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Workplace Characteristics and Determinants of Over-education and Overskilling in the Manufacturing Sector in Malaysia

(Ciri-ciri Tempat Kerja dan Penentu-penentu 'Over-education' dan 'Overskilling' dalam Sektor Pembuatan di Malaysia)

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ABSTRACT

This paper explores the influence of workplace characteristics on the determinants of over-education and overskilling in Malaysia. Based on the 2007 Productivity Investment Climate Survey (PICS-2) dataset, about 19 percent of workers are over-educated while 29 percent are overskilled (7% severely overskilled and 22% moderately overskilled). The multinomial logit reveals that workplace characteristics such as firm size, percentage of university workers at the workforce, types of ownership, number of competitors, and types of hiring practices all influence over-education. Nevertheless, the severely overskilled individual is less evident in firms with higher share of university workers, lower proportion of foreign ownership, higher number of competitors (> 25 competitors), and in firms where education and technical skills are of highest priority for hiring workers. Therefore, it may be surmised that the existence of such incidences is not only due to individuals' characteristics as found in other studies but also contributed by employer characteristics where individuals work at.

Keywords: Overskilling; over-education; workplace characteristics; Malaysia

ABSTRAK

Kertas ini bertujuan mengkaji pengaruh ciri-ciri tempat kerja terhadap insiden 'over-education' dan 'overskilling' di Malaysia. Dengan menggunakan data Productivity Investment Climate Survey (PICS-2) tahun 2007, sekitar 19 peratus pekerja didapati terlebih kelulusan (over-educated) manakala 29 peratus lagi terlebih kemahiran (overskilled) (iaitu 7% adalah sederhana 'overskilled' dan 22% serius 'overskilled'). Regresi multinomial logit menunjukkan bahawa ciri-ciri tempat kerja seperti saiz firma, peratusan pekerja berkelulusan universiti di tempat kerja, jenis pemilikan, bilangan pesaing dan perbezaan amalan pengambilan pekerja semuanya mempunyai pengaruh terhadap insiden 'over-education'. Sementara itu, insiden 'overskilled' yang serius kurang ketara dalam firma yang mempunyai ramai pekerja berkelulusan universiti, pemilikan asing yang sedikit, ramai pesaing (>25 pesaing) dan firma yang meletakkan pendidikan dan kemahiran teknikal sebagai keperluan utama dalam proses pengambilan pekerja. Dapatan kajian ini menunjukkan bahawa kewujudan insiden 'over-education' dan 'overskilling' dalam pasaran buruh bukan sahaja disebabkan oleh ciri-ciri individu itu sendiri, malah juga dipengaruhi oleh elemen tempat kerja di mana individu itu bekerja.

Kata kunci: Over-educated; overskilled, ciri-ciri tempat kerja; Malaysia

INTRODUCTION

Over the last two decades, the number of studies on over-education has risen considerably, especially in developed countries (for reviews, see McGuinness 2006; Battu 2008). In this research, workers who have higher schooling than what their jobs require are deemed 'over-educated', while those with lower schooling than what is required are considered 'undereducated'. On the other hand, a small but important body of literature has demonstrated the presence of overskilling in the labour market (Allen & van der Valden 2001; Mavromaras et al. 2009; Mavromaras et al. 2010; McGuinness & Sloane 2010). Here, overskilling describes the extent to which employees adequately use their skills in their jobs, which means that individuals working in jobs for which they are unable to utilise all their abilities or skills are considered overskilled (Mavromaras et al. 2009). As a concept, overskilling is superior since over-education implicitly assumes that qualifications or schooling is an accurate indicator of skills, which is an unnecessary assumption.

It is broadly accepted in the literature that individual human capital endowment, particularly education and training (Dolton & Vignoles 2000; Cutillo & Di Pietro 2006; Di Pietro & Cutillo 2006; McGuinness & Bennett 2007; Robst 1995, 2007, 2008); heterogeneity in skills and ability (Green et al. 1999; Green & McIntosh 2007; Chevalier 2003; Chevalier & Lindley 2009), job characteristics (Cutillo & Di Pietro 2006; Green & McIntosh 2007; Dolton & Silles 2008), and spatial factors (McGoldrick & Robst 1996; Büchel & Battu

2003; Büchel & van Ham 2003) play significant roles in ascertaining why some individuals are over-educated or overskilled whereas others are not. There is however a very limited number of studies in the literature which pay attention on the role of workplace characteristics such as hiring practice, share of highly educated workers at the workplace, firm competitors, capital and labour-intensive firms in influencing the determinants of over-education and overskilling. Apart from Belfield (2010), the role played by workplace characteristics is relatively unexplored.

The fact that over-education and overskilling resulted in wage penalty (for example see McGuinness 2006; Battu 2008) and lower job satisfaction (see for example Fleming & Kler 2007), it is plausible to say that over-education and overskilling as a sub-optimal outcome for workers. If this is the case, it would imply that both over-education and overskilling at the workplace are sub-optimal for the firm too since employers are the ones who employ them. Tsang and Levin (1985) argue that firms may run the risk of lower profits as a result of poor deployment of workers due to lower worker effort. Moreover, over-education may be related to feeble hiring practice or poor labour management decisions by the managers (Belfield 2010). For any argument, firms may want to understand why workers might be over-educated or overskilled as they want to avoid hiring or retaining them.

Yet, identifying such workers should be incorporated together in the characteristics of the firms and those of the workers. This is because workers are only classified as over-educated or overskilled when they are given tasks at the workplace. The reason why the role of workplace characteristics on the incidence of over-education and overskilling has been omitted in the literature is mainly due to lack of employer-employee dataset. What is more, both over-education and overskilling studies are very limited in the context of developing country. The main reason why mismatch is not examined in developing countries stems from poor data, especially with regards to education or skills required to perform in a job (Mehta et al. 2010). We are fortunate in that we have here a dataset that allows us to examine the effects of workplace characteristics on the determinants of over-education and overskilling as our dataset contains extensive information on employers-employees background.

This paper then focuses mainly on the role of workplace characteristics on over-education and overskilling determinants in the manufacturing sector in Malaysia. This sector-specific analysis (manufacturing) has an advantage over the existing literature since very few studies focus on particular sectors or firms, a notable exception being Tsang (1987). This paper is organised as follows. Section 2 provides previous studies regarding the determinants of over-education and overskilling. Section 3 outlines dataset and the measurement of over-education and overskilling while section 4 details out empirical estimation methods. The effects of workplace characteristics on the determinants of over-education and overskilling are explored in section 5 and the final section provides some concluding remarks.

LITERATURE REVIEW

In the over-education and overskilling literatures, much has been discussed about the role played by individuals' characteristics (e.g. gender, educational background, age and ability and skills) on the determinants of both the mismatch incidences in the labour market. It would be the case that over-education may reflect individuals' deficiencies in other types of human capital accumulation and there is also strong support for what has been termed the 'substitutability hypothesis', in which work experience and training are negatively correlated with the probability of over-education (Sloane et al. 1996, 1999; Kiker et al. 1997; Daly et al. 2000; Büchel & Pollmann-Schultz 2004; Green & McIntosh 2007) and overskilling (Green & McIntosh 2007; Mavromaras et al. 2009). For example, Green and McIntosh (2007) find that being one year older reduces the probability of over-education and overskilling by almost 5 percent and 6 percent, respectively, among graduates. Büchel and Pollmann-Schultz (2004), in a study of the German labour market, find that for each number of training sessions attended, the risk of over-education is reduced by 25 percent.

Nevertheless, the relationship between educational attainment and over-education is generally positive, partly because of the way over-education is measured. For example, under the workers' assessment and objective method, over-education cannot exist for the most lowly educated (Wirz & Atukeren 2004; Frenette 2004). For instance, Wirz and Atukeren (2004) show that individuals with a university degree run a higher risk of over-education as compared to individuals with non-university qualifications. In Canada, Frenette (2004) reveals that individuals with a master's degree are more likely to be overqualified than those with bachelor's degree. However, other studies point out that the greater the qualifications, the lower the probability of over-education (Dolton & Vignoles 2000; Cutillo & Di Pietro 2006; Di Pietro & Cutillo 2006; McGuinness & Bennett 2007; Robst 1997, 2007). This perhaps may be due to the assumption that individuals with greater educational attainment are more likely to be hired because they have the needed skills.

Over-education is also somewhat related to individuals' skills and ability where within over-educated workers, they (the over-educated) are heterogeneous, i.e. over-educated workers are in some way less able relative to their well-matched counterparts. Green et al. (1999) deal with this heterogeneity by proxying abilities and skills via controls for a numeracy test. Using the National Child Development Study (NCDS) dataset, they find that individuals who score higher on the mathematics test make being over-educated more unlikely than individuals with a lower score. Chevalier and Lindley (2009) in the

UK controlled for two types of individual skills: academic skills (written and spoken communication, foreign language, numerical, basic computer, research skills, etc.) and professional skills (entrepreneurial, teamwork, leadership or management skills). Their findings show that the probability of being apparently and genuinely over-educated is contingent upon respondents' academic or professional skills. Specifically, they find that over-education has almost nothing to do with academic skills, apart from writing skills, which are found to increase the probability of apparent over-education by 9 percentage points. In contrast, having professional skills, particularly management and leadership skills significantly reduce the risk of being genuinely over-educated by approximately 6 and 11 percentage points, respectively.

Space or mobility constraint is also associated with over-education and overskilling incidence as highlighted by the theory of differential overqualification (Frank 1978). Mobility constraints may prevent individuals from searching a job within a wider spatial area and they become reliant on the small markets around their own neighbourhoods or regions. This might be particularly evident amongst particular groups of workers such as married women. Büchel and Battu (2003), in their study in Germany, find that married women who live in the rural area increase the odds of being in an over-educated job relative to unmarried women or men (married and unmarried). In another study, Büchel and van Ham (2003) also highlight the importance of space, though they do not focus on the gender dimension. Using the German panel data (GSOEP), they find that individuals who own cars for personal use and individuals with a shorter commuting time to a large agglomeration have a reduced risk of over-education.

In term of job characteristics, workers in part-time employment are found to have higher over-education incidence as they may for a variety of reasons be more concerned with gaining employment irrespective of match quality (Cutillo & Di Pietro 2006; Green & McIntosh 2007; Dolton & Silles 2008). For example, Cutillo and Di Pietro (2006) in Italy and Dolton and Silles (2008) in the UK find that the probability of being over-educated among full-time working graduates is 11 percent points lower compared to part-time working graduates. Also, the probability of over-education is negatively associated with the respondent's occupational level – the higher the occupation level attained, the lower the risk of over-education. This is particularly evident in the case of graduates (Di Pietro & Cutillo 2006; Dolton & Silles 2008). This stems from the fact that many professional and managerial occupations require greater competencies which may only be possible with having a degree level education.

Unfortunately, very few have examined how firm-specific characteristics influence neither over-education nor overskilling. Tsang and Levin (1985) argue that since workers' prosperity used to be tied to the welfare of firms, the incidence of job mismatch at workplace leads to a decline in the productivity of workers and firms also suffer in their pursuit of profits. Jones et al. (2009) investigate the effects of having overskilled workers at the workplace on employers in the UK in terms of turnover and absence rates, labour productivity, and product market performance. Using the 2004 WERS, the results are mixed and there is only limited support for the notion that overskilling has deleterious effects on workplace performance. Only turnover rates are negatively associated with overskilling whereas absence rates, labour productivity and product quality are not significantly associated with overskilling. Using the same dataset, Belfield (2010) further explores the effects of overskilling on workplace performance. This time, the author focuses on indicators that relate to work effort (i.e., absenteeism, quit rates, job satisfaction and job contentment) alongside a measure of workplace average pay. Having a higher proportion of overskilled workers at a workplace is found to have a negative impact on average workplace earnings in the public and private sectors. In particular, a 10 percent increase in the overskilling rate in the workplace decreases workers' average pay by 1 to 3 percent. With regard to workers' effort, a positive relationship between overskilling and quit rates is found, particularly in the private sector (a 10% rise in the overskilling rate in the workplace leads to a 5.4% increase in the quit rate). In addition, higher workplace overskilling leads to a lower job satisfaction and job contentment. However, no evidence indicates that overskilling increases the likelihood of absenteeism in public or private sectors.

Based upon these two limited studies, it would imply that the management – labour relationship is to a large extent important for any employer to ensure that labour inputs are optimally productive. Firms might therefore, wish to identify workforce characteristics and labour practices that either minimize the incidence of over-education or alleviate its effects on earnings and job satisfaction.

DATA DESCRIPTION

Data used in this paper is taken from the second survey of the Productivity Investment Climate Survey (PICS-2) which is carried out in 2007 which covers the manufacturing and business support services sectors. The advantage of the PICS-2 is the survey consists of employers-employees survey which allows us to examine the workplace characteristics such as hiring practice, higher percentage of workers with university qualification at the workplace, firm size, types of ownership, and firm competitors. In particular, two interviews are structured - employer and employee for each of the workplaces - one with the Chief Executive Officers (CEOs) or where appropriate, managers and another one with employees. For the latter, 10 employees are randomly selected for each workplace in order to seek information on the usual array of demographic and work-related information as well as human capital endowments (i.e. earnings, previous and current job, education, training, and work experience).

Yet, this paper only focuses on the manufacturing sector alone due to the fact that it is representative of the manufacturing sector as a whole (World Bank 2009). In particular, 1,115 establishments are selected from nine manufacturing industries. Samples in this paper however are confined to workplaces where more than four workers have responded to the worker survey and the respondents are in full-time employment, aged between 15 and 64 years old. The final samples then comprise of 10,302 workers (50.4% male and 49.6% female) across 1,043 manufacturing-based firms.

Table 1 provides some descriptive statistics for the key variables in our analysis. Generally, respondents are on average 34 years of age and reported to have had

TABLE 1. Descriptive statistics (mean and standard deviation)

Variable	All (n = 10,302)		Male (n = 5,610)		Female (n = 4,692)	
	Mean	SD	Mean	SD	Mean	SD
Individuals' background						
Age	34.89	9.83	35.86	9.99	33.91	9.56
Years of schooling completed	10.35	3.52	10.21	3.63	10.92	3.34
Education level						
No/informal qualification	0.03	0.18	0.04	0.21	0.02	0.14
Primary education	0.12	0.33	0.13	0.33	0.12	0.33
Lower secondary	0.25	0.43	0.28	0.45	0.21	0.41
Upper secondary	0.38	0.49	0.36	0.49	0.41	0.49
Diploma	0.13	0.34	0.11	0.31	0.15	0.36
University	0.09	0.29	0.08	0.29	0.09	0.29
Experience (month)	165.45	120.05	181.26	123.15	149.38	114.61
Train	0.42	0.49	0.43	0.5	0.4	0.49
Female	0.55	0.45				
Married	0.65	0.48	0.68	0.47	0.62	0.49
Workplace characteristics						
Industry						
Food processing	0.22	0.41	0.23	0.42	0.21	0.41
Textiles	0.04	0.19	0.04	0.19	0.04	0.19
Garments	0.07	0.26	0.02	0.15	0.12	0.33
Chemical	0.08	0.27	0.09	0.28	0.07	0.25
Rubber & plastics	0.25	0.44	0.25	0.43	0.26	0.44
Machinery & equipment	0.09	0.28	0.12	0.32	0.05	0.23
Electric & electronic	0.04	0.18	0.03	0.18	0.04	0.19
Auto parts	0.11	0.31	0.11	0.31	0.11	0.31
Wood & furniture	0.11	0.31	0.11	0.32	0.1	0.31
Firm size						
Firm size less than 50 employees	0.4	0.49	0.43	0.5	0.37	0.48
Firm size 50 to 150 employees	0.31	0.46	0.3	0.46	0.32	0.47
Firm size more than 150 employees	0.29	0.45	0.27	0.44	0.31	0.46
Ownership						
Purely domestically-owned	0.68	0.47	0.68	0.47	0.68	0.47
Less than 30% foreign-owned	0.05	0.21	0.05	0.22	0.04	0.21
More than 30% foreign-owned	0.27	0.45	0.27	0.44	0.28	0.45
Percentage of workers with university qualification at the workplace						
Graduates less than 25%	0.76	0.42	0.76	0.43	0.77	0.42
Graduates 25 to 50%	0.19	0.39	0.18	0.38	0.19	0.39
Graduates more than 50%	0.05	0.22	0.06	0.23	0.04	0.2
Share on labour cost of the total cost						
Labour cost less than 25%	0.64	0.48	0.65	0.48	0.63	0.48
Labour cost 25 to 50%	0.26	0.44	0.25	0.43	0.28	0.45
Labour cost 51 to 75%	0.07	0.25	0.07	0.26	0.07	0.25
Labour cost more than 75%	0.03	0.16	0.04	0.17	0.02	0.15
Number of competitors						
No competitor	0.05	0.21	0.05	0.23	0.05	0.22
Competitor less than 25	0.86	0.35	0.87	0.34	0.88	0.33
Competitor more than 25	0.09	0.29	0.08	0.27	0.07	0.26
Hiring practice (1 = Yes, 0 = No)						
Education-based	0.58	0.49	0.51	0.5	0.57	0.5
Work experience-based	0.84	0.37	0.84	0.37	0.82	0.39
Technical-based	0.78	0.41	0.8	0.4	0.77	0.42
Firm providing on-the-job training	0.52	0.49	0.49	0.5	0.55	0.5

about 10.5 years of schooling which is equivalent in Malaysia to upper secondary qualifications. With respect to other human capital variables, respondents on average accumulated about 157 months of work experience, 7.6 (years) job tenure, and nearly 40 percent have once attended a training course. By gender, women are slightly younger than men (34 versus 36 years old) and men have more work experience and job tenure within firms than women (181 months and 9 years respectively vs. 149 months and 7 years respectively). However, women are slightly better educated with 25 percent holding higher degree qualifications (both diploma and university qualifications) relative to 20 percent among men. In terms of occupation distribution, a quarter of the women (25%) occupy higher job levels (management and professional) with a corresponding figure of 22 percent for men.

With regard to firm characteristics, a large proportion of workers are employed at firms specialised in rubber and plastic and food-processing products, smaller firms (less than 50 employees), firms that are purely-domestically owned and firms that provide on-the-job training programmes at the workplace. In terms of the quality of the workforce, around 76 percent and 64 percent of workers work at the workplace with less than 25 percent of the workers having a university qualification and at firms where labour costs represent less than 25 percent of the total cost, respectively.[1] On top of that, over 86 percent of respondents work at firms with less than 25 competitors. Regarding hiring practices, at least 78 percent of workers were employed at firms that use work experience and technical aspect rather than education as the most important criteria in recruitment.[2]

How over-education and overskilling are measured? The PICS-2 provides a direct measure of required education and skills based on a worker's assessment (WA) where workers are asked the following two questions:

1. What is the most appropriate level of education for the work you are doing?
2. Your current job offers you sufficient scope to use your knowledge and skill.

This WA approach has its own advantages as it incorporates all information about a respondent's specific job and the workers are the one who are actually in the best position to understand the requirements of an occupation (Hartog 2000; Marzo-Navarro 2007). The main problems are however, workers may lack sufficient benchmarks against which to assess their job requirements, especially for young workers who have little work experience. Moreover, workers may inflate or overstate the requirements of the jobs as a form of self-worth (Hartog 2000), which may lead to an under- or over-estimation of over-education. Nevertheless, for the first question, there are seven educational levels to choose from; 1 (degree) to 7 (no qualification). In the second question, four responses are available; from 1 (do not agree at all) to 4 (agree completely).

Table 2 provides the raw responses for question one (top panel) and question two (bottom panel). Roughly, 36 percent of workers believe that an upper secondary qualification is the most appropriate educational requirement. Lower secondary level is the second most appropriate (23%), followed by diploma (17%). Only 11 percent of workers report that a degree is the most appropriate educational level for the job they currently hold. The gender differences are small. Nevertheless, the corresponding responses of question 2 are 8.1%, 22.9%, 54.7% and 14.3%, respectively. By gender, the responses are quite similar between males and females.

Over-education is obtained by comparing the survey respondents' educational attainment (see Table 1) with the perceived minimum education requirement for the job (top panel of Table 2). If an individual's actual schooling (S^a) exceeds what the job requires (S^r), he/she is considered to be over-educated ($S^a > S^r$). Instead, if an individual's actual level of education is below that required for the job, he/she is classified as under-educated ($S^a < S^r$). Those whose actual educational attainment is appropriate for the job (i.e. actual and required education are the same) are deemed well-matched ($S^a = S^r$). With respect to overskilling, we collapse the four responses to the second question into three categories. Here, those with response 1 are classified as severely overskilled, those with response 2 are classified as moderately overskilled, and those with responses 3 or 4 are classified as well-matched.

TABLE 2. Education required for current job (%) and the degree of skills utilisation

	All (n = 10,302)	Male (n = 5,610)	Female (n = 4,692)
Most appropriate education level			
Degree	10.5	10.7	10.2
Diploma	17.1	15.1	19.5
Upper secondary	35.5	34.3	36.9
Lower secondary	23.1	24.6	21.4
Primary	8.2	8.4	8.0
Informal/None	5.6	6.9	4.0
Total	100	100	100
Overskilling (skills underutilisation)			
Do not agree at all	8.1	8.8	7.3
Somewhat agree	22.9	23.5	22.1
Agree	54.7	53.0	56.7
Agree completely	14.3	14.7	13.9
Total	100.0	100.0	100.0

Table 3 shows the incidence of over-education (top panel) and overskilling (bottom panel) among workers in the manufacturing sector and the key finding is that the majority of workers, around 52 percent, are employed in jobs matched to their educational level. Only 18 percent are over-educated and 29 perfect are under-educated. For overskilling, 72 percent of workers were reported as working in jobs that were in line with their knowledge and skills. Only 28 percent of them were in jobs that did

not fully utilise their skills. In particular, moderately and severely overskilled workers represented 21.6 percent and 6.7 percent of the sample survey, irrespective of gender.

TABLE 3. The incidence of over-education and overskilling (%)

	Pooled (n = 10,302)	Male (n = 5,610)	Female (n = 4,692)
Education level			
Well-matched	51.9	48.7	55.7
Over-educated	18.5	18.5	18.6
Undereducated	29.6	32.8	25.7
Total	100.0	100.0	100.0
Skills underutilisation			
Adequately-skilled	71.7	72.3	71.2
Moderately overskilled	21.6	21.4	21.8
Severely overskilled	6.7	6.3	7.0
Total	100.0	100.0	100.0

It is difficult to compare these estimates with those elsewhere since there is considerable variation in the incidence of over-education across the different measures used. Nevertheless, the incidence of over-education in Malaysia seems to be at the lower end of the existing estimates. Groot and van den Brink (2000) undertake a meta-analysis based on data from 25 over-education studies and find that the incidence of over-education varies from 10 percent to 42 percent with the unweighted average for over-education standing at 23.3 percent. A recent review by Leuven and Oosterbeek (2011) reports a mean over-education rate across studies of 30 percent with self-assessment approaches having an average over-education rate of 37 percent. The extent of overskilling (both severely and moderate) in Malaysia is then low at around 28 percent compared with 53 percent (severe and moderate) reported in Belfield (2010) for the UK, and 44 percent in Mavromaras et al. (2010) for Australia.

EMPIRICAL METHODS

To estimate the determinants of over-education and overskilling, here we employ multinomial logit regression as the dependent variable consists of three categories of match quality – educational mismatch (over-educated, undereducated and well-matched) and skills mismatch (skill-matched, moderately overskilled and severely overskilled). The probabilities of each outcome are defined as:

$$\Pr(y_i = j) = \frac{\exp(x_i^{'}\beta_j)}{1+\sum_j^J \exp(x_i^{'}\beta_j)} \tag{1}$$

where for the ith worker, y_i is the observed outcome (dependant variable) and $x^{'}$ is a vector of explanatory variables (individuals' characteristics, job attributes and firm characteristics), whilst j is the particular outcome and J refers to all outcomes. When using the multinomial regression, one category of the dependent variable is chosen as the comparison or baseline category (Long 1997) and, in this case, having a job that corresponds to individuals' education (well-matched group, $j = 1$) is specified as the baseline category. The probability of being well-matched (outcome 1) can be expressed as follows:

$$\Pr(y_i = 1) = \frac{1}{1+\sum_{j=1} \exp(x_i^{'}\beta_j)} \tag{2}$$

The probability of a worker being over-educated or moderately overskilled (outcome 2) relative to the probability of being in the default group (well-matched) is given by:

$$\Pr(y_i = 2) = \frac{\exp(x_i^{'}\beta_2)}{1+\sum_{j=1} \exp(x_i^{'}\beta_j)} \tag{3}$$

and, finally, the probability of being undereducated or severely overskilled (outcome 3) is stated as

$$\Pr(y_i = 3) = \frac{\exp(x_i^{'}\beta_3)}{1+\sum_{j=1} \exp(x_i^{'}\beta_{\mathrm{j}})} \tag{4}$$

The unknown parameter (β_j) for a multinomial logit is estimated via the maximum likelihood method (ML). Following Schmidt and Strauss (1975), the ML can be written as:

$$L = \prod_{i\in\theta_1} P_{i1} \prod_{i\in\theta_2} P_{i2} \prod_{i\in\theta_3} P_{i3} \tag{5}$$

where $\theta_j = [i|j^{th}$ mismatches is observed (2, 3)]

Hence

$$L = \prod_{i\in\theta_1} \frac{1}{1+\sum_{j=2,3} e^{x_i^{'}\beta_j}} \prod_j \prod_{i\in\theta_j} \frac{e^{x_i^{'}\beta_j}}{1+\sum_{j=2,3} e^{x_i^{'}\beta_j}}$$

$$L = \prod_{i=1}^{\mathrm{T}} \left(\frac{1}{1+\sum_{j=2,3} e^{x_i^{'}\beta_j}} \right) \coprod_j \prod_{i\in\theta_j} e^{x_i^{'}\beta_j} \quad \text{where } j = 2 \text{ and } 3 \tag{6}$$

As usual, we estimate β_j by maximising (L) using the STATA program.

Separate regressions are performed on a combined sample, male only sample and female only sample.

In accordance with substitutability hypothesis, it is expected that the well-matched may be evident for more trained and experienced workers whilst over-education would be among highly educated workers. This is due to the fact that highly educated workers are used to low accumulation of other human capital endowments (work experience and on-the-job training) and this is particularly

true for young graduates. For overskilling, well-matched job may be evident for highly-educated and better trained workers as both could be used as a proxy for skills particularly where employers have incomplete knowledge of the skill levels of potential employees.

It is expected that married women run a higher risk of over-education than married men or single females. Mobility constraints, family commitment and child-care faced by married women, perhaps may reduce the desire for them to find jobs match for their educational or skills background.

With respect to a range of workplace characteristics, it is hypothesised that capital-intensive industry (such as chemical, auto parts, machinery & equipment, and electrics & electronics industries) increases the job match whilst labour-intensive industries (food-processing, garments, textiles, rubber & plastics, and wood & furniture) run a high risk of being in mismatched jobs. This may be due to the needs of highly-educated and skilled workers might be higher in a capital-intensive industry as opposed to a labour intensive industry.

Also, firms with a higher share of graduates in the workplace reduce the risk of over-education or overskilling as such firms lean more towards capital-intensive techniques and therefore may require more highly educated or skilled workers.

One may also argue that capital intensive-firms may require more highly skilled workers relative to labour-intensive firms so that skills underutilisation may be more evident in the latter. Following Battu et al. (2003) and Belfield (2010), firms where labour costs account for less than 25 percent of total costs are assumed to be capital intensive while an establishment where labour costs denote over 75 percent of total costs is classified as labour-intensive. It is expected that over-education or overskilling may be evident for firms where labour costs represent more than 75 percent of the total cost as such firms tend towards a labour-intensive mode which typically requires less highly educated or skilled workers.

Over-education or overskilling may be less likely for large than small firms and firms with greater foreign ownership because large firms typically provide more positions for people to find jobs that match their educational or skills background than small firms. In addition, firms with greater foreign equity tend to be more efficient in terms of human resource management, and are more productive and more innovative than firms that are domestically-owned (Hallward-Driemeier et al. 2006; Aydin et al. 2007; Goedhuys et al. 2008).

Hiring practice can also play a role in the job matching process. Belfield (2010) argue that mismatch is higher where firms have weak hiring systems and so do not properly check individuals' skills and capabilities prior to hiring. To some extent this result holds for Malaysia; all three main hiring practices as previously discussed (i.e. education, technical aspect and work experience) and included in the regression ascertain their impact on mismatch.

Firms with many competitors seem more efficient at adapting to rapid change and hence, matching the workers' actual education to their jobs may be crucial in sustaining productivity and competitiveness. Therefore, a job match quality may be expected for a firm with many competitors than a monopoly or firms with fewer competitors. Finally, firms providing training facilities at the workplace allow workers to increase participation in on-the-job training and to increase the value of their human capital endowment. This may increase the workers' opportunities to get a well-matched job.

DETERMINANTS OF OVERSKILLING AND OVER-EDUCATION

Tables 4 and 5 report the marginal effects estimated from the multinomial logit at the sample means. For the sake of the discussion, only the results of over-education and severely overskilled are discussed here. However, full results of the determinants of over-education and overskilling are available upon request.

Before we discuss the influence of workplace characteristics, let us examine the characteristics of individuals on educational and skill matching (see Table 4). In accordance with the over-education literature and a *priori* expectation, over-education increases with education whilst more trained and experienced workers increase the probability of being in a well-matched job. By contrast, overskilling decreases with education where the higher the education individuals attain, the lower the risk of overskilling. This holds in particular for those with a college diploma compared to primary education (reference group). This perhaps as argued by Mavromaras et al. (2010) suggests that formal education could be used as a signalling device where employers have incomplete knowledge of the skills level of potential employees. Consequently, individuals with higher educational attainment will obtain jobs for which their knowledge and skills are appropriate. Better trained workers also reduce the risk of being overskilled, which is particularly true for males. This perhaps is due to one would expect (as it is tied to the workplace) that it would improve the quality of the skill-match (Mavromaras et al. 2009; Green & McIntosh 2007).

Now, we focus our attention to the effects of a range of workplace characteristics on the job matching process. For this, we re-estimated the regressions by including a vector of workplace characteristics and the results are presented in Table 5. The log-likelihood ratio test (LR) is found to be statistically significantly different from zero, which means that the full model (the model with the inclusion of workplace characteristics) is preferable over the previous model (the model without controlling for workplace characteristics). In general, the results show that workplace characteristics are found to be important for predicting educational and skills mismatch.

First, we begin with types of industry. As expected, there is evidence that workers employed in capital-

TABLE 4. The determinants of over-education and severely overskilled (marginal effects)

	Over-education			Severely overskilled		
	All	Male	Female	All	Male	Female
Educ (ref - no/primary education)						
Lower secondary	0.074 ***	0.069 ***	0.084 ***	-0.025 ***	-0.013 *	-0.036 ***
	0.020	*0.025*	*0.031*	*0.006*	*0.008*	*0.008*
Upper secondary	0.193 ***	0.194 ***	0.204 ***	-0.037 ***	-0.031 ***	-0.037 ***
	0.019	*0.025*	*0.029*	*0.006*	*0.008*	*0.008*
College diploma	0.315 ***	0.319 ***	0.329 ***	-0.049 ***	-0.037 **	-0.054 ***
	0.022	*0.031*	*0.033*	*0.010*	*0.015*	*0.013*
University degree	0.568 ***	0.599 ***	0.541 ***	-0.038 ***	-0.029	-0.047 ***
	0.025	*0.037*	*0.036*	*0.013*	*0.019*	*0.016*
Experience	-0.001 *	0.000	-0.001 **	0.000	0.000	0.000
	0.000	*0.000*	*0.000*	*0.000*	*0.000*	*0.000*
Training	-0.097 ***	-0.118 ***	-0.070 ***	-0.020 ***	-0.036 ***	0.000
	0.011	*0.015*	*0.015*	*0.005*	*0.008*	*0.007*
Female	-0.007			0.005		
	0.010			*0.005*		
N	9856	5311	4545	9,971	5,380	4,591
Pseudo R-sq	0.171	0.182	0.176	0.071	0.086	0.068
Log-likelihood	-8281.300	-4466.900	-3707.100	-7358	-3990	-3309

Note: Robust standard error in italics. Other covariates – household size, region (5), work distance (km), job tenure, unionisation and number of job held in the past. Asterisks *, **, and *** respectively indicate significance at 0.1, 0.05 and 0.01 levels.

intensive industry increase the likelihood of being in well-matched job than workers employed in labour-intensive industry. In particular, workers in firms specialising in auto parts products are less likely to be over-educated than workers in the reference group (food-processing firms) whereas workers in garment industry increase the risk of over-education. As noted earlier, perhaps highly educated workers are more needed in the former than in the latter, resulting in a lower over-education risk.

For overskilling, the risk of overskilling as a whole is not only lower in the capital-intensive industry, i.e. chemicals and auto parts products but also in the labour-intensive firm where firms in the garment industry reduce the workers' probability of being overskilled as compared to the reference group (food processing firm).

There is similar finding with respect to workforce composition. The probability of being over-educated and overskilled is found to be lower for workers in a firm which employs more highly-educated workers. For example, relative to the reference group (less than *25*% graduates at the workplace), the risk of over-education is 6 to 9 percentage points lower for workers (women in particular) who work in firms where over 50 percent of the workforce (more than 50% graduates) are having a university qualification. Similarly, firms where graduate workers account for over 50 percent of the workforce reduce the risk of overskilling by 3.5 to 6.2 percentage points as compared to the reference group. This holds true irrespective of gender. These are the expected results as workplaces that are skewed towards hiring more educated workers perhaps have more scope for improving match quality. Perhaps workplaces that are skewed towards hiring more educated workers have a better scope for improving match quality.

One argument may have been that larger firms may be more likely to employ graduates and where they do they may find it easier to accommodate their skills and education. There are some supports for this where over-education risk is higher in a small firm (reference group) than a medium-sized firm. Working in a small-sized firm is associated with a 4 to 5 percentage points increase in the risk of over-education as compared to working in a medium-sized firm. Yet, there seems to be no discernible relationship between firm size and skills mismatch. Working in a medium size firm increases by 1 and 2 percentage points the risk of men being severely overskilled than working in small-size firms. As such, the result contradicts expectation and the over-education results. It is perhaps much easier for employers to see the level of education each applicant has, but their skills may not be fully observed. Once individuals are hired, they are matched in terms of education but they may be mismatched in terms of skills.

Ownership does not matter for over-education. Instead, the effects of firm's ownership on overskilling seem clear. Firms with foreign ownership (less than 30%) is associated with reduced overskilling by 5 to 7 percentage points regardless of gender compared to purely domestically-owned (base group). Meanwhile, it is difficult to draw any conclusion with regards to a firm's labour costs from the table. The results show that a higher risk of over-education for more labour-intensive firms

TABLE 5. Workplace characteristics and the determinants of over-education and overskilling (marginal effects)

	Over-education			Severely overskilled		
	Pooled	Male	Female	Pooled	Male	Female
Industry (ref-Food processing)						
Textiles	-0.006	-0.038	0.047	0.002	-0.003	0.012
	0.026	0.037	0.037	0.009	0.012	0.013
Garments	0.039 **	0.040	0.049 **	-0.027 ***	-0.049 ***	-0.015 *
	0.018	0.032	0.024	0.008	0.016	0.009
Chemical	-0.013	-0.017	-0.009	-0.047 ***	-0.035 **	-0.058 ***
	0.02	0.029	0.029	0.011	0.014	0.018
Rubber & plastics	0.002	-0.02	0.025	-0.008	-0.012	-0.006
	0.014	0.019	0.02	0.005	0.007	0.007
Machinery & Equipment	0.022	0.035	-0.015	-0.014 *	-0.015	-0.005
	0.02	0.025	0.034	0.008	0.01	0.013
Electrics & Electronics	-0.019	-0.011	-0.021	-0.012	0.015	-0.047 **
	0.028	0.04	0.038	0.014	0.018	0.023
Auto parts	-0.038 *	-0.041	-0.034	-0.068 ***	-0.074 ***	-0.06 ***
	0.019	0.029	0.026	0.013	0.019	0.015
Wood & Furniture	0.017	0.012	0.015	-0.016 **	-0.021 **	-0.009
	0.016	0.022	0.025	0.007	0.009	0.01
Share of workforce with university qualifications (ref – graduates less than 25%)						
Graduates 25 to 50%	-0.023	-0.033	-0.01	-0.005	-0.001	-0.009
	0.014	0.02	0.019	0.006	0.008	0.008
Graduates more than 50%	-0.064 ***	-0.042	-0.093 ***	-0.052 ***	-0.062 ***	-0.035 *
	0.024	0.032	0.036	0.014	0.018	0.021
Firm size (ref – firm size less than 50)						
Firm size 50 to 150	-0.039 ***	-0.038 **	-0.047 **	0.011 **	0.019 **	0.001
	0.013	0.018	0.018	0.005	0.008	0.007
Firm size more than 150	-0.015	-0.004	-0.027	-0.002	0.015	-0.014
	0.015	0.021	0.021	0.007	0.01	0.009
Ownership (ref –purely domestically-owned)						
Less than 30% foreign-owned	0.015	0.006	-0.043	-0.058 ***	-0.053 ***	-0.072 **
	0.024	0.031	0.039	0.017	0.02	0.029
More than 30% foreign-owned	0.005	-0.009	0.02	-0.007	-0.008	-0.004
	0.013	0.018	0.017	0.005	0.008	0.007
Competitors (ref – No competitor)						
Competitor less than 25	-0.007	-0.046	0.017	-0.012	-0.018	-0.003
	0.021	0.032	0.027	0.008	0.013	0.009
Competitor more than 25	-0.02	-0.029	-0.025	-0.024 **	-0.042 ***	-0.001
	0.026	0.039	0.036	0.01	0.016	0.012
Hiring practice						
Education-based	-0.023 **	-0.023	-0.016	-0.010 **	-0.012 **	-0.009
	0.01	0.014	0.014	0.004	0.006	0.005
Work experience-based	-0.015	-0.041 **	0.026	0.010 *	0.01	0.010
	0.013	0.018	0.019	0.006	0.007	0.008
Technical-based	0.033 ***	0.055 ***	-0.005	-0.010 **	-0.01	-0.009
	0.012	0.017	0.016	0.005	0.007	0.006
Firm training	-0.025 **	-0.047 ***	-0.01	-0.007	-0.005	-0.009
	0.013	0.018	0.018	0.005	0.007	0.006
No. of obs	9,700	5,217	4,483	9,814	5,285	4,529
No. of firm	1,013	1,013	1,013	1,013	1,013	1,013
Pseudo R-sq	0.18	0.196	0.185	0.081	0.092	0.083
Log-likelihood	-8069	-4315	-3616	-7148	-3851	-3208
Log likelihood ration test (χ)	424.4 ***	303 ***	182.8 ***	426.2 ***	278.4 ***	203.4 ***

Note: Robust standard error in italics. Asterisks *, **, and *** respectively indicate significance at 0.1, 0.05 and 0.01 levels.

(where labour costs account for 51 to 75% of the total cost) in the pooled and female samples. For overskilling, the results here support the hypothesis that overskilling is more prone to labour-intensive firms. A higher risk of overskilling is evident at firms where labour costs account for over 75 percent of the total cost as revealed in the male sample.

The results also reveal that the extent of educational and skill mismatch differs by how much competition a firm faces. Firms with a high number of competitors (competitors more than 25) reduce the workers' probability of being over-educated although the results are not statistically significantly different from zero. To some extent, the result reported here is in line with Belfield (2010) who finds no effect via competition though his focus is upon over-education. Nevertheless, relative to a firm which is considered to have a monopoly, i.e. no competitors, a higher number of competitors (more than 25) decreases the likelihood for being overskilled, men in particular. Increased competition perhaps keeps firms more "on their toes" in terms of ensuring good matches.

There are some evidences that over-education is related to hiring practice. Workers have a lower risk of over-education at firms that emphasise education as the main criteria for recruitment (albeit for the pooled sample). Where work experience (technical skills) is a priority for hiring practice, it reduces (increases) the risk of over-education (albeit for men). Nevertheless, workers have lower severe overskilling when they work at firms that emphasise technical skills in hiring and this is evident for the combined and male samples. On top of that, firms which place emphasis on technical skills in recruitment also reduce the probability of workers being overskilled although this is only evident for the pooled sample. For women, there is weak evidence at 10 percent that being employed in firms where education is the most important consideration for hiring reduces the risk of overskilling.

The evidence also indicates that firms providing on-the-job training at the workplace (firm train) increase the likelihood of workers being in jobs that correspond to their educational background (albeit for the male and combined samples). This is in line with our earlier finding that workers with greater participation in on-the-job training have a better job-match quality.

In summary, there is some evidence that firm-specific labour practices do influence the level of over-education and overskilling across workers controlling for workers' own characteristics. These practices tend to be associated with initial hiring and deployment decisions, although on-the-job training and appraisal programs also have some modest influence.

CONCLUSIONS

This paper aims to find out the factors that drive the incidence of over-education and overskilling. The studies of mismatch have examined the individuals' characteristics and spatial factors to explore the determinants of over-education. They tend not to examine the possible effects of workplace characteristics due to lack of employer-employee dataset. To fill this gap, this study explores over-education and overskilling in the context of a developing country such as Malaysia as we have at our disposal a unique workplace dataset that contains extensive workplace and individual worker level of information.

Using the workers' own self-assessment of their skills, nearly 30% of workers are overskilled (yet only 6% are severely overskilled) while 18% are over-educated. The majority are in well-matched jobs. Using multinomial logit, apart from individuals and spatial elements, there are some evidences that the characteristics of the workplace where the respondents work at play significant impacts on the over-education or overskilling determinants. As a whole, the risk of being over-educated is lower in the capital-intensive industry, firms with a higher number of graduates in the workforce, medium-sized firms, a greater number of competitors, firms in favour of education and work experience in hiring practices and firms that provide on-the-job training programmes. Firms with higher foreign ownership and firms in favour of technical-based skills in hiring practice in general increase the risk of mismatch. Nevertheless, overskilled individual is less evident in firms with higher share of university workers, lower proportion of foreign ownership, higher number of competitors (> 25 competitors), and a firm where education and technical skills are of highest priority for hiring workers.

This study provides some evidences of the role played by employers on the incidence of over-education and overskilling at workplaces. It is not fair to say the existing of both incidences at workplaces are driven by supply side factor alone, i.e. individuals' characteristics as found in other studies (see for example Chevalier 2003; Chevalier & Lindley 2009). Nevertheless, many studies have provided evidence on the negative impact of over-education and overskilling on either the individuals' earnings or job satisfaction, it is important for firms to reduce both incidences at the workplace so that they can ensure that labour inputs are optimally productive, hence, increases the firms' performance.

ENDNOTES

1 PICS-2 has information on the percentage of workforces with tertiary education, and the total cost and total labour cost. For convenience, we differentiate the former into three categories; less than 25%, 25-50%, and more than 50. For the latter, we generate the percentage of total labour cost of the total cost and classify them into four categories following Battu et al. (2003) and Belfield (2010): less than 25%, 25-50%, 51-75%, and more than 75%.

2 In particular, managers in the PICS-2 are asked to list the important criteria used to hire workers. The three that are deemed most important for hiring potential employees are experience, technical skills, and education

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