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# THE EFFECTS OF OVER, REQUIRED AND UNDER-EDUCATION ON EARNINGS IN MANUFACTURING SECTOR IN MALAYSIA

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**Abstract**

*This paper presents returns to education by taking into account the quality of jobs match held by workers in the manufacturing sector of Malaysia. This type of study is quite rare not only in the country but also across developing nations. Using the Second Malaysia Productivity Investment Climate Survey (PICS-2), nearly 20 per cent and 30 per cent of workers employed in jobs for which they are overeducated and undereducated, respectively. Further findings indicated that over-education is more acute amongst highly-educated workers whilst under-education is more evident for lowly educated workers. By gender, women have a higher proportion of over-educated workers compared to men. Consequently, over-education leads to lower productivity in terms of earnings. In the study, augmented Mincer earnings equation, i.e. the ORU model clearly showed that although returns to surplus education was positive ($S^o$), the return was lower than the returns to required education ($S^r$), approximately 6 per cent against 10 per cent. This means that overeducated workers earn significantly lower than their co-workers who are in similar jobs but who have less education, but well matched. Moreover, the ORU model signified that returns to required education was much greater than returns to actual educational attainment. All of these implied that the rate of return to education depends on the allocation of skills over jobs where earnings is not fully embodied but is (partly) determined by job characteristics and/or by the quality of the match between skills supplied by the worker and skills required by the job. Nevertheless, the situation of over-education among highly educated workers in the Malaysian labour market may impede the country's intention to move toward the state of being a high-income country, as outlined in the "New Economic Model" blueprint, since it reduces individuals' productivity.*

**JEL Classifications: J24, J31**
***Keywords:*** *Over-education, required education, surplus education.*

## Introduction

This paper present the results of a study or returns to education by considering the role of the quality of jobs match held by workers in the manufacturing sector of Malaysia. This type of study is quite rare not only in the country but also across developing nations.[1] Over-education can be defined as workers who have higher schooling than what their jobs require while those with lower schooling than what is required are considered under-educated. Malaysia is an interesting case in its own right. It is a middle income country which has, since the 1970s, moved from being a primary goods exporter to one that is much more reliant on manufacturing and services. Education has played a pivotal role in this transformation with higher levels of investment and educational attainment (UNDP, 2009). The expenditure on education as a percentage of Gross Domestic Product (GDP) in Malaysia has increased from 4 per cent in 1970 to 6 per cent in 2011 (World Bank, 2014).[2] This compares favourably with a number of developed countries such as the UK, USA, Japan, and also Singapore (2.9 per cent to 5.5 per cent in 2011) (World Bank, 2014).[3] There has been a significant increase in enrolments at the tertiary level where between 1995 and 2005, the total number of students in tertiary education at degree level increased by over 200 per cent (MOHE, 2010). As a result, the number of graduates produced by public HEIs has tremendously increased, from 62,990[4] in 1985 to 392,552 in 2005, an increase of 5.23 times. This helps to improve the quality of the workforce – in 2013, the percentage of the labour force with tertiary education had increased to 26 per cent, more than three times higher than it was in 1985 (about 7 per cent) (Labour Force Survey, 2013).

The increasing supply of educated and skilled workers is due undoubtedly to a greater expansion in the manufacturing sector, particularly a growing demand for skilled and educated workers. The increasing importance of the manufacturing sector is a key factor to this development where the sector plays a significant role on Gross Domestic Product (GDP), export, and employment. In 2013, the manufacturing sector contributed around 40 per cent of the GDP, this compares to 21 per cent in 1980 (CIA Fact, 2014).[5] Not surprisingly, the manufacturing sector gradually replaced the agricultural sector as Malaysia's main job provider. In terms of exports, the manufacturing sector is the largest contributor in terms of value and percentage as it accounted for over 85per cent of total exports in 2012 compared to 22 per cent in 1985 (Malaysia Economic Report, 2013/2014). With respect to employment, the manufacturing sector alone was the highest

contributor to total employment with 18 per cent in 2013, and the wholesale and retail trade, repair of motor vehicles, and motorcycles subsector registering the highest share of 16.80 per cent (Labour Force Survey, 2013).

Despite these developments, there are a number of outstanding challenges faced by the manufacturing sector in Malaysia particularly with regard to a shortage of skilled workers. A study by the World Bank (2009) revealed that about 40 per cent of employers in the manufacturing sector in Malaysia find it difficult to fill skilled job vacancies due to the applicants not possessing the skills required by employers. Though significant resources had been devoted to increasing the quantity of educated workers, the quality and type of educated labour do not match that demand by industry, especially in science and technology. Since Malaysia has slowly moved to a knowledge-based economy, the country needs more workers in such areas in order to switch from low to high value-added products, particularly in the manufacturing sector. While universities continue to mass-produce, inevitably, questions had been raised about the quality of job held by workers in the labour market (World Bank, 2009). Indeed, a report again from World Bank (2011) suggested that the quality and type of educated labour the country produces does not yet match what is demanded by industries. Notwithstanding, to date no study has addressed the utilisation of education and skills in the Malaysian labour market.

There are two main objectives for this research. Firstly, the extent of over-education was documented. Secondly, the effect of over-education on individuals' earnings was investigated. In doing so, this paper is organised as follows. Section 2 focuses on a review of the mismatch literature in Malaysia. Section 3 provides a very brief overview of some theoretical perspectives on mismatch. Section 4 outlines the data by mainly focusing on the measurement and the incidence of over-education, while section 5 details empirical estimation methods. Section 6 highlights the results of the effects of over-education, and the final section concludes.

## Job Mismatch in Malaysia

There is a limited number of studies carried out to identify job mismatch in Malaysia. However, few reports highlighted the mismatch issue, the earliest of which dated back to the late 1980s. In

a study on higher education and employment in Malaysia, Ungku Abdul Aziz, Buan Hock, and Sanyal (1987) highlighted the issue of job mismatch among workers with a tertiary and post-secondary qualification. Using their own survey data collected between 1981 and 1983, the relevance of individuals' educational background and their jobs was assessed by the degree to which their education was perceived as useful to their present jobs. Based on a scale of three ('very relevant,' 'relevant', and 'not relevant'), their study revealed that about 6 per cent and 12 per cent of workers with a post-secondary and tertiary education, respectively, were in jobs that were not relevant with their qualifications. By gender, the mismatch was even more pronounced among female workers (15 per cent overall) than among the men (11 per cent overall). Furthermore, a large proportion of mismatched workers were from the arts, economics and social sciences backgrounds. By sharp contrast, nearly 100 per cent of the graduates in medicine, engineering, and architecture found their courses to be very useful. Yet, no further analysis was done to examine whether gender and field of education play a significant role in the job matching process.

A study conducted by Morshidi Sirat et al. (2003) provided some evidence regarding the quality of job match held by graduates. Although the main focus of the study was graduate employability amongst bachelor degree holders from public HEIs, their report revealed that at least 31 per cent of graduates from the 2001 cohort were employed in jobs that were not relevant to their fields of study. Furthermore, over 35 per cent of graduates worked in jobs outside of their academic qualifications. The mismatch phenomenon was also highlighted in "*Employability Profiles of Graduate 2006-2008: The Malaysian Scenario*" (Rohana, Zubiri, & Abu Bakar, 2009). The report revealed that the mismatch phenomenon was lower among individuals with post-graduate qualifications (PhD and Master's degree) as opposed to a bachelor's degree. Only 0.6 to 1.4 per cent of respondents with a PhD qualification and 6 to 7 per cent graduated with a master's degree were employed in non-professional and managerial occupational group 20. In contrast, 34 to 36 per cent of those with a bachelor's degree ended up in jobs below their qualification (i.e., working in technical, clerical, and sales occupational levels).

Annie and Hamali (2006), Lim, Rich, and Harris (2008), and Ishak, Rahmah, and Robiah (2008) focused on particular public HEIs when examining the job quality of graduates in the labour market. Annie and Hamali (2006), for instance, explored employability amongst

graduates with a Diploma in Business and Administration from the Mara University of Technology (UiTM), Sarawak branch. Among the main issues were concerned with the appropriateness of graduate employment, which was based on discrepancies between the graduates' skills and the requirements of the job market. The authors noted that these graduates were trained to take up semi-professional jobs at mid-level management and administrative levels. The findings indicated that about 10 per cent of graduates were engaged in a professional job, whilst 41 per cent were engaged in jobs matching their diploma qualifications (i.e., administrative occupations). About 49 per cent were in positions that required levels of educational attainment lower than a diploma, and hence were overeducated.

Lim et al. (2008) investigated labour market outcomes among recent graduates from University Utara Malaysia (UUM). Graduates in the survey were asked about their current labour market situation and four labour market outcomes were observed: unemployment, part-time job, full-time job commensuratimg with qualifications, and full-time job not commensurating with qualifications. The authors found that 34.1 per cent of respondents surveyed were unemployed, 28.4 per cent were employed in a full-time job commensurating with qualifications, a further 28 per cent were in jobs not commensurating with qualifications, and the remaining 9.5 per cent were in part-time employment. By field of study, their results indicated that accounting graduates have better labour market achievements relative to other graduates: 57 per cent were employed in jobs that corresponded to their degree, while only 18 per cent were in positions that did not require their degree. In contrast, 49 per cent of economics graduates were employed in jobs that did not match their qualifications relative to 22 per cent who were in employment in line with their degree.

Ishak et al. (2008) analysed job match quality among bachelor degree holders from Universiti Kebangsaan Malaysia (UKM) between 1998 and 2002. The authors found that 70 per cent of respondents were employed in jobs corresponding to their actual qualifications, while 30 per cent were employed in jobs that did not match their actual qualifications. By field of study, half of graduates with social sciences background were employed in jobs for which their actual qualifications were unnecessary, whereas all medicine and dental graduates were in jobs that matched their qualifications.

Empirical evidence of the incidence, causes and outcomes of the mismatch phenomenon is scarce not only in Malaysia but also in

developing countries. Only three studies had focused on developing countries: one undertaken by Quinn and Rubb (2006) in Mexico and Mehta, Felipe, Quising, & Camingue (2011) who covered Mexico, India, Philippines, and Thailand. As noted in the previous chapter, the reason for this scarcity of studies is due to lack of information on the number of years of schooling required to perform a given job. Most labour force surveys in developing countries collect education data by the stage of the school system completed, rather than by years of schooling (Mehta et al., 2011).

## Theoretical Background of Over-Education

It is worth noting that there is no single unified and accepted theory regarding mismatch. Instead, there is a reliance on existing theoretical frameworks within labour economics as an explanation of over-education. Here, human capital and career mobility theories focus on the supply side, whilst job competition and assignment approaches focus on the demand side.

Under the human capital theory (Becker, 1964), productivity is a function of human capital (i.e. education, experience, and training) and workers are paid based on the value of their marginal product. Consequently, wages are determined by workers' educational qualifications, experience, and training. Educational mismatch arises if and when an increase in workers' educational attainment is not matched by a rise in the demand for education and this, in turn, leads to a reduction in the relative wage of highly educated workers. From the firm's perspective, falling relative wages would encourage employers to replace the more highly educated with low-educated workers and adjust production techniques to take advantage of such cheaper labour. Highly-educated workers are then placed in positions previously filled by low-skilled workers. Mismatch here is transient since firms adjust their production processes while workers reduce their investment in education in response to the lower relative earnings of skilled and/or highly educated workers.

For the career mobility theory (Sicherman & Galor, 1990), over-education may reflect the inferior quality of education of workers or other human capital deficiencies such as less work experience or lack of training. Highly educated workers may then be willing to accept a job for which they are overeducated in order to accumulate skills that can then be used later to switch to a higher level occupation or position.

For example, increased training may allow workers to acquire more firm-specific skills that complement their formal education and so progress toward higher paid positions. This then reduces mismatch.

The job competition theory (Thurow, 1975) offered a demand side explanation of over-education. Central to this is the notion that when workers compete in the labour market for high-wage jobs, this creates a job queue in which jobs are ranked by earnings and a worker's position in the queue is determined by relative training costs. Individuals here may invest in more education in order to move up the labour queue. In the extreme, education and skills investment simply places individuals at the front of the queue for jobs, as it signals that the employer will be required to invest less in training. Highly skilled workers may require less training and are therefore ranked at the top of the labour queue.

The assignment theory focuses on the problem of assigning workers to jobs (Sattinger, 1993). The basic premise here is that both supply and demand are relevant, individual performance varies from job to job, and for the economy as a whole, total output depends on how workers are assigned to jobs. The allocation is optimal when workers are allocated top-down in relation to their skills, whereby the least competent are given the simplest jobs and the most competent are placed in the most complex jobs. As a result, highly educated individuals are more likely to be matched with job vacancies requiring a higher level of education. However, the matching process may not be perfect, for example, when too many workers vie for a specific position. This may lead to some individuals being assigned jobs lower down the hierarchy. In this instance workers may be overeducated, whilst others prove to be undereducated.

## Data Set

This study uses data from second survey of the Malaysia Productivity Investment Climate Survey (PICS-2) carried out in 2007 as a workplace survey, involving a collaborative effort between the World Bank and the Malaysian Government via the Economic Planning Unit and the Department of Statistics. The survey attempted to understand the investment climate faced by enterprises and how this impacts upon business performance, particularly in the manufacturing and business support services sectors. Samples used in this study however were restricted to the manufacturing sector and respondents who were in

full-time employment, aged between 15 and 64, and who reported no missing in earnings. By such restriction, this left about 10,302 respondents, of which 54.5 per cent were males and 45.5 per cent females across nine major industries.[6]

Table 1

*Means and Standard Deviation*

| Variable | All | | Male | | Female | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| *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 |
| *Most appropriate level of education for the work you are doing* | | | | | | |
| 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 | |
| Age | 34.89 | 9.83 | 35.86 | 9.99 | 33.91 | 9.56 |
| Years of schooling completed | 11.31 | 3.52 | 11.02 | 3.63 | 11.64 | 3.34 |

(continued)

| Variable | All | | Male | | Female | |
|---|---|---|---|---|---|---|
| | Mean | SD | Mean | SD | Mean | SD |
| Years of schooling required | 10.73 | 2.21 | 10.61 | 2.26 | 10.88 | 2.15 |
| Years of surplus schooling | 2.58 | 1.08 | 2.60 | 1.13 | 2.54 | 1.02 |
| Years of deficit schooling | 2.60 | 1.09 | 2.60 | 1.10 | 2.61 | 1.09 |
| Exp (month) | 165.45 | 120.05 | 181.26 | 123.15 | 149.38 | 114.61 |
| Train | 0.42 | 0.49 | 0.43 | 0.50 | 0.40 | 0.49 |
| Female | 0.55 | 0.45 | | | | |
| Married | 0.65 | 0.48 | 0.68 | 0.47 | 0.62 | 0.49 |
| *Ethnicity* | | | | | | |
| Malay | 0.55 | 0.50 | 0.58 | 0.49 | 0.52 | 0.50 |
| Chinese | 0.35 | 0.48 | 0.33 | 0.47 | 0.39 | 0.49 |
| Indian | 0.10 | 0.29 | 0.09 | 0.29 | 0.10 | 0.30 |
| *Region* | | | | | | |
| Central | 0.35 | 0.48 | 0.35 | 0.48 | 0.34 | 0.47 |
| North | 0.23 | 0.42 | 0.24 | 0.42 | 0.23 | 0.42 |
| South | 0.33 | 0.47 | 0.31 | 0.46 | 0.34 | 0.47 |
| East coast | 0.03 | 0.16 | 0.03 | 0.18 | 0.02 | 0.13 |
| Malaysia East | 0.07 | 0.25 | 0.07 | 0.25 | 0.07 | 0.25 |
| *Educational -mismatch* | | | | | | |
| Well-matched | 51.9 | | 48.7 | | 55.7 | |
| Overeducated | 18.5 | | 18.5 | | 18.6 | |
| Undereducated | 29.6 | | 32.8 | | 25.7 | |
| *Hourly earnings* | | | | | | |
| Well-matched | 12.09 | 30.73 | 13.77 | 26.48 | 10.56 | 34.10 |
| Overeducated | 9.79 | 18.44 | 10.19 | 14.54 | 9.42 | 21.48 |
| Undereducated | 12.17 | 19.74 | 13.91 | 23.21 | 9.93 | 13.73 |

Table 1 provides summary statistics for the key variables in this analysis. Respondents were on average 34 years old and reported to have had about 11.3 years of schooling attained, 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 per cent had once attended a training course. A large proportion of respondents were Malay, from the central region, small firms and firms that were purely domestically-owned. By gender, there were some differences. Women were slightly younger than men (34 versus 36 years) and were slightly better educated with 25 per cent holding higher degree qualifications (both diploma and university qualifications), relative to 20 per cent among men. Men instead have more work experience and job tenure within firms than women (181 months and 9 years respectively versus 149 months and 7 years respectively).

The main concern about the dataset is how would one measure over-education. Over-education is measured by comparing an individual's actual education with the required education for a particular job. Whilst measuring actual educational attainment is relatively straightforward, acquiring information on the required education level is trickier. Three methods were considered for measuring the required education: subjective, objective, and statistical methods. This paper utilises the subjective method which relies on the worker's own assessment to measure the required education to obtain or do a particular job.[7] In the survey, respondents were asked directly about required education to do their jobs via the following statements "According to you, what is the most appropriate level of education for the work you are doing?" There were seven educational levels to choose from, starting from (1) degree, to (7) no qualification.

As shown in Table 1 (bottom of the table), approximately one in three workers believed that upper secondary qualifications were the most appropriate level of education in doing their job (36 per cent). Diploma was the second most appropriate (21 per cent), followed by a degree qualification (12 per cent). By comparing the survey respondents' educational attainment with the perceived appropriate education required for the job, conventional estimates of over-education were derived. Where an individuals' actual schooling exceeds what the job requires, they were considered to be overeducated ($S^a > S^r$). Where an individuals' actual level of education is below that required for the job, they were classified as undereducated ($S^a = S^r$). Those whose actual educational attainments appropriate for the job (i.e. actual and required education are the same), were deemed well-matched ($S^a > S^r$). Years of required education were lower than years of actual schooling attainment (10.7 years against 11.3 years), whereas years of surplus and deficit schooling were approximately 2.6 years each.

The estimates of over-education incidence is shown in the bottom panel of Table 1 with 19 per cent, and the corresponding figures of 52 per cent and 30 per cent for adequately matched and undereducated, respectively. Whilst a higher proportion of women were overeducated compared to men, the reverse holds for under-education.[8] With respect to earnings across mismatches (bottom panel of Table 1), well-matched workers earn higher wages than their overeducated counterparts, irrespective of gender. Overeducated workers earn on average RM9.8 per hour compared to RM 12 each for the well-matched and undereducated workers.

One of the so called "stylised facts" within the over-education literature is that over-education seems more prevalent amongst highly-educated workers. The data seems to support this where over-education is more prevalent amongst the more highly educated (Figure 1), whilst under-education is more evident for lowly educated workers. In addition, there is considerable heterogeneity with respect to the incidence of mismatch across industries. As revealed in Figure 2, the proportion of respondents who are overeducated ranged from as low as 13 per cent (Electrics & Electronics) and as high as 21 per cent (Garments). In contrast, the highest incidence of under-education was reported in the Machinery and Equipment (35 per cent) industry. This might be due to the fact that this industry faces difficulty in hiring highly educated workers (World bank, 2009).

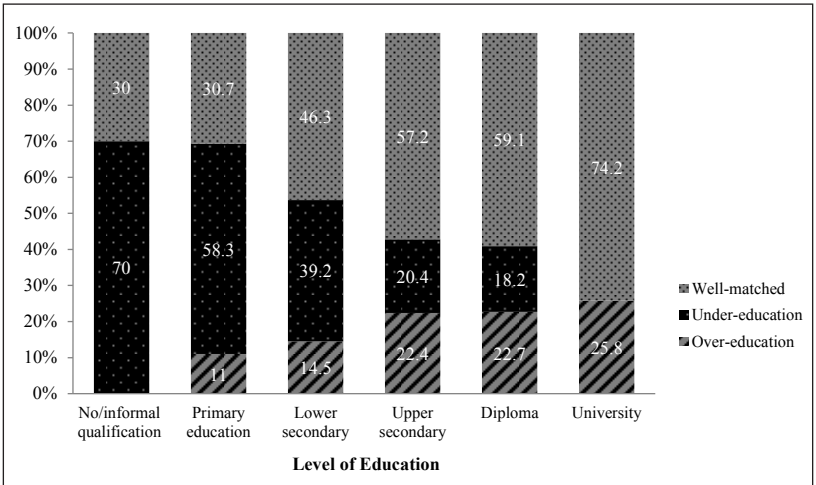


*Figure 1.* The incidence of educational mismatch across level of educational attainment.

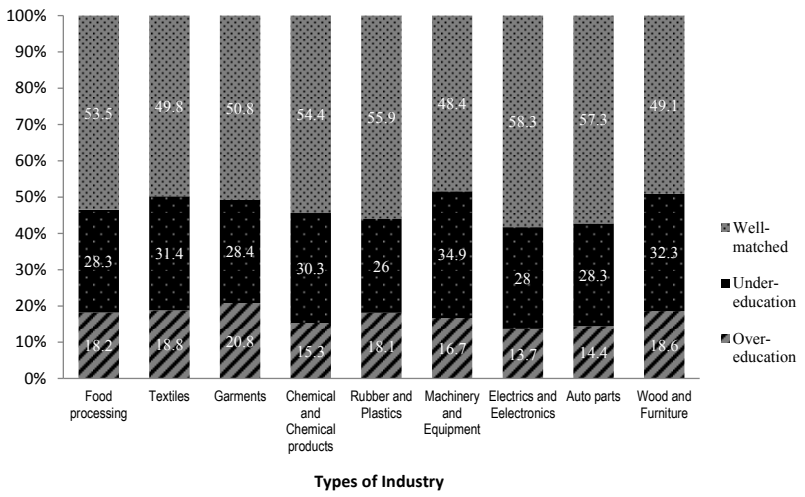


*Figure 2*. The incidence of educational mismatch by industry.

## Methodology

The classic specification of the earnings regression is based on the Mincer specification (Mincer, 1974) which generally takes the following form:

$$\ln(w_i) = \alpha_0 + \alpha_1 X_i + \alpha_2 S + \alpha_3 Exp + \alpha_4 Exp^2 + \varepsilon_i \qquad (1)$$

where ln (*w*) is a natural logarithm of earnings (hourly), $X$ is a vector of explanatory variables, $S$ is education, $Exp$ is experience and $Exp^2$ is a quadratic term of potential work experience, and $\varepsilon$ is the error term for individual $i$. Equation (1) suggests that workers' productivity ($w$) is determined by worker's characteristics, particularly education. There is no distinction made between actual and required years of education which means that any year of education is just as valuable as another. Also, there is no role for demand side factors, where more years of education imply higher earnings.

In contrast, Thurow's model suggests that earnings are wholly determined by demand side factor, i.e. required education for a given job, which means that surplus education has no reward. Instead,

the required education for the job wholly determines earnings. The Mincer earnings equation (1) is then augmented by replacing required education for actual schooling. The model then can be written as:

$$In(w) = \beta_0 + \beta_1 X_i + \beta_2 S^r + \beta_3 \exp + \beta_4 \exp^2 + \mu \qquad (2)$$

where $S^r$ is the years of education required for a particular job given. Equation (2) tells us that overeducated workers have similar productivity and receive the same wage levels as those workers who are in jobs with the required education level (well matched).

However, following Sattinger's assignment theory (Sattinger, 1993), earnings should be treated as a function of both demand and supply side where both required education and actual attained education play an important role on earnings determination. The equation in (1) is augmented so that the earnings equation can be written as:

$$\ln(w) = \gamma_0 + \gamma_1 S^r + \gamma_2 S^o + \gamma_3 S^u + \gamma_4 \exp + \gamma_5 \exp^2 + \mu \qquad (3)$$

where actual educational attainment ($S$) is decomposed into years of required education ($S^r$), years of surplus education ($S^o$), and years of deficit schooling ($S^u$) in relation to those necessary to obtain or perform the job. Equation (3) is also known as the 'ORU earnings function' (Over-education, Required, and Under-education) (Hartog, 2000).[9,10] Equation (3) showns that when over-education is measured in terms of years of surplus education, then the overeducated are being compared to people doing the same job who are not overeducated and who have less education.

In the majority of studies that utilised the ORU stressed that a return to surplus education is generally positive ($\gamma_2 > 0$) but less than the return to required education ($\gamma_1 > \gamma_2$). The return to under-education is usually found negative ($\gamma_3 < 0$), which implies that undereducated workers earn less than adequately educated workers.

Sicherman and Galor (1991) introduced two stylised facts relating to the return to over and under schooling. Firstly, workers in occupations that require less schooling than they actually have (overeducated) earn lower wages than workers with similar levels of schooling who hold jobs that require the level of schooling they have obtained. These overeducated workers, however, earn more than their co-workers

who are not overeducated (i.e., who have the required and, therefore, lower schooling). Secondly, workers in jobs that require more schooling than they have obtained (undereducated) receive higher wages than workers with the same level of schooling who work in jobs that require just their level of schooling. Undereducated workers, however, receive lower earnings than do their co-workers with the required and, therefore, higher schooling. These observations have been made by other authors (Duncan & Hoffman, 1981; Hartog, 1986; Rumberger, 1987; Hartog & Oosterbeek, 1988). The extent to which these are found in Malaysia will be discussed in the next section.

Another use for Equation (3) is it allows one to test whether returns to education hold for human capital or job competition model, following Hartog and Oosterbeek (1988). As noted earlier, human capital theory argued that wages were determined by endowments of human capital (*S* and *X*) and not the demand side factors. As such, the theory predicts a positive return to education which suggests that education increases wages (productivity) in a linear fashion–the higher the educational attainment, the greater the earnings outcome. Job competition model does recognise that earnings surplus and deficit education has no reward. These imply that the human capital theory holds if $\gamma_1 = \gamma_2 = -\gamma_3$ and the job competition model appears to be true if $\gamma_2 = \gamma_3 = 0$. Hence, estimation can proceed with Equation (3) testing for human capital and job competition theory as nested hypotheses. If both hypotheses are rejected, this means that returns to education depends on both demand and supply sides, as argued by the assignment theory.

## Empirical Results

Table 2 presents the results of the wage impact of over-education. Three specifications were examined. Specification 1 focused on the basic human capital model, whilst Model 2 and 3 focused on the augmented human capital model to allow the required and surplus education take effect. Looking firstly at Model 1, the results showed that the coefficient of individuals' actual educational attainment (*S*) is positive and significant at the 1 per cent level which means that the higher the education attained, the greater the returns on education. Other factors being equal, for each additional year of schooling completed, it increases 4 per cent of individuals' hourly earnings[11]. This is in accordance with other studies in Malaysia (Aminah, 1998; Rahmah & Ragayah, 2003; Milanovic, 2006).

Table 2

*The Wage Impacts of Over-Education and Under-Education*

| lnwage (hourly) | Model 1 | | Model 2 | | Model 3 | |
|---|---|---|---|---|---|---|
| Yearsch | 0.03699 | *** | | | | |
| | (0.00183) | | | | | |
| Required edu ($S^r$) | | | 0.07040 | *** | 0.09873 | *** |
| | | | (0.00293) | | (0.00338) | |
| Surplus edu ($S^o$) | | | | | 0.05478 | *** |
| | | | | | (0.00474) | |
| Deficit edu ($S^u$) | | | | | –0.04480 | *** |
| | | | | | (0.00461) | |
| Exp | 0.00122 | *** | 0.00119 | *** | 0.00136 | *** |
| | (0.00015) | | (0.00015) | | (0.00015) | |
| Expsqr100 | –0.00017 | *** | –0.00018 | *** | –0.00018 | *** |
| | (0.00003) | | (0.00003) | | (0.00003) | |
| Training | 0.09076 | *** | 0.06630 | *** | 0.06234 | *** |
| | (0.01208) | | (0.01197) | | (0.01186) | |
| Female | –0.26177 | *** | –0.25256 | *** | –0.25259 | *** |
| | (0.01093) | | (0.01086) | | (0.01074) | |
| Cons | 2.97966 | *** | 2.57944 | *** | 2.22788 | *** |
| | (0.05553) | | (0.06139) | | (0.06423) | |
| N | 9902 | | 9903 | | 9902 | |
| R-square | 0.661 | | 0.667 | | 0.675 | |
| R-adjusted | 0.659 | | 0.665 | | 0.673 | |
| Log-likelihood | –6771.71 | | –6680.42 | | –6558.00 | |

*Robust standard error in italics*
**, **, and *** respectively 0.1, 0.05 and 0.01.*

In Model 2, *yearsch* was replaced with education required for the job ($S^r$), as suggested by Thurow's model. As expected, the results showed that the coefficient on required education, 0.0704 was positive and statistically significantly different from zero at the 1 per cent level. This means that returns to required education is positive. Other factors being constant, for each year of required education will result in an increase of individuals' hourly earnings by 7 per cent if the individuals are allocated to a job where required and attained levels of education are equal ($S^r = S^a$). As a comparison, the return to required education (Model 2) is far greater than the return to actual schooling (Model 1). Does this suggest that the job competition model is more superior than human capital theory? This will be discussed later.

In Model 3, the ORU specification is presented as proposed by the assignment theory. The coefficients on required and surplus education have a positive sign, about 0.0987 and 0.0549 respectively, and both are statistically significant at the 1 per cent level. This can be interpreted that returns to required and surplus education are positive. Other factors holding constant, the rate of return to required education is nearly 10 per cent if individuals are allocated to a job where required and attained levels of education are equal. Each year of schooling surplus leads to an increase of earnings by 5 per cent. Though positive, the returns to years of schooling that are above what is needed for the job ($S^o$) are lower than the returns to required education. This means that workers who are working in occupations that demand less schooling than they actually have (overeducated) get higher wages than their co-workers (holding other characteristics constant) but lower wages than workers with similar levels of schooling who work in jobs in which their schooling equals what is required. Meanwhile, the coefficient on deficit education is negative, –0.0448 showing penalty to educational insufficiency for undereducated workers. This means that the undereducated receive lower wages than their co-workers but get more than workers with the same level of schooling who work in jobs that require their level of schooling.

Next is a brief discussion on the effects of other variables on the determinants of earnings. The coefficient on work experience across all datasets was positive while the estimated coefficient on work experience squared showed a negative sign. This indicated that

wage increases with work experience but at a diminishing rate. The coefficient on training was positive and significant, meaning that training was positively associated with earnings and this return was found to be higher than the return to experience. The results showed that women earn significantly lower than their men counterparts across the three datasets and the earnings gaps were much higher reported for the married respondents. In particular controlling for other characteristics, women earn about 22 per cent less than that of men.

For this reason, a separate analysis was also undertaken for males and females, and these results are presented in Table 3. Looking at first specification, males earn higher wages than females (approximately 4.3 per cent against 3.0 per cent). Using *t-test*, this difference was found to be statistically significant at 0.01. This result, however, should be interpreted with caution due to a sample selection bias problem, particularly among the women sample. Since female participation is lower than that of males and that the participation decisions will depend on earnings potential, it may be the case that the coefficients of the female earnings equation may be biased by the absence from the labour market of females who would otherwise have lower earnings. Data in hand however does not permit employing the selection approach due to lack of potential instruments.[12] For specification 2, the return to required education for females was fairly higher than that for males (10 per cent against 9 per cent). For specification 3, the return to required education was also slightly higher for females, about 10 per cent as compared to 9.3 per cent for males. Nevertheless, the return to surplus education was considerably greater for females than for males. If males end up in a job that less schooling is required than they have available, return for each year of surplus education is about 4.4 per cent compared to 6.3 per cent for females.

As a comparison, the return to required, over and deficit schooling are in ranges with those reviewed from Groot and Maassen Van Den Brink (2000), Kiker, Santos and De Oliveira (1997), McGuinness (2006), Battu (2007), and Leuven and Oosterbeek (2011). These authors reported that the return to a year of required education ranged from 3.9 – 8.6 per cent whilst 4.2 – 7 per cent for a year of surplus education. Moreover, those reviews also suggested that return to required education for female outnumbered the male counterparts, which is in line with the one generated here.

Table 3

*The Wage Impacts of Over-Education and Under-Education by Gender*

| lnwage (hourly) | Male | | | | | | Female | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 3 | | Model 1 | | Model 2 | | Model 3 | |
| Yearsch | 0.04340 | *** | | | | | 0.03039 | *** | | | | |
| | (0.00287) | | | | | | (0.00238) | | | | | |
| Required educ ($S^r$) | | | 0.06836 | *** | 0.09298 | *** | | | 0.06771 | *** | 0.09962 | *** |
| | | | (0.00410) | | (0.00481) | | | | (0.00424) | | (0.00488) | |
| Surplus edu ($S^o$) | | | | | 0.04423 | *** | | | | | 0.06311 | *** |
| | | | | | (0.00649) | | | | | | (0.00705) | |
| Deficit edu ($S^u$) | | | | | –0.03779 | *** | | | | | –0.05424 | *** |
| | | | | | (0.00589) | | | | | | (0.00746) | |
| Exp | 0.00095 | *** | 0.00153 | *** | 0.00160 | *** | 0.00146 | *** | 0.00079 | *** | 0.00109 | *** |
| | (0.00023) | | (0.00020) | | (0.00019) | | (0.00020) | | (0.00024) | | (0.00023) | |

(continued)

| lnwage (hourly) | Male | | | | | | Female | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Model 1 | | Model 2 | | Model 3 | | Model 1 | | Model 2 | | Model 3 | |
| Expsqr100 | –0.00012 | ** | –0.00024 | *** | –0.00022 | *** | –0.00021 | *** | –0.00012 | ** | –0.00015 | *** |
| | *(0.00005)* | | *(0.00004)* | | *(0.00004)* | | *(0.00004)* | | *(0.00005)* | | *(0.00005)* | |
| Training | 0.10168 | *** | 0.04982 | *** | 0.04526 | *** | 0.07562 | *** | 0.08443 | *** | 0.08045 | *** |
| | *(0.01675)* | | *(0.01720)* | | *(0.01711)* | | *(0.01739)* | | *(0.01674)* | | *(0.01655)* | |
| Cons | 2.67399 | *** | 2.63955 | *** | 2.32951 | *** | 3.10203 | *** | 2.39368 | *** | 2.00445 | *** |
| | *(0.07719)* | | *(0.08675)* | | *(0.09173)* | | *(0.07937)* | | *(0.08609)* | | *(0.08964)* | |
| N | 4547 | | 5355 | | 5355 | | 5355 | | 4548 | | 4547 | |
| R-square | 0.673 | | 0.667 | | 0.673 | | 0.659 | | 0.674 | | 0.685 | |
| R-adjusted | 0.669 | | 0.664 | | 0.670 | | 0.655 | | 0.670 | | 0.681 | |
| Log-likelihood | –2883.30 | | –3693.97 | | –3649.17 | | –3763.41 | | –2878.92 | | –2799.10 | |

*Robust standard error in italics*

**, **, and *** respectively 0.1, 0.05, and 0.01.*

Two stylised facts of returns to over-education and under-education were found from specification 3 across the three samples, and this is simplified in Table 4. Firstly, workers who were overeducated in their job get higher wages than their co-workers, roughly 4.4 to 6.3 per cent, but their earnings were still lower than workers with similar levels of schooling who work in jobs in which their schooling equals what is required, approximately 9.3 to –9.9 per cent.[13] This suggested that there is a pay loss for being an overeducated than a well-matched worker, and the pay loss is considerably larger for females than for males. In particular, the penalty for being overeducated is 53 per cent (i.e., the return falls from 9.3 to 4.4 per cent) for males as compared to 37 per cent than of females (the return drops from 10 per cent to 6.3 per cent). Using the Wald test, these differences were statistically significantly from zero at 0.01. This implied that the surplus education was not the result of a *potential* decrease, instead, it showed a positive and increasing returns on earnings from schooling that exceeded the requirement for the job occupied, as found in Sicherman and Galor (1991) and Alba-Ramirez (1993). Secondly, workers who were undereducated, i.e., jobs that require more schooling than they have would receive lower wages than their co-workers, but they get more than workers with the same level of schooling who are well-matched, i.e., work in jobs that require their level of schooling (–0.0448 against 0.0539)[14]. This means that for each year of deficit schooling, returns on education will drop by 4.5 percentage points, from 9.9 to 5.4 per cent. This time, the earnings loss was larger for females than for males (5.5 versus 4.5 percentage points).[15] These observations also were found in other studies such as in Hartog (1986), Rumberger (1987), Hartog and Oosterbeek (1988) and Sicherman and Galor (1991).

To test whether the earnings equations were restricted either to equation (1) or to equation (2), an F-test was employed on the residual sum of squares, and the results are presented in Table 5. The results showed that the hypothesis that returns to education are determined some way either by supply side or the demand side, was rejected at the 1 per cent level regardless of gender. This means that the earnings do not seem to be decided exclusively on the basis of actual schooling attained (Model 1) or required education (Model 2). Instead, earnings are determined by how workers are assigned to their jobs as shown in Model 3, which is superior to both the human capital specification and to the job competition specification. In fact, one would underestimate the rate of return in comparison to properly allocated individuals if they employ either equation (1) or equation (2) because the coefficient on $S^r$ in specification (3) is higher than the respect we coefficient in (1)

Table 4

*Summary of the Wage Impacts of Surplus and Deficit Education*

| lnwage (hourly) | Pooled | | Male | | Female | |
|---|---|---|---|---|---|---|
| Model 1 | | | | | | |
| Year of schooling completed ($S^a$) | 0.03699 | *** | 0.04340 | *** | 0.03039 | *** |
| | *(0.00183)* | | *(0.00287)* | | *(0.00238)* | |
| N | 9,902 | | 5,355 | | 4,547 | |
| R-adjusted | 0.659 | | 0.669 | | 0.655 | |
| Model 2 | | | | | | |
| Required education ($S^r$) | 0.07040 | *** | 0.06836 | *** | 0.06771 | *** |
| | *(0.00293)* | | *(0.00410)* | | *(0.00424)* | |
| N | 9902 | | 5,355 | | 4,547 | |
| R-adjusted | 0.66500 | | 0.664 | | 0.670 | |
| Model 3 | | | | | | |
| Required education ($S^r$) | 0.09873 | *** | 0.09298 | *** | 0.09962 | *** |
| | *(0.00338)* | | *(0.00481)* | | *(0.00488)* | |
| Surplus education ($S^o$) | 0.05478 | *** | 0.04423 | *** | 0.06311 | *** |
| | *(0.00474)* | | *(0.00649)* | | *(0.00705)* | |
| Deficit education ($S^u$) | –0.04480 | *** | –0.03779 | *** | –0.05424 | *** |
| | *(0.00461)* | | *(0.00589)* | | *(0.00746)* | |
| N | 9,902 | | 5,355 | | 4,547 | |
| R-adjusted | 0.673 | | 0.670 | | 0.681 | |

*Robust standard error in italics.*
*Other covariates – work experience, training, female, marital status, children under 12 years old, ethnic, occupations, hours of work, tenure, industry, firm size, ownership and firm age.*
*, **, and *** respectively 0.1, 0.05, and 0.01.*

Table 5

*F-Statistics of Equation (3) Against the Alternatives*

| | Total | Males | Females |
|---|---|---|---|
| *Human capital theory* | | | |
| $H_1$: $\gamma_1 = \gamma_2 = -\gamma_3$ | 118.38*** | 72.60*** | 68.01*** |
| *Job competition model* | | | |
| $H_2$: $\gamma_2 = \gamma_3 = 0$ | 119.50*** | 46.76*** | 26.31*** |

*** *Significant at 0.01.*
*Note.* $\gamma_1$, $\gamma_2$, and $\gamma_3$ *denote required, over and under schooling, respectively.*

and (2), applying when $S^o = S^u = 0$. These findings are in line with Hartog and Oosterbeek (1988), Alba-Ramirez (1993), Groot (1996), Kiker et al. (1997), and Sloane, Battu and Seaman (1999). This implied that the rate of return to education depends on the allocation of skills over jobs where workers found are not randomly distributed, instead there are based on the choices made to maximise their income.

## Conclusion

This paper is an attempt to fill a lingering gap in the existing studies on over-education by examining the incidence, determinants, and effects of over-education in the context of a middle income developing country, such as Malaysia. This research at has it disposal a unique workplace dataset that contains information on required education to do the job.

Using the workers' own self-assessment, it was found that whilst the majority of workers in the manufacturing sector were in well-matched jobs, over-education accounted for about 19 per cent of the sample and nearly one-third of our sample is undereducated. The earnings outcomes of surplus, required, and deficit schooling were explored. The findings showed that the rate of return to education depends on the allocation of skills over jobs where earnings is not fully embodied, but is (partly) determined by job characteristics and/or by the quality of the match between skills supplied by the worker and skills required by the job. Returns to required education is much greater than returns to actual education attainment. Moreover, the ORU model clearly showed that although returns to surplus education were positive ($S^o$),

the returns were lower than the returns to required education ($S^r$). This can be interpreted as the earnings loss for individuals for ending up in an overeducated job. Therefore, there is no reason to expect that wage rates will be wholly related to acquired/actual schooling or other individual attributes as in human capital theory, neither should it be expected that wage rates will be wholly related to the nature of the job, as argued by the job competition model.

However, this could not suggest that higher expenditure on education by our government in the last 5–10 years is a waste of resource due to the fact that there is still a positive and increasing return on earnings from schooling that exceeded the requirement for the job occupied. To some extent, this would also imply that the surplus education is not the result of *potential* decrease. In addition, overeducated workers may bring positive spill-overs at the workplace. If workers have accumulated more education than is optimal, it may positively influence co-worker wages where overeducated workers may share their skills and knowledge, to mutually raise co-worker productivity and thereby raise wages.

Nevertheless, for policy implication, the phenomenon of over-education among highly educated workers in the Malaysian labour market may impede the country's intention to move toward the state of being a high-income country, as outlined in the "New Economic Model" blueprint since it reduces individuals' productivity.

## End Notes

[1] This paper was presented at the "Persidangan Kebangsaan Ekonomi Malaysia VIII 2013" held in Johor Bahru, 7–9 June 1995. The author acknowledges the World Bank Enterprise Survey (WBES) and the Department of Statistics from which the 2007 Productivity Investment Climate Survey (PICS) data were acquired. None of these organisations bears any responsibility for the author's analysis and interpretations of the data. The main explanation revolves around the paucity of data in developing countries; in particular, there is a lack of information regarding the education or skills required to perform or obtain a job (Mehta et al., 2011).

[2] Retrieved on 4th July, 2014 from http://data.worldbank.org

[3] Retrieved on 4th July, 2014 from http://data.worldbank.org

[4] Both diploma and degree qualifications at public universities.

[5] Retrieved on 4th July 2014 from https://www.cia.gov

[6] Nine major industries are food processing, textiles, garments, wood and furniture, chemical and chemical products, rubber and plastics, machinery and equipment, electrics and electronics and motor vehicles and parts. The exact number of workers for the analysis varies due to missing data in some explanatory variables.

[7] See McGuinness (2006) and Oosterbeek and Leuven (2011) for other methods.

[8] Nevertheless, the incidence of over-education in Malaysia seems to be at the lower end of the existing estimates. Groot and Maassen van den Brink (2000) undertook a meta-analysis based on data from 25 over-education studies and found that the incidence of over-education varies from 10 per cent to 42 per cent with the unweighted average for over-education standing at 23.3 per cent. A recent review by Leuven and Oosterbeek (2011), over-education using the subjective method stands at an average over-education rate of 37 per cent.

[9] Years of required ($S^r$), years of surplus education ($S^o$) and years of deficit schooling ($S^u$) were obtained using the following formula (Hartog, 2000):

$$\begin{aligned} S &= S^r + S^0 - S^u \\ S^0 &= S - S^r \quad \text{if} \quad S > S^r \\ &= 0 \quad \text{otherwise} \end{aligned}$$

and

$$\begin{aligned} S^u &= S^r - S \quad \text{if} \quad S^r > S \\ &= 0 \quad \text{otherwise} \end{aligned}$$

[10] An alternative and simpler earnings specification involves a dummy for over-education and under-education in the earnings equation. When using dummy specification, the overeducated are being compared to individuals with the same education but are well matched.

[11] Since the earnings regression specification is in semi-logarithmic form, the percentage point effect (PE) was obtained using the following formula: PE = $(e^{\beta-1})$ x 100, where $\beta$ is the coefficient estimate. The percentage point effect will be used throughout the discussion in this paper.

[12] The model could be identified by functional form alone, though this is not the scope of this paper.

[13] This figure comes from the discrepancy between the surplus and required coefficient (surplus – required).

[14] These figures are obtained by subtracting deficit and required education (0.0987 – 0.0448).

[15] Using a Wald test, these differences also are statistically significant different from zero across the male and female sample. These results are available upon request.

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