICS II 2007, which was carried out by the Malaysian government and the World Bank presents detailed information on workers and employers. This study focuses on the manufacturing sector in which 10615 workers were surveyed, including 9337 native and 1244 foreign workers.

The sample analysed in this study was restricted to workers aged between 15 and 65 in 2007. Since the survey process was conducted at the workplace, unemployed, retired, and inactive workers were excluded. Following the extant literature, any observations with missing information concerning the variables analysed in this study were omitted. The aforementioned exclusion resulted in a sample size of 8985 native and 1177 foreign workers.

Table 2 presents the summary statistics of selected variables for native and foreign workers, respectively. Monthly wages (lnwage) were calculated using monthly salaries reported by the workers from the current job (including all allowances and bonuses). Native workers engaged in the manufacturing sector, on average, received 57.6% more monthly wages than foreign workers. Meanwhile, native workers tend to be older, more experienced and had more schooling years compared to foreign workers. Among the subsample of foreign workers, about 84.5% were male and less than 27% received training. The PICS II 2007 divides the workers into two types, production workers and non-production workers namely. In order to avoid misconceptions, four occupational groups in this study are categorized as, Non-production managerial/Professional, Non-production/Clerical, Skilled production, and unskilled production respectively. The vast majority of foreign workers (more than 60%) were employed as ‘unskilled production labour’, while less than 25% of native workers were classified under this occupation category. The opposite situation occurred in ‘non-production management/professional’ occupation category where there were only 0.32% foreign workers and about 23% native

workers. Within 'skilled production' occupational category, the percentage difference was relatively insignificant.

Table 2 Mean (Standard Deviation) of variables for native and foreign workers respectively.

	Total	Native workers	Foreign workers
Lnwage	7.078 (0.660)	7.144 (0.658)	6.568 (0.400)
Gender (0 female; 1 male)	0.543 (0.498)	0.503 (0.500)	0.845 (0.362)
Age (years)	34.259 (9.744)	34.938 (9.925)	29.079 (6.123)
Age_2	1268.636 (733.706)	1319.147 (752.985)	883.045 (389.270)
Married (0 married; 1 unmarried)	0.622 (0.485)	0.645 (0.478)	0.444 (0.497)
Schooling Years	10.521 (3.527)	10.874 (3.280)	7.824 (4.128)
Training (0 no; 1 yes)	0.389 (0.488)	0.405 (0.491)	0.265 (0.442)
Exp (years)	13.667 (11.508)	14.333 (10.928)	8.581 (14.238)
Exp_2	319.193 (779.380)	324.829 (643.640)	276.17 (1442.740)
Foreign Involved (0 foreign-private involved; 1 100% domestic owned)	0.691 (0.462)	0.679 (0.467)	0.779 (0.415)
Occupation			
Non-production/Clerical	0.156 (0.363)	0.169 (0.375)	0.059 (0.237)
Non-production Management/Professional	0.207 (0.405)	0.23 (0.421)	0.032 (0.177)
Skilled production	0.351 (0.477)	0.36 (0.480)	0.283 (0.451)
Unskilled production	0.285 (0.452)	0.241 (0.428)	0.625 (0.484)
N	10162	8985	1177

EMPIRICAL FINDINGS

Non-discriminatory Occupational Attainment

To derive the non-discriminatory occupational attainment structure (Equation 11), variables including age, age squared, experience, experience squared, and years of schooling were involved in the parameter estimations. The results obtained by the multinomial logit model are shown in Table 3. The results of non-discriminatory occupational attainment present that compared to actually observed occupation attainment, foreign workers are heavily over-represented in the last occupational category (unskilled production workers) while the unskilled production native workers, on the contrary, are under-represented. Meanwhile, the proportion of foreign non-production/clerical, non-production management/professional or skilled production workers is much higher than the observed; and except for skilled production native workers, the proportions of native workers in the first two occupational categories were slightly lower than the observed. The results indicate that when based on the same non-discriminatory occupational structure reference, given foreign workers' productivity characteristics, more foreign workers would work as non-production / clerical, non-

production management/professional or skilled production workers while the proportion of those who would be unskilled production workers was drastically reduced. In addition, the results of Brown's occupational attainment show that if the occupational structure reference is based on foreign workers, the proportion of unskilled production native workers would increase while those native non-production management / professional workers would sharply fall.

Table 3 Occupational attainment in terms of native and foreign workers

	Observed Occupational Attainment	Non-discriminatory Occupational Attainment	Observed Occupational Attainment		Brown Occupational Attainment		Non-discriminatory occupational Attainment	
		(P_j^*)	N (P_j^N)	F P_j^F	N	F	N (P_j^{N*})	F P_j^{F*}
Non-production/ clerical	0.156	0.174	0.169	0.060	0.147	0.065	0.159	0.137
Non-production management/ Professional	0.207	0.138	0.229	0.032	0.054	0.068	0.207	0.100
Skilled production worker	0.352	0.407	0.360	0.283	0.386	0.345	0.368	0.344
Unskilled production worker	0.285	0.281	0.241	0.625	0.413	0.522	0.266	0.419

Note: Non-discriminatory occupational attainment is calculated using the way aforementioned in the context (from Eq. 9 to 11). Brown occupational attainment for native workers is the probability of occupational attainment when the foreign workers are the non-discriminatory occupational structure reference; correspondingly, Brown occupational distribution for foreign workers is based on the reference of native workers. N denotes native workers and F is foreign workers.

Occupation-specific Wage Functions with Occupational Selection Corrected Term

Table 4 presents the results of the selectivity corrected wage equations for each specific occupation in terms of native and foreign workers. Overall, the results show a fairly good fit, with R^2 for native and foreign workers ranging from 0.200 to 0.342 and 0.095 to 0.618, respectively. The effects of age on native workers' wages were significantly positive in all occupations except for "unskilled production workers". As for foreign workers, only the wage for skilled production workers was positively affected. This means that working experience is important for native workers but not for "Non-production management/Professional". In addition, working experience is also essential for foreign workers but only for "skilled production workers".

Years of schooling, which is regarded as the important component of human capital, do not have a consistent positive effect on both native and foreign workers and workers in all occupations. Specifically, years of schooling also exert a significant positive influence on native and foreign skilled production workers but negatively affect wages of unskilled production workers. The production workers are subjected to output based

wage system. In other words, they are paid based on the number of output produced. Therefore, human capital characteristics such as experience and schooling years do affect production more significantly than non-production workers. Aside to this, gender is also an important variable that generates valid effects statistically on two groups of workers in all occupations. Almost all male native and foreign workers have a relatively higher wage than their female counterparts, with the exception of the non-production management/professional occupation in which female foreign workers would earn much more.

Native workers who receive training for the job would gain higher wage. However, this relationship does not hold for the foreign workers. For proprietorship and partnership businesses, the companies are divided into two groups, namely the foreign-investment-involved firm and the 100%-domestic-private firm. The results present that the native workers in all occupations and foreign skilled workers receive relatively higher wages from the companies of the former type, who do not generate distinctive financial aids for other occupational types of foreign workers relative to the companies of the latter type. In addition, within all log wage regressions, the coefficients of half selectivity correction terms, Lamda (λ_j), are significant. Specifically, except for native management/professional workers, native workers in all other occupations are not randomly sampled. For foreign workers, significant self-selection, as expected, does exist for those unskilled production workers, which again may reflect the over-representation of foreign workers in the unskilled production occupational category.

Native-foreign Worker Wage Differential Decomposition

The upper panel in Table 5 presents the means of all variables in occupational-specific wage equations in terms of native and foreign workers. All these variables were used to anticipate the decompositions of native-foreign worker differential in wage which are shown in the lower panel of Table 5. Observed total wage differential between native and foreign workers was, on average, 0.5768 expressed in log form, indicating that Malaysian native workers have wages at a mean of as much as 70% ($\exp(0.5768) - 1$), higher than foreign workers. Of this total differential, around 71.63% came from the within-occupation differential with a value of 0.4132 while the remaining 28.37% came from the between-occupation differential. Apparently, the within-occupation differential plays a dominant role in native-foreign worker wage differential. In addition, irrespective of the occupational segregation, the composition effect attributable to the productivity characteristics contributes 44.6% of total difference. Meanwhile, the unexplained part, which is referred to as the discrimination effect, accounts for the rest. In other words, the discrimination effect is of core importance and predominantly functions in the total wage differential as a whole; which is also consistent with extant studies aforementioned.

The composition and discrimination effects, however, have significantly different performances in the within-occupation and between-occupation differentials, respectively. The composition effect primarily explains the within-occupation differential (30.68% of the total) and is substantially less for between-occupation differential (13.92% of the total). For the discrimination effects, the between-occupation portion (14.45%) is considerably lower than the within-occupation portion (40.95%) which indicates that the discriminatory treatment within given occupation is found to be of central influence. In addition, the unequal access to occupation also makes foreign workers to be at disadvantaged but by comparison, is relatively less serious. The deviations in native and foreign worker returns separately explained the discriminatory effect for the within-occupation differential. Specifically, the deviation in native worker returns, which means the nepotism towards native workers, accounts for only 4.17% of total differential. Meanwhile, the deviation in foreign worker return, which represents discrimination against foreign workers, accounts more than 36% of total differential. For the between-occupation discriminatory effect, the preference of employers for native workers between occupations explains only 3.72% of total differential; which is much less than the discrimination against foreign workers (10.73%).

Table 6 presents the results of decomposition of native-foreign worker wage differential using the Brown et al. methods for comparison. In accordance to the reference choice, the results are divided into two parts. The composition effect overwhelmingly accounts for over 82% of the total differential if native workers are used as the reference group; and less than 17.7% from the discrimination effect which drastically takes up to about 43.6% if foreign workers are regarded as the reference group. This indicates that the choice of native or foreign workers as the reference group may have a substantial impact on the decomposition results and thereby the reliability of corresponding suggestions.

Table 4 Occupation-specific wage equations corrected for occupational selection bias

	No-production/clerical worker				Non-production Management/Professional			
	N		F		N		F	
Age	0.042***	-0.012	0.04	-0.089	0.089***	-0.017	0.505	-0.327
Age_2	0.000***	0	0	-0.001	-0.001***	0	-0.009	-0.006
Exp	0.015***	-0.005	0.01	-0.013	0	-0.007	-0.035	-0.095
Exp_2	0.000**	0	0	0	0	0	0.003	-0.004
Schooling Years	0.058***	-0.005	-0.007	-0.022	0.031	-0.042	-0.27	-0.259
Gender	0.067**	-0.026	0.174	-0.14	0.266***	-0.023	-0.365*	-0.119
Married	0.087***	-0.03	0.04	-0.118	0.048*	-0.028	0.055	-0.213
Training	0.163***	-0.026	0.059	-0.131	0.151***	-0.023	0.107	-0.216
Foreign Involved	-0.056**	-0.028	-0.036	-0.105	-0.069***	-0.023	0.18	-0.203
Lamda	-0.359***	-0.126	-1.42	-3.014	0.123	-0.268	2.74	-2.198
Constant	4.825***	-0.211	2.534	-7.35	5.210***	-1.068	8.746	-5.242
R-squared		0.2234		0.1811		0.3415		0.6178
Observations		1519		70		2064		38

Table 4 Cont.

	Skilled production worker				Unskilled production worker			
	N		F		N		F	
Age	0.061***	-0.008	0.092**	-0.036	-0.035***	-0.012	-0.026	-0.018
Age_2	-0.001***	0	-0.001**	-0.001	0.000***	0	0.000*	0
Exp	0.012***	-0.002	0.030***	-0.01	0.008***	-0.003	-0.001	-0.005
Exp_2	0.000**	0	-0.001	0	0.000**	0	0	0
Schooling Years	0.042***	-0.004	0.024**	-0.011	-0.047**	-0.02	-0.029***	-0.01
Gender	0.368***	-0.018	0.148***	-0.054	0.300***	-0.021	0.130***	-0.036
Married	0.058***	-0.022	0.027	-0.045	0.096***	-0.027	-0.032	-0.029
Training	0.159***	-0.019	0.062	-0.045	0.062**	-0.025	-0.004	-0.029
Foreign Involved	-0.064***	-0.019	-0.097**	-0.047	-0.077***	-0.026	0.02	-0.033
Lamda	-0.443***	-0.083	-0.534	-0.383	-1.017***	-0.21	-1.134***	-0.349
Constant	4.610***	-0.179	3.970***	-0.965	6.376***	-0.188	6.309***	-0.248
R-squared		0.2615		0.2113		0.2		0.095
Observations		3238		333		2164		736

Note: Lamda is the selectivity correction terms, λ_{ij}, which describes in the text.
Figures in the parentheses are standard deviations.
N and F mean/are native and foreign workers respectively.
*,**,*** denote statistical significance at 10%, 5% and 1% levels.

Table 5 Decomposition of log wage differential between native and foreign workers

	No-production/clerical worker		Non-production Management/Professional		Skilled production worker		Unskilled production worker	
	N	F	N	F	N	F	N	F
Lnwage	7.074	6.555	7.653	7.303	7.135	6.604	6.723	6.514
Age	33.862	30.029	34.100	32.500	35.815	29.381	35.179	28.675
Age_2	1242.766	941.914	1241.526	1126.184	1377.010	899.207	1360.216	857.580
Exp	13.635	13.286	12.207	9.763	15.612	7.559	14.937	8.535
Exp_2	288.079	742.429	231.500	165.658	369.376	102.520	372.987	316.101
Schooling Years	11.081	7.443	13.215	12.053	10.385	8.577	9.226	7.302
Gender	0.340	0.829	0.464	0.763	0.622	0.823	0.478	0.861
Married	0.634	0.429	0.647	0.500	0.679	0.459	0.600	0.435
Training	0.396	0.186	0.540	0.368	0.425	0.351	0.253	0.228
Foreign Involved	0.699	0.657	0.602	0.684	0.660	0.703	0.768	0.830
Lamda	-1.476	-1.962	-1.083	-1.852	-1.010	-1.169	-0.584	-1.168

	Expressed in logs	% of total differential
Observed Wage differential	0.5768	100
Difference due within-occupations differentials in wages attributable to:	0.4132	71.63
Composition effect $\sum_{j=1}^{J}[P_j^*(\bar{X}_j^N - \bar{X}_j^F)\hat{\beta}_j^*]$	0.1770	30.68
Deviation in native worker returns $\sum_{j=1}^{J}[P_j^*\bar{X}_j^N(\hat{\beta}_j^N - \hat{\beta}_j^*)]$	0.0240	4.17
Deviation in foreign worker returns $\sum_{j=1}^{J}[P_j^*\bar{X}_j^F(\hat{\beta}_j^* - \hat{\beta}_j^F)]$	0.2122	36.78

Table 5 Cont.

Difference due between-occupations differentials in wages attributable to:	0.1636	28.37
Composition effect $\sum_{j=1}^{J}\left[\overline{lnw_j^N}\left(P_j^{N*}-P_j^*\right)+\overline{lnw_j^F}\left(P_j^*-P_j^F\right)\right]$	0.0803	13.92
Deviation in effect of in native worker characteristics on occupations $\sum_{j=1}^{J}\left[\overline{lnw_j^N}\left(P_j^N-P_j^{N*}\right)\right]$	0.0214	3.72
Deviation in effect of in foreign worker characteristics on occupation $\sum_{j=1}^{J}\left[\overline{lnw_j^F}\left(P_j^{F*}-P_j^F\right)\right]$	0.0619	10.73

Note: Lamda is the selectivity correction terms, λ_{ij}, which describes in the text.

Table 6 Comparison of decomposed results using The Brown et al decomposition

	The Brown et al decomposition (Native workers as a reference group)		The Brown et al decomposition (Foreign workers as a reference group)	
	Composition effect	Discrimination effect	Composition effect	Discrimination effect
Within-occupation	54.5	1.5	33.3	37.7
Between-occupation	27.8	16.2	23.1	5.9
Total	82.3	17.7	56.4	43.6

Note: figures above mean percentage of the total differential

Table 7 specifically presents the estimated results for the degrees of nepotism towards native workers and discrimination against foreign workers across occupations. For the within-occupation part, native workers are not given much preferential treatment by employers across occupations. It suggests that there is a huge likelihood for foreign workers to be employed in the 3Ds jobs since the natives are highly unlikely to involve in jobs that are stressful and have long working hours without proper compensation. Therefore, the -1.67% of total differential source from native workers implies that there is an improvement in financial adversity for foreign workers. The highest degree of discrimination is found in skilled production occupation category (28.13% of total differential), followed by non-production/clerical workers (11.72%). Low skilled production foreign workers remained to be highly in demand by firms. For between-occupation, there is a significant discrimination non-production/clerical occupation category (88.72%). This is followed by the "Management/Professional" occupation category (85.48%) and "Skilled production worker" occupation category (69.57). Native workers have favourable advantages to work in management/professional and non-production/clerical occupation categories.

Table 7 Estimation of Nepotism towards native workers and Discrimination against foreign workers

	Within-occupation		Between-occupation	
	Nepotism towards native workers	Discrimination against foreign workers	Nepotism towards native workers	Discrimination against foreign workers
No-production/clerical worker	1.46	11.72	12.60	88.72
No-production Management/Professional	0.62	2.35	29.93	85.48
Skilled production worker	3.76	28.13	-9.44	69.57
Unskilled production worker	-1.67	-5.41	-29.38	-233.04
Total	4.17	36.78	3.72	10.73

Note: figures above mean percentage of the total differential

SUMMARY AND CONCLUSION

The present study revisits the native-foreign workers wage differential in Malaysian manufacturing sector with consideration of occupational segregation using the extended Brown et al. decomposition. The PICS II 2007 database was used, which is the only available source of the representative sample of the whole manufacturing sector and information with regard to both native and foreign workers. Four occupational categories were considered in this study and occupational selection bias had been significantly identified. According to the decomposition procedures, the non-discriminatory wage structure and occupational attainment were developed for further decomposing of estimations, which overcomes the biasness or inefficiency resulted from the index number problems (Type I and II). After running occupational-specific wage regressions with selectivity correction terms, within- and between-occupation wage differential between native and foreign workers were decomposed according to the composition and discriminatory effects.

The results unveiled that foreign workers are, as expected, significantly over-represented in "unskilled production worker" occupation category and under-represented in others. Overall, the discrimination effect is relatively the major reason for the native-foreign worker wage differential. This result is consistent with the finding in Anees et al. (2011). In particular, the discriminatory effect dominantly accounts for the wage differential within given occupations but to a much lesser extent for the between-occupation differential. This suggests that unequal access to the occupation would still be an obstacle for foreign workers but not as serious as the unequal treatment relative to their native counterparts. In addition, the nepotism towards native workers and discrimination against foreign in within- and between- occupation differentials reveal many interesting situations. While foreign workers being more likely to be employed in the "unskilled production worker" occupation is empirically collaborated; there are heterogeneity effects on the access to occupations. The new implementation of

minimum wage policy is a strategic move to attract low skilled native workers as well as to motivate employers to demand more the locals and substitute foreign workers. Monthly minimum wages of 1000 RM for Peninsular Malaysia and 920 RM for East Malaysia is expected to reduce the dependency on a different note. Foreign worker policy should have provided an attractive package to bring high skilled foreign workers to work in Malaysia since they have positive and significant impact on economic growth. The attractive package should include but not be limited to tax exemption, family support program as well as nonmonetary benefit.

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