Journal for Labour Market Research

ORIGINAL ARTICLE

Open Access

Demand and supply effects on native-immigrant wage differentials: the case of Malaysia

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Abstract

This paper uses a matched employee-employer dataset using the Productivity and Investment Climate Survey 2007 to assess the relative effect of demand and supply-side characteristics on the wages of native and immigrant workers in Malaysia. In doing so, the study demonstrates noteworthy differences in the wage determination process. Individual supply-side characteristics are found to be a key determinant of wages for native workers, and are relatively more important in explaining the wage variation than demand-side effects. In contrast, individual supply-side characteristics are found to explain noticeably less of the wage variation for immigrant workers. Therefore, this study reveals that native and immigrant wages do not solely reflect the workers' productivity, although this effect is far more pronounced for the migrant workers.

Keywords Firm characteristics, Demand-side, Wage differentials, Migration

JEL Classification J61, J31

1 Introduction

Malaysia has become a major host country for foreign workers in Asia (Athukorala and Devadason 2012) as the number of immigrant workers in Malaysia increases (Abdullah et al. 2020) due to increasing demand for labour because of economic growth and industrialisation (Noor et al. 2011). Narayanan and Lai (2014) have found that immigrant workers have lower wages compared to their non-immigrant counterparts and that the flow of unskilled foreign workers reduced the pressure on firms to embark on industrial upgrading.

Kaur (2008) has shown that the 1986 global economic recession has caused the government of Malaysia to realise that there has been an intensified competition between natives and immigrants in the job market. In response to this, in 1990, the Malaysian government has introduced migration reforms in an attempt to discourage and reduce migration flows (Blanca 2010). For example, some reforms have aimed at increasing the cost of hiring immigrant workers and imposing a freeze on the recruitment of immigrant workers. Another set of reforms aimed at forcing immigrants to leave Malaysia (Gurowitz 2000).

However, considering labour market demand pressures, the above restrictions have been relaxed in more recent years. New immigration policies have allowed immigrant workers to stay in Malaysia for a short period, with the option of applying for a permanent residency after a continuous stay of 5 years. The Immigration Department has issued various types of work permits, based on the sector of employment, duration of permits, costs, recruitment procedures, benefits, and protections (Del Carpio,

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Karupiah, Marouani, Ozden, Testaverde, Wagner, 2013). In addition, immigrant workers are allowed to work in most industries except employment in national security. As a result, there has been a significant increase in migration flows in Malaysia. The Department of Statistics Malaysia (2017) reported that in the year 2004, the number of immigrant workers was 993,235, about 9.4 percent of the total labour force. The number of immigrant workers has increased by 115 percent to 2,139,540 workers in 2015, and it amounts to 15 percent of the total workforce.

In a recent study, Abdullah et al. (2020) explored the wage differentials between native and immigrant workers in the Malaysian labour market, and although differences in endowments explain a large part of immigrant-native wage differentials, the unexplained component (largely attributed to discrimination) also plays a significant role. Importantly, the above literature has predominantly focused on the supply side, with scarce attention paid to exploring the impact of demand side effects. This study considers both the labour supply and demand effects in explaining the immigrant and native wage determination and their respective wage differentials in Malaysia. It further assesses the relative importance of supply and demand factors in explaining these wage differentials. An important innovative aspect of this study is the use of a matched employee-employer dataset, that provides rich information on firm characteristics, thus capturing demand side effects that, as mentioned above, have been neglected in the existing literature.

Human capital theory proposes that the level of wages is explained by worker characteristics. Thus, wage determination is driven by workers' individual characteristics that are rewarded in the labour market. However, Krueger and Summers (1988) argue that different employees, although they may have similar characteristics and qualifications, may earn different wages since some firms pay higher wages because their objective is not only to maximise profit but also to serve other objectives. Thus, wage levels for similar individuals may vary across firms because firms are not identical, but differ in terms of their capacity, objectives, strategy, technology, and so on. Indeed, Wachtel and Betsey (1972) have shown that the demand side factors, firm structural characteristics or other firm characteristics, are crucial in determining the level of wages. In view of this, in studying wage determination, one should also consider factors other than individual characteristics that might influence wages (Sørensen and Vejlin 2013).

Hartog (2000) developed a framework based on assignment theory that focuses predominantly on the demand side. Within this model, an optimal allocation of workers implies the assignment of highly skilled workers to complex jobs, whereas the lesser skilled workers are hired to perform simple job tasks (Allen and Velden 2001). The assignment of workers to jobs that require lower education than their actual qualifications is considered non-optimal because the workers do not fully use their skills and knowledge. As a result, this mismatch leads to lower productivity and subsequently lower wages, compared to workers of the same educational level who are adequately matched to the skill/education requirements of their job (Pietro and Urwin 2006). Hence, wages are determined not only by the human capital embodied in the workers, as predicted by the human capital theory, but also by the level of pay the particular job, to which the worker is matched, commands.

Furthermore, evidence from the rent sharing literature, based on matched worker-firm data, suggests that the elasticity of wages with respect to worker productivity does not exceed 0.15. In addition, wage determination literature suggests that demand side factors explain 20 percent of the observed wage variation. Card et al. (2018) developed a static monopsony model to explain these findings and to provide a framework to explain the relationship between firm productivity and wages that is not explained by supply side characteristics.

In summary, although there is a large and well-established body of literature demonstrating the effect of 'supply side' labour market factors on wage differentials there is still a paucity of studies that focus on the 'demand side' effects, especially with reference to the native and immigrant wage differentials. Therefore, the objectives of this study are first, to identify the demand side effect on the wage variation of native and immigrant workers; and second, to explore the relative importance of demand and supply factors in explaining these wage differentials in the Malaysian labour market.

2 A brief literature review

Most studies on wage determination and wage differentials have focused on the characteristics of the workers and how they are rewarded in the labour market without any emphasis placed on the demand-side effects. In the human capital literature, wages paid to a worker are equal to his or her marginal product. In turn, the worker's own productivity is reflected in his or her human capital or other innate characteristics. However, Heinze and Wolf (2010) have argued that workers with similar characteristics or similar productivity do not necessarily receive similar wage rates. This originates from Wachtel and Betsey (1972), who have pointed out that workers are not necessarily paid in line with their human capital, skills, experience, or education, but there are demand side factors or firm structural characteristics that play a significant role. Aspects such as firms' performance

and profitability, labour union membership, the rate of change in productivity, and employment are found to be key wage determinants.

The literature points out that that the characteristics of a firm have a significant effect on the wage paid to its labour force. Recent studies (Arai and Heyman 2009; Card et al. 2014; Guertzgen 2009; Martins 2009) have found significant correlations between individual wages and firm's profitability as well as changes in the firm's profitability. Torres et al. (2013) have shown that the level of wages paid to the workers depends on the ability of the firm to pay. They have shown that firms pay higher wages than the average wage in the market in order to reduce workers' turnover, which in turn allows them to pay higher salaries. In addition, Dickens and Katz (1987) have shown that workers with similar characteristics are paid different wage rates in firms operating in different industries. In summary, it appears that that wage determination and wage differentials are not solely determined by individual characteristics (supply-side effect) but also by the heterogeneity of the firm characteristics (demand-side effect).

However, there is no clear consensus on the relative importance of supply side characteristics versus demand side. For example, Abowd and Kramarz (1999) have concluded that the workers' characteristics outweigh the firm's characteristics in explaining wage differentials. Similarly, Torres, Addison, and Guimaraes (2013), using large matched employer-employee data, have concluded that firm-specific characteristics are not as important as worker-specific characteristics in explaining wage differentials. Yet, Drolet (2002), exploring the gender wage gap in Canada, have concluded that the firm characteristics explain a larger part of the gender pay gap than individual characteristics.

In addition to the above literature, a number of studies have discussed various aspects of firm characteristics such as organisational structure, industrial relations, investment and financial performance, trade, labour and capital utilisation that influence wage level by using matched employer-employee samples (for instance, Abowd and Kramarz 1999; Drolet 2002; Faberman and Menzio 2015; Kettemann et al. 2017).

3 Definition of variables and descriptives

This study utilises the Productivity Investment Climate Survey 2007 (PICS 2007)[1] data collected by the Economic Planning Unit and Department of Statistics Malaysia in collaboration with the World Bank.[2] The survey was conducted in fiscal year 2007–2008. The PICS 2007 data consists of a randomly drawn sample of establishments, covering 10 percent of the Manufacturing and Services sectors in Malaysia. To collect samples, a single-stage stratified systematic sampling method is utilised. The sample frame is divided into sectors, regions, states, and industries. To compile the sample, establishments within each industry, region, and area combination are grouped according to the output value for each sector. The selection is then done individually for each substratum using a linear systematic method. The dataset has provided rich information about the employees and employers in Malaysia. The PICS 2007 is the only dataset in Malaysia in which data on employees and employers are jointly available. The dataset was drawn from 1500 establishments, including 1200 establishments in the manufacturing sector and 300 establishments in the service sector. However, in this study 92 establishments have been excluded due to informational gaps. Hence, 1408 establishments are included in the analysis, employing 13,170 employees in both manufacturing and service sectors.

3.1 The variables used in the study

Log hourly wage is the outcome variable of interest in this study. The log hourly wage is defined as the hourly wage in the past 12 months before the interview. The wage is calculated as the sum of basic salary, allowances, and bonuses.

The explanatory variables, considering the discussion above, are divided into three categories, the individual characteristics (supply side), the firm characteristics (micro, demand side), and regional controls (macro, demand side). Ten variables, commonly used in the literature, capturing individual characteristics are included in the estimation as control variables. These variables include demographic characteristics such as gender, marital status, and citizenship. Furthermore, controls for human capital variables such as the individuals' educational qualifications, training (length in months), tenure (and its square), and potential experience (and its square) are included in the estimated models. There are four educational classifications used: degree, diploma, upper secondary and below upper secondary education. The latter was used as the reference group in the regression analysis. Furthermore, the type of job is also

[1] Enterprise Analysis Unit—World Bank Group https://www.enterprisesurveys.org

[2] The PICS 2007 data covered establishments in the manufacturing and business support services sectors. For manufacturing industries, the economic activities were defined according to Divisions under the Malaysia Standard Industrial Classification (MSIC) 2000 (2-digit codes), which is identical to the United Nations Statistical Division's International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3) up to the 4-digit level. In Malaysia PICS 2007, 12 manufacturing industries and 5 business support services sectors were surveyed.

included in the analysis, with controls for Management, Professional, Skilled, and Unskilled work, while the lower non-manual and apprentice work is the reference group.

Demand side effects are captured both at the micro level, reflecting firm-level specific demand factors, and at the macroregional level. A detailed description of the firm characteristics that capture micro-level aspects of the demand side is provided below.

3.1.1 Vacancy

Intuitively, since demand for labour is determined by the propensity of the firm to hire workers, advertised job vacancies are a key measure of the demand for labour and hence an important determinant of the firm's wage levels. Kettemann et al. (2017) has shown that firms that are rapidly growing have more vacancies and pay higher wages to attract labour to fill the increasing labour shortages. Therefore, the number of firm vacancies should be expected to have a positive relationship with wages (Faberman and Menzio 2015; Kettemann et al. 2017). However, one might expect that there may be a negative association between the number of vacancies in a particular firm and wage rates paid by this firm, if a firm pays such low wages as to fail to attract sufficient number of applicants, thus causing the number of vacancies to accumulate. To account for the different sizes of firms in the PICS dataset, a relative measure is used, instead of the absolute level of vacancies. Hence, the "vacancy rate" is calculated by dividing the total number of vacancies by the total number of workers in the firm.

Furthermore, Andrews et al. (2008) have pointed out that it takes longer for firms to fill a job vacancy if they are targeting high-quality workers. This implies that the duration of vacancies has a positive effect on wages (Faberman and Menzio 2015; Kettemann et al. 2017). Indeed, Viking and Long-Hwa (2009) have found that higher-wage jobs take a longer time for firms to fill. The vacancy duration refers to the average duration (reported in weeks) to fill up the recent vacancies in the firm. The vacancy duration only refers to filled vacancies.

Therefore, the number of vacancies and their duration faced by a firm are important firm characteristics (demand factors) that should be when exploring the determinants of the wage structure.

3.1.2 Employment level

This study will classify the employment level into three groups: (i) overemployment, (ii) underemployment and (iii) sufficient level of employment. This classification is based on the following question asked to employers: "Given your current level of output, if you were free to choose without restrictions your current level of employment, what % of the current level would you choose?". Sufficient level of employment is then classified when the response is "100%". If the percentage reported is more than 100%, then the firm is classified as over-employed. Similarly, if the percentage reported is less than 100%, the firm is classified as under-employed.

Gralla and Kraft (2012) have proposed that firms may suffer a loss if they employ workers above the number needed to operate efficiently, because of diseconomies of scale. Such overemployment should be expected to have a negative relationship with individual wages. The same could be argued for underemployment, where a firm employs fewer workers than the number required to operate efficiently. To control for the size of the firm's workforce, three dummy variables are used namely overemployment, underemployment, and sufficient level of employment.

3.1.3 Industry

Krueger and Summer (1988) have argued that there are differences in wages for equally skilled workers across industries and Sørensen and Vejlin (2013) in their analysis of inter-industry wage differentials have shown that firm characteristics are more important at the industry level than at the worker level. Thus, the heterogeneity of industry would influence the wage variation within the same type of job. The PICS 2007 data contain information only for firms operating in the manufacturing and service sectors. Hence, a control dummy variable is included to control for industry-specific effects.

3.1.4 The age of the firm

Dunne et al. (1988) and Davis and Haltiwanger (1991) have argued that long-established firms tend to pay higher wages compared with newly established firms. As Brown and Medoff (2003) have pointed out, individual characteristics may be associated with firm characteristics. For instance, worker tenure and the age of the firm may have a positive correlation. Furthermore, workers in newly established firms might have no sufficient time to invest in human capital in terms of specific training, compared with workers in older firms. Due to the above, workers in the newly established firms should be expected to receive lower wages compared with those employed in older firms. The above imply that the age of the firm should be expected to play an important role in the level of wages that a firm pays. In this paper, the age of the firm, measured in years, in included in the wage equation.

3.1.5 Firm ownership

Drolet (2002) have shown that foreign ownership is associated with a wage premium. Foreign-owned firms are offering relatively higher wages since they can afford to

do this because, as ModÈn (1998) has observed, they are hiring highly productive employees. Griffith and Simpson (2001) have also found that foreign ownership has a positive relationship with productivity and wages. However, Feliciano and Lipsey (1999) who studied foreign-owned establishment and wages have found that foreign-owned companies pay higher wages compared to the domestic-owned companies, but this depends on the type of the industry they operate on. A dummy variable of firm ownership with the value 1 if the firm is a foreign-owned company and 0 if the firm is a local-owned company.

3.1.6 Firm size

Dickens and Katz (1987) and Drolet (2002) have found that large firms typically pay higher wages compared to smaller firms. Yet, Verbič and Ogorevc (2016) have suggested that if the firm size is measured by total sales, then size has a positive effect on wages, but if the firm size is measured by the number of workers employed in the firm, firm size exerts a small and negative effect on wages. From the data obtained, there are three categories of firm size, namely small, medium, and large. In this study, the size of the firm is measured based on the number of the employees, and the small firm is selected as the reference group for the firm size variable. A firm is classified as small if it employs fewer than 50 people, medium if it employs 50–249 people, and large if it employs 250 or more people. This study uses bands to avoid issues of collinearity between firm size and vacancy rate.

3.1.7 Union

It is long established in the labour literature that in the firm wage determination collective bargaining plays a significant role. Indeed, the main objectives of a trade unions are to improve the welfare of their members by negotiating with the employers better working conditions, high job tenure, and most importantly higher earnings (Ashenfelter and Johnson 1972; Schmidt and Strauss 1976). In Malaysia, workers have the right to form and join trade unions (Sect. 5 of the Industrial Relations Act, 1967) including temporary and foreign workers, but trade union activity is monitored and is subject to labour market legislation. Trade unions actively negotiate over working conditions, including wages, through collective bargaining. In the PICS 2007 survey, 48 percent of native workers are members of a trade union, whereas only a few immigrants become the members of a trade union, around 8.5 percent.

However, in the context of developing countries, some studies have found that unionisation and wages have a negative relationship (Johnson 1971; House and Rempel 1976; Manda 1997 and Manda et al. 2005). The study uses a dummy variable that corresponds to 1 if a trade union is established in the firm, and 0 if there is no trade union.

3.1.8 Export-oriented firm

Du Caju et al. (2012) and Raess (2014) have concluded that wage differentials are correlated with the export activities of the firm. The PICS 2007 dataset, defines an establishment as an export-oriented firm if the export activity is above 10 percent of total sales. A firm is classified as a local-oriented firm if its total exports are less than 10 percent of its total sales.

3.1.9 Legal status

Verbič and Ogorevc (2016), have argued that ownership status is an important factor in wage differentials. Thus, a dummy variable, taking the value 1 if the firm is a public sector company and 0 otherwise, is included in the specification.

3.1.10 Region

Demand side effects are important not only at the micro level, as captured by firm demand for labour (vacancies and vacancy duration), but also at macro-regional level. As Elias and Paradise (2016) have shown, regional variation in population density leads to cultural diversity that should be expected to affect productivity growth. The regional wage differentials exist due to differences in the characteristics of each region García and Molina (2002), differences in labour market behaviour Alejandro et al. (2012) and the level of economic development or specific industrial structure between region (Elias and Paradise 2016). Furthermore, each region has a different endowment of human capital, and the return that individuals receive from it varies sharply across regions (Enrique López-Bazo & Elisabet Motellón (2012). Murillo-Huertas et al. (2020) has found that regional wage differences are very similar throughout the wage distribution. The PICS 2007 observation was conducted at the plant level. Region is defined as the location in which a plant operates. These are Central, North, South, East Coast, Sabah and Sarawak regions. The Central region is selected as the reference group, because it is economically the most developed.

The definitions and descreptives of the variables used in this study are provided in Tables 1 and 2.

4 Methodology

A wage determination model that accounts for the supply-side effects is provided below:

$$W_i = \beta_0 + \boldsymbol{\beta} \boldsymbol{I}_i + e_i \tag{1}$$

The W_i refers to the natural logarithm of an individual's i hourly wage. $\boldsymbol{I}_i$ is a vector containing the individual characteristics discussed above, while e_i refers to the random disturbance term.

The wage equation model that captures the demand side effects are given as:

$$W_i = \gamma_0 + \boldsymbol{\gamma}_1 \boldsymbol{F}_i + \boldsymbol{\gamma}_2 \boldsymbol{R}_i + u_i \tag{2}$$

where $\boldsymbol{F}_i$ represents a set of firm-specific characteristics that capture the demand side effects at the micro/firm level and $\boldsymbol{R}_i$ is a set of regional controls to account for region-specific demand effects.

Finally, Eq. (3) encompasses both the supply and demand effects:

$$W_i = \alpha_0 + \boldsymbol{\beta} \boldsymbol{I}_i + \boldsymbol{\gamma}_1 \boldsymbol{F}_i + \boldsymbol{\gamma}_2 \boldsymbol{R}_i + n_i \tag{3}$$

All the above wage equation models are estimated both using the overall pooled sample and separately for the native and immigrant subsamples. Also, given that in the PICS dataset there are six to ten workers randomly selected from each firm, standard errors are clustered by firm to account for this.

4.1 Estimating the contribution of wage determinants on wage variation

Multiple regression analysis is not able to disentangle the goodness-of-fit of the variable itself and in combination with other variables (Johnson 2000). However, the dominance analysis can distribute the goodness-of-fit of the model among the variables according to the Shapley and Owen values[3] (Huettner and Sunder 2012). This can consider the effect of each variable, or in combination with other variables on the goodness-of-fit (R^2) of the multiple regressions. Therefore, dominance analysis is performed to identify the contribution of individual (supply-side) characteristics and firm and regional (demand-side) characteristics to variation of wages.

In applying this method, Eq. (3) is divided into two groups; Individual characteristic and firm-specific and regional characteristics. Assume that V refers to all explanatory variables. According to Huettner and Sunder (2012), to distribute the R^2, $R^2(V)$ should be distributed systematically among all the regression variables (V). Therefore, the additional regression analysis for every combination of variables ($v \subseteq V$) can be written as follows:

$$W_i = \beta_0 + \sum_{X_j \in v} \beta_j X_j + \varepsilon_j \tag{4}$$

In Eq. (4), j is the number of combination variables in each of the regression analyses. Each regression analysis produces its goodness-of-fit, $R^2(V)$, underlying the goodness-of-fit among regressor variables (Huettner & Sunder 2012).

5 The results: disentangling the effects of individual and firm characteristics on wages

(1) Individual characteristic effects on wage

Table 3 presents the regression results regarding the effects of individual characteristics on wages as in Eq. (1) for the whole sample as well as for the natives and immigrants separately. The standard errors are adjusted for heteroscedasticity.

(a) Pooled Sample

Column 1, Table 3, shows that 34.2 percent of the variation in wages is explained by individual characteristics controlled for in the model. All the variables included in the estimation have the expected sign and are statistically significant at the 1 percent level (with the exception of Tenure Squared which is at 10 percent level). Importantly, from the viewpoint of this study immigrant workers earn 33.9 percent lower compared to native workers.

(b) Native and immigrant desegregations

The analysis of the native/immigrant stratified sample in Table 3 (columns 2 and 3) reveals important differences across the two groups. The human capital premia are estimated to be higher for natives than immigrant workers. This is true both for educational qualifications, training and job-related skills, as captured by potential experience. The striking feature of this dissagregation is that training and higher qualifications (upper secondary and degree) are rewarded to a higher degree for native workers than for immigrants. In contrast, immigrants are paid higher rates than natives when they are in professional occupations. Furthermore, unskilled natives suffer higher wage fall compared to those in lower non-manual jobs or apprenticeships, which is not the case for the unskilled immigrant labour.

(2) Regional and firm characteristic effects on wage

Table 4 presents the regression results on the demand side determinants of wages, Eq. (2), for the whole sample

[3] The Shapley and Owen value is a way to calculate the factor contribution, and it also allows decomposition in the grouped regressor (Huettner & Sunder 2012). Using the Shapley value decomposition it able to assign the goodness of fit of the regression analysis to each of the groups directly (Huettner & Sunder 2012).

Table 1 Description of variables

Variable	Description
Hourly wage	The hourly wages is the sum of basic salary, allowances and bonuses The hourly wage is calculated by the following formula: $hourlywage = \frac{\frac{12months}{52week} \times monthly\ salary}{weekly\ hours}$
Log hourly wage	Due to positive skew in the hourly wage, the log hourly wage should be used to fit the model
Immigrant	A dummy variable. The worker considers as immigrant if he/she is a non-Malaysian regardless of their country of origin and place of birth. (1 if the worker is immigrant and 0 if native)
Male	Corresponds to the gender of the workers (1 if male and 0 if female)
Married	Corresponds to the marital status. (1 if married or ever married 0 if single)
Training	This variable corresponds to the duration of training attended, measured in month
Tenure	This variable corresponds to the years of tenure with current employer
Tenure square	The worker's tenure is not normally distributed. Thus, the square of length of tenure should be used in the analysis
Potential experience	Potential experience in the labour market. The potential experience is calculated by the following formula: $Potexp = \left[Age - 6 - (years\ of\ education)\right] - \frac{unemployment\ period,\ in\ month}{12\ months}$
Potential experience square	The potential experience is not normally distributed. Thus the square of potential experience should be used
Degree	A dummy variable for workers who completed up to degree education (1 if completed degree and 0 otherwise)
Diploma	A dummy variable for workers who completed up to diploma education (1 if completed diploma and 0 otherwise)
Upper secondary	A dummy variable for workers who completed up to upper secondary school (1 if completed upper secondary and 0 otherwise)
Lower education (Reference group)	A dummy variable for workers who completed up to lower education (1 if below upper secondary and 0 otherwise)
Management	This dummy variable refers to the type of job at current job (1 if management and 0 otherwise)
Professional	This dummy variable refers to the type of job at current job (1 if professional and 0 otherwise)
Skilled	This dummy variable refers to the type of job at current job (1 if skilled production and 0 otherwise)
Unskilled	This dummy variable refers to the type of job at current job (1 if unskilled production workers and 0 otherwise)
Non Production/apprentice (Reference group)	This dummy variable refers to the type of job at current job (1 if the worker is non production worker or apprentice and 0 otherwise)
Union	This dummy variable corresponds to the membership of of the workers in the trade union (1 if a member of trade union and 0 otherwise)
Vacancies	This variable corresponds to the vacancy rate in 2006, calculated as the rate of total number of vacancies over the total number of workers in the firm
Vacancies duration	This variable refers to the average duration (reported in weeks) to fill up the recent vacancies in the firm. The vacancy duration only refers to filled vacancies
Small firm (Reference group)	This dummy variable refers to the firm size by number of employees (1 if a small size firm and 0 otherwise)
Medium firm	This dummy variable refers to the firm size by number of employees (1 if a medium size firm and 0 otherwise)
Large firm	This dummy variable refers to the firm size by number of employees (1 if a large size firm and 0 otherwise)
Central (Reference group)	This dummy variable refers to the region of the firm is located (1 if in the Central region and 0 otherwise)
North	This dummy variable refers to the region of the firm is located (1 if in the North region and 0 otherwise)
South	This dummy variable refers to the region of the firm is located (1 if in the South region and 0 otherwise)
East Coast	This dummy variable refers to the region of the firm is located (1 if in the East coast region and 0 otherwise)
Sabah	This dummy variable refers to the region of the firm is located (1 if in the Sabah region and 0 otherwise)
Sarawak	This dummy variable refers to the region of the firm is located (1 if in the Sarawak region and 0 otherwise)
Export orientation	This variable corresponds to the firm's orientation (1 if export orientation and 0 otherwise)

Table 1 (continued)

Variable	Description
Foreign owned companies	This variable corresponds to the firm's state of ownership (1 if foreign owned companies and 0 otherwise)
Overemployment	This variable corresponds to the level of employment (1 if firm is over-employing and 0 otherwise)
Sufficient employment (Reference group)	This variable corresponds to the level of employment (1 if firm is employing sufficint number of workers and 0 otherwise)
Underemployment	This variable corresponds to the level of employment (1 if firm is under-employing and 0 otherwise)

as well as for the natives and immigrants separately. The standard errors are adjusted for heteroscedasticity.

(a) Pooled sample

The results (Table 4, column 1) show that higher vacancy rates are correlated with lower wages, after controlling for vacancy duration. This shows that there is a negative association between the number of firm vacancies and wage rates paid by this firm, which intuitively implies that if a firm pays low wages it fails to attract sufficient number of applicants, thus causing the number of vacancies to accumulate. The vacancy duration is positively associated with wages, in line with previous studies such as Faberman and Menzio (2015), Kettemann et al. (2017), and Viking and Long-Hwa (2009).

(b) Native and immigrant desegregations

Consistent with the earlier results vacancy duration has a positive correlation with the wage rates for natives Column 2 (Table 4), but it has an insignificant effect on immigrant wages. This implies that in the case of native workers, employers are targeting high-quality workers matched suitably to the requirements of the job vacancy and hence it takes longer for firms to fill the job vacancy. This is consistent with the earlier findings in Table 3, where it is shown that native workers are commanding higher returns to education and training in contrast to their immigrant counterparts. Furthermore, in line with Gralla and Kraft (2012), the results show that firms that employ workers above the number needed to operate efficiently pay lower rates for their workers as the firms suffer from diseconomies of scale. This effect is more taxing on migrant workers.

There are some other noteworthy results regarding the effects of other demand-side characteristics on wages. Both natives and immigrants employed in the manufacturing sector earn less compared with those employed in the service sector. Furthermore, natives and migrants employed in foreign-owned companies have a wage advantage compared to those employed in domestic firms. Finally, the results indicate that there are some regional pay differences.

(3) The dominance analysis of firm characteristics on wage

Table 5 shows the results of the dominance analysis, based on a wage equation specifications that include supply side characteristics, as reported in Table 3, and demand side variables, as reported in Table 4, on the overall sample, as well as on the native and immigrant subsamples.

(a) Pooled sample

For the overall sample, the model R^2 is estimated to be 0.408 (Table 1, Column 1). Based on the dominance analysis, which decomposes the goodness-of-fit, 67.61 percent of the R^2 of the model is explained by the individual supply-side characteristics. The demographic and human capital variables[4] have the most substantial effect on the goodness-of-fit, 51.93 percent of the overall R^2, while the type of job[5] only explains 16.86 percent of the overall R^2. Regional and firm characteristics contribute the remaining 32.39 percent to the R^2 of the model, with roughly half of this, 15.38 percent, attributed to regional effects, and the rest to the variables that represent firm characteristics.[6]

(b) Native and immigrant desegregations

Dominance analysis for native and immigrant subsamples are presented in Columns 2 and 3. The contribution of the individual supply-side characteristics on the overall goodness-of-fit is greater for natives than immigrants. 66.54 percent of the overall R^2 for the natives is explained

[4] Immigrant, gender, marital status, education, labour market experience, training and tenure.

[5] Managerial, professional, skilled and unskilled jobs.

[6] Vacancies, vanacy duration, employment level, age and size of the firm, union, firm ownership, export and public company.

Table 2 The difference of the mean

Variables	Pooled	Native (μ^n)	Immigrant (μ^m)	T-test $H_1 : \mu^n - \mu^m \neq 0$)
Hourly wage	12.208	12.890	5.675	***
Log hourly wage	2.007	2.074	1.369	***
Male	0.537	0.505	0.849	***
Married	0.633	0.652	0.456	***
Training	2.493	2.663	0.868	***
Tenure	7.525	7.895	3.979	***
Tenure square	105.758	113.472	31.868	***
|Potential experience	17.037	17.200	15.481	***
Potential experience square	414.738	426.593	301.185	***
Degree	0.138	0.149	0.035	***
Diploma	0.144	0.156	0.038	***
Upper secondary	0.362	0.376	0.227	***
Low education	0.355	0.319	0.701	***
Management	0.083	0.091	0.013	***
Professional	0.096	0.104	0.020	***
Skilled	0.183	0.189	0.124	***
Unskilled	0.364	0.336	0.630	***
Non production/apprentice	0.274	0.280	0.213	***
Central	0.431	0.438	0.365	***
North	0.207	0.201	0.263	***
South	0.265	0.259	0.321	***
East coast	0.021	0.022	0.010	***
Sabah	0.033	0.033	0.029	
Sarawak	0.044	0.047	0.013	***
Manufacturing	0.790	0.770	0.982	***
Percentage of vacancies	0.139	0.136	0.173	***
Vacancy duration	3.945	3.861	4.742	***
Age of the firm	18.444	18.645	16.516	***
Small firm	0.478	0.460	0.651	***
Medium firm	0.287	0.293	0.227	***
Large firm	0.235	0.247	0.121	***
Union	0.084	0.090	0.031	***
Export oriented firm	0.446	0.444	0.466	
Non export oriented firm	0.554	0.556	0.534	
Locally owned companies	0.727	0.720	0.790	***
Foreign owned companies	0.273	0.280	0.210	***
Public limited company	0.035	0.038	0.008	***
Overemployment	0.227	0.223	0.267	***
Underemployment	0.217	0.213	0.255	***
Sufficient employment	0.556	0.564	0.478	***

* Statistically significant at $p < 0.1$

** Statistically significant at $p < 0.05$

*** Statistically significant at $p < 0.01$

Table 3 OLS regression of wage equation with individual characteristics

Variables	Pooled	Native (β^n)	Immigrant (β^m)	T-Test Pr ($\beta^n - \beta^m = 0$)
Immigrant	−0.339***	–	–	–
	(0.023)			
Male	0.186***	0.189***	0.130**	
	(0.013)	(0.013)	(0.054)	
Married	0.097***	0.100***	0.090**	
	(0.016)	(0.017)	(0.044)	
Training	0.004***	0.004***	−1.85-E04	*
	(0.001)	(0.001)	(0.003)	
Tenure	0.026***	0.026***	0.017*	
	(0.003)	(0.003)	(0.009)	
Tenure square	−1.97E-04*	−2.17-E04*	2.74-E04	***
	(1.14E-04)	(1.19-E04)	(3.36-E04)	
Potential experience	0.033***	0.035***	0.010	**
	(0.002)	(0.002)	(0.010)	
Potential experience square	−0.001***	−0.001***	−3.14-E04	***
	(4.58-E05)	(4.74-E05)	(2.71-E04)	
Degree	1.054***	1.088***	0.565***	***
	(0.027)	(0.028)	(0.140)	
Diploma	0.714***	0.735***	0.570***	
	(0.023)	(0.024)	(0.148)	
Upper secondary	0.263***	0.280***	0.080	***
	(0.016)	(0.017)	(0.055)	
Management	0.223***	0.221***	−0.006	
	(0.026)	(0.026)	(0.218)	
Professional	0.284***	0.270***	0.613***	*
	(0.026)	(0.027)	(0.202)	
Skilled	0.096***	0.092***	0.167**	
	(0.019)	(0.020)	(0.080)	
Unskilled	−0.160***	−0.169***	−0.052	**
	(0.016)	(0.017)	(0.048)	
Constant	1.027***	0.992***	1.026***	
	(0.025)	(0.026)	(0.106)	
R^2	0.342	0.320	0.117	
N	13,170	11,925	1,245	

Numbers in parentheses are standard errors

Dependent variable is Log hourly wage

* Statistically significant at $p < 0.1$

** Statistically significant at $p < 0.05$

*** Statistically significant at $p < 0.01$

by individual characteristics, whereas 48.12 percent of the R^2 of regression for the immigrants is explained by their individual characteristics. This difference is mainly driven by demographic and human capital characteristics (51% for natives and 32.95% for immigrants), which is consistent with the earlier findings (Table 3) that human capital premia are higher for native workers.

Demand-side characteristics contribute more to the overall R^2 for the immigrants sample, 51.88 percent of the overall R^2, compared with the native sample, 33.46 percent on the overall R^2. The contribution of the regional variables to the overall R^2 is roughly equal to the contribution of firm characteristics for the native sample, but the regional contribution is more prominent compared to the firm characteristics for the immigrant workers.

Table 4 OLS regression of wage equation with firm characteristics

Variables	Pooled Samples	Native (β^n)	Immigrant (β^m)	T-Test Pr ($\beta^n - \beta^m = 0$)
Percentage of vacancies	−0.140***	−0.130***	−0.050	
	(0.036)	(−0.033)	(0.155)	
Vacancy duration	0.005**	0.008***	−0.003	***
	(0.002)	(−0.002)	(−0.003)	
Overemployment	−0.056	−0.042	−0.150	
	(0.041)	(−0.042)	(−0.095)	
Underemployment	−4.23-E04	0.016	−0.039	
	(0.042)	(−0.043)	(−0.116)	
Manufacturing	−0.619***	−0.554***	−0.747***	
	(0.044)	(−0.044)	(−0.261)	
Age of the firm	−4.86-E04	−0.001	6.49-E05	
	(0.001)	(−0.002)	(−0.003)	
Foreign owned companies	0.183***	0.164***	0.226*	
	(0.042)	(−0.042)	(−0.126)	
Medium firm	0.093**	0.054	0.115	
	(0.042)	(−0.043)	(−0.123)	
Large firm	0.153***	0.097**	0.226	
	(0.044)	(−0.044)	(−0.162)	
Union	0.074	0.054	−0.238	
	(0.051)	(−0.051)	(−0.175)	
Export oriented firm	0.008	0.022	−0.066	
	(0.039)	(−0.04)	(−0.088)	
Public limited company	−0.023	−0.046	0.239	
	(0.074)	(−0.075)	(−0.208)	
North	−0.307***	−0.302***	−0.306**	
	(0.047)	(−0.047)	(−0.128)	
South	−0.398***	−0.410***	−0.322***	
	(0.042)	(−0.042)	(−0.096)	
East coast	−0.603***	−0.656***	−0.655***	
	(0.115)	(−0.121)	(−0.134)	
Sabah	−0.600***	−0.625***	−0.405**	
	(0.074)	(−0.08)	(−0.16)	
Sarawak	−0.588***	−0.630***	−0.904***	
	(0.079)	(−0.08)	(−0.297)	
Constant	2.623***	2.646***	2.330***	
	(0.051)	(−0.051)	(−0.264)	
R^2	0.198	0.190	0.124	
N	13,110	11,874	1,236	

Numbers in parentheses are standard errors

Dependent variable is Log hourly wage

* Statistically significant at $p < 0.1$

** Statistically significant at $p < 0.05$

*** Statistically significant at $p < 0.01$

Table 5 Dominance analysis on the relative importance on supply and demand-side characteristics on wages

Group % R-square	Pooled samples	Native subsample	Immigrant subsample
Supply-side	67.61	66.54	48.12
Demographic and human capital	51.93	51.00	32.95
Type of Job	16.86	16.52	16.22
Demand-Side	32.39	33.46	51.88
Regions	15.38	17.14	30.06
Firm characteristics	15.83	15.34	20.77
R^2	0.408	0.392	0.192
N	13,110	11,874	1,236

6 Conclusion

The paper presents a novel insight into issues of migration and the labour market in a developing country. The existing literature has predominantly focused on developed countries, whereas developing countries have been treated as a source of migration to developed countries. However, this paper provides a new perspective in the context of a developing country, Malaysia, which has experienced a significant inflow of immigrants. For instance, it is estimated that in 2015, immigrants account for 15% of the total workforce in Malaysia. This study uses an original employer-employee dataset to investigate the demand and supply effects on wage differentials between immigrants and natives.

The analysis reveals some noteworthy differences in the wage determination process for native and immigrant workers. In line with standard neoclassical theory, individual characteristics are found to be a key determinant of wages for native workers, and are relatively more important in explaining wage variation than demand-side effects. In contrast, individual supply-side characteristics are found to explain noticeably less of the wage variation for immigrant workers. Therefore, this study reveals that native and immigrant wages do not necessarily reflect the workers' productivity, although this effect is far more pronounced for the migrant workers. This result is in line with Wachtel and Betsey (1972), who have suggested that workers are not necessarily paid in line with their human capital, but there are demand side factors or firm structural characteristics that have significant effects on pay. However, there may be a residual variation due to workers' unobserved productivity. Conversively, demand-side firm and regional characteristics have an impact on both native and immigrant wages, but the effect is more evident on the wages of the immigrants. This may partly explain why immigrant workers receive relatively lower wages than their native peers. The findings help to explain the drivers behind the wage differentials between native and immigrant workers in the Malaysian labour market.

Acknowledgements

This article would not have been possible without support and guidance from many people. Firstly, I would like to express my special appreciation and thanks to my academic supervisors Professor Alexandros Zangelidis and Professor Ioannis Theodossiou for all their guidance, encouragements and motivation. We also thank the editor, and the anonymous referees for their suggestions and insight.

Author contributions

The authors confirm contribution to the paper as follows: the study conception and design: all authors; data collection: BA; analysis and interpretation of results: all authors; draft manuscript preparation: BA. Reviewed the results and approved the final version of the manuscript: all authors.

Funding

This study funded by Ministry of Higher Education, Malaysia (Grant No: RACER/1/2019/SS08/UMS//1).

Availability of data and materials

The dataset generated and analysed using Enterprise Analysis Unit—World Bank Group data which avaibale at https://www.enterprisesurveys.org.

Declarations

Competing interests

The authors declare no competing interests.

Received: 14 May 2022 Accepted: 14 July 2023
Published online: 05 August 2023

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