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Salwaty Jamaludin, Sharulshahida Shakrein Safian, Rusmawati Said, Ariff Azly Muhamed

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Salwaty Jamaludin[1], Sharulshahida Shakrein Safian[2], Rusmawati Said[3], Ariff Azly Muhamed[4]

[1,2,4]Faculty of Business and Management, Universiti Teknologi MARA Cawangan Selangor, Kampus Puncak Alam, Malaysia, [3]School of Business and Economics UPM, Universiti Putra Malaysia, Malaysia
Corresponding Author Email: salwatyjamaludin@uitm.edu.my

Abstract
This study measures educational mismatch – overeducated and undereducated by aggregating individual mismatch for each group of occupations for manufacturing sector in Malaysia. This is crucial as the incidence of mismatch in the labour market could affect the workers' salaries and wages, and impede long-term country's' productivity. By employing Realised Matches method on Malaysia Labour Force Survey (LFS) data, the findings concluded that the population of undereducated workforce outweighed the population of overeducated workforce for manufacturing sector, with 36% of the workforce being undereducated compared to the latter at 14% of the workforce. However, a pattern was identified indicating an increase in the overeducated workforce throughout the year, implicating that those of the overeducated workforce (underemployed) were increasing.
Keywords: Education, Over-Education, Under-Education, Mismatch, Labour Market.

Introduction
Slow growth of salaries and wages could be an indicator of labour mismatch in the market. A report by Ministry of Human Resources (MOHR) and The World Bank (2016) disclosed that in Malaysia, the wage growth for educated workers is slowing down due to mismatch, as the mismatch is highly related to wage penalty. Osman & Shahiri (2013) also suggest that the issue of mismatch is emerging in Malaysia labour market. In addition, rate of return to education has declined, even negative, which could be interpreted as a sign for education inflation.

Data from DOSM reveal that half of all graduates (53.7%) make less than RM2,000 per month, which is slightly higher from the minimum wage, RM1,200. Starting salaries for graduates have largely stagnated since 2007 too, even in sectors that offer high salaries at the entry level, such as oil and gas. This is also supported by an employer survey (BNM, 2018), that suggests the nominal starting salaries for graduates remain at modest levels. Even after adjusting for inflation, real starting monthly salaries for most fresh graduates have declined

since 2010. A fresh graduate with a diploma earned a real salary of only RM1,376 in 2018 (RM1,458 in 2010), while a master's degree holder earned a real salary of RM2,707, a 7% decline from RM2,923 in 2010.

The same report mentions that Malaysians are still being paid less than employees in benchmark economies (United States, United Kingdom, Germany, Australia, and Singapore), even after accounting for the different productivity levels across countries. To make it clear, for an output worth $1,000, a Malaysian worker will be paid $340. The wage received by a worker in the benchmark economies for producing the same output is much higher, $510. This suggests that the current wages in Malaysia do not match its productivity levels.

The World Bank (2009) reports that the stagnancy of real wages and decline in wage premiums indicate the unwillingness of employers to pay since the workers' skills do not meet the expectations of the employers. Furthermore, the National Economic Advisory Council (2009) reveal that in some circumstances, employers not only refrain from paying high wages to skilled workers, but they keep relying on low-skilled foreign workers to generate higher profits from the production of low value-added products. This tendency has contributed significantly to the dampening of wages.

In Malaysia, even though manufacturing sector is among the sector that continues to play an important part in the country's economic transition, which contributes 23% to the country GDP on average, the issue of stagnant salaries and wages, continue to emerge. Table 1 shows the mean monthly salaries and wages by group of occupations (following Malaysia Standard Classification of Occupations (MASCO)) for manufacturing sector. For the high-skilled group such as legislators, senior officials, and managers, the growth rate of salaries and wages is higher compared to other groups. For the middle-skilled group such clerical workers, service and sales workers, craft and related trades workers, plant and machine-operators and assemblers, these groups received quite stagnant monthly salaries and wages, without taking the inflation into the account.

Table 1: Mean monthly salaries and wages by occupational groups for manufacturing sector, 2010-2015 (RM)

Group of occupations	2010	2011	2012	2013	2014	2015
Legislators, senior officials, and managers	4,621	5,358	5,467	5,834	7,194	7,741
Professionals	3,530	3,460	3,910	4,420	4,319	4,750
Technicians and associate professionals	1,962	1,959	2,140	2,182	2,418	2,523
Clerical workers	1,293	1,366	1,441	1,516	1,671	1,678
Service and sales workers	1,215	1,342	1,290	1,278	1,540	1,563
Craft and related trades workers	1,102	1,171	1,213	1,275	1,373	1,489
Plant and machine-operators and assemblers	908	932	1,015	1,122	1,225	1,265
Elementary occupations	719	780	840	898	1,026	1,163

(Source: Department of Statistics Malaysia (DOSM) and author's calculation)

Lastly, for the low-skilled group which is elementary occupations, this group of occupation suffering from the issue of stagnant salaries and wages the most. In 2014, there is slightly

increase in salaries and wages due to the implementation of minimum wage of RM900 a month in the peninsular Malaysia and RM800 in Sabah, Sarawak and Labuan.

This pattern may emerge for several reasons. First, the nature of jobs in the industry itself, whether the industry is capital- or labour-intensive. Second, over-reliance on low-skilled workers and cheap foreign workers. Third, occupational mismatch. Undeniably, in the real labour market, not all workers are matched with their occupations in terms of education level; some may be overeducated and struggle with underemployment.

This issue should not be disregarded as it could question the return to education as promises by human capital theory. Ismail et al (2015) find that overeducated workers receive lower—but still positive—returns to education compared to well-matched workers. Undereducated workers, however, are much worse-off, since they receive negative returns from education. These conclusions are also supported by Zakariya (2014), who reports that overeducated workers earn significantly less than their lower-educated colleagues who are well-matched with their jobs.

Literature Review
Theorical review
Human Capital Theory

Human capital can be defined as the skills, knowledge, and experiences to generate economic value for individuals, employers, or the country as a whole. Becker (1962) defines human capital investment as any form of investment in education made by an individual for future returns that are expected to exceed the current costs of participating in education. Returns are of two kinds: earnings premium for the individual and higher productivity for the firm. However, with the presence of mismatch in the labour market, the validity of this theory has been questioned.

Empirical Review

There are several methods to measure mismatch in the labour market. Generally, these can be grouped into subjective method (Worker Self-Assessment), objective method (Job Analysis), and statistical method (Realised Matches).

The subjective method or Worker Self-Assessment (WA) depends entirely on the worker's own assessment to measure the level of education required to perform a job. The worker determines the education level that he believes to be essential to perform the jobs. For example, he is asked, "What kind of education does a person need in order to perform your job?" (Alba-Ramirez, 1993). A worker is categorised as well-matched if his education level is equal to the level required to perform the jobs. He is considered overeducated (undereducated) if his education level is above (below) the required qualification.

Zakariya (2014); Zakariya & Noor (2014) employ this method to identify the mismatch level of workers in Malaysia's manufacturing sector using the Second Malaysia Productivity Investment Climate Survey (PICS-2). The author finds that almost 19% of workers are overeducated and 33% are undereducated. Using this method, Osman & Shahiri (2013) measure occupational mismatch and educational inflation. Based on Mincer's (1974) modified income model, the results indicate the presence of occupational mismatch in

Malaysian labour market, reducing, even reversing, the rate of return to education, indicating possible education inflation.

The second method is the objective method or Job Analysis (JA). It uses the information provided by professional job analysts regarding the required qualification for an occupation. This method is convenient as it provides a clear measure of the qualification level necessary to perform the tasks and duties of a given occupation (Hartog, 2000). In Malaysia, workers' education level can be compared to the requirements delineated in MASCO 2008, which is published by MOHR. However, as this method depends on the judgment of job analysts, it is susceptible to subjective biases.

Thirdly, the statistical method or Realised Matches (RM). This method compares either the mean or mode of education level of workers in the same job title and occupational group, resulting in a measure similar to the variance of the distribution of education levels of the workers in that job or occupational group. The mode method is advantageous as it is more sensitive to changes in the labour market (Borghans & De Grip, 2000). Furthermore, it avoids the problem of extreme values or outliers, thus it could be a more reliable indicator of mismatch (De Oliveira et al., 2000).

Most studies have used RM to measure mismatch. A worker is classified as overeducated if his education level is above the mean or mode of the education level of a specific job and occupational group. Among the earliest studies to identify overeducation and undereducation by comparing the mean are Kiker & Santos (1991); Kiker et al (1997), while De Oliveira et al (2000) use mode instead of mean. Recently, Morgado et al. (2016) employ this method to measure labour mismatch in 30 European countries. The authors find that undereducation affects more workers than overeducation in most European countries. Specifically, 15-35% of workers are employed in jobs that require a higher or lower education level, while 20-50% work in a job with a different field of qualification.

Flisi et al (2017) estimate occupational mismatch in OECD countries using data from the Survey of Adult Skills (PIAAC). They find that workers with higher education are more likely to be in the mismatched group, while workers with lower education are more likely to be in the matched group. Similarly, workers with higher skills are more likely to be in the mismatched group, whereas those with lower skills are more likely to be in the matched group. Using the same survey, Pellizzari & Fichen (2017) find that 16% of workers, mostly tertiary graduates, are over-skilled, while 9% of workers are under-skilled.

Methodology
Using Labour Force Survey (LFS) data, occupational mismatch is calculated using Realised Matches (RM), following (Morgado et al., 2016; Flisi et al., 2017). The highest level of education is proxy by the mode of highest level of education attained by workers in a given occupation. If a worker lies beyond one standard deviation from the mean or mode, it means that mismatch is present. It is signalled with either 1 (overeducated) or -1 (undereducated), depending on whether it is above or below the high or low limits of the interval. A case that lies beyond two standard deviations from the mean or mode, signalled with 2 or -2, means that the worker is either severely overeducated or severely undereducated in his occupation. Put simply, mismatch is the proportion of cases signalled -2, -1, 1, and 2 in relation to the total

number of observations for a given occupation and year. That measure will have a value between zero (no mismatch) and one (full mismatch). Overeducation and undereducation are additive and total the percentage of mismatch.

Let e_i represent the highest level of education for worker i ($\bar{e}$ is the average and s_e is the standard error of e_i). Let o_i be the occupation of that worker according to MASCO 2008:

$$\text{IE}_{iy}\,(\,e_i|o_i, y_i) = -2 \Leftarrow e_i - \bar{e} < -2s_e$$
$$\text{IE}_{iy}\,(\,e_i|o_i, y_i) = -1 \Leftarrow -2\,s_e < e_i - \bar{e} < -s_e$$
$$\text{IE}_{iy}\,(\,e_i|o_i, y_i) = 0 \Leftarrow -s_e < e_i - \bar{e} < s_e$$
$$\text{IE}_{iy}\,(\,e_i|o_i, y_i) = 1 \Leftarrow s_e < e_i - \bar{e} < 2s_e$$
$$IE_{iy}\,(\,e_i|o_i, y_i) = 2 \Leftarrow e_i - \bar{e} > 2s_e$$

Thus, the measure of mismatch is denoted by

$$ME_y = \frac{\sum_{i:IE_{iy} \neq 0} |IE_{iy}|}{n_y}$$

(1)

This methodology allows the researcher to identify the proportion of workers whose education is above or below based on required level of education for a given occupation and economic activity (which is the interpretation of the value for the mean or mode level of education). Hence, the sum of both proportions yields the level of mismatch, which is the value of indicator ME_y.

The definitions for the certificates obtained from public or private formal educational institutions are adapted from the International Standard Classification of Education (ISCED–97) (Table 2).

Table 2: Classification of certificates

Mode of the highest level of education	Types of certificate	Definition
0	No certificate	Refer to those who are currently attending school or who have completed schooling without receiving any certificate.
1	UPSR/UPSRA or equivalent	Refer to *"Ujian Penilaian Sekolah Rendah"/"Ujian Penilaian Sekolah Rendah Agama"* or equivalent.
2	PT3/PMR/SRP/LCE/SRA or equivalent	Refer to *"Pentaksiran Tingkatan 3"*, *"Penilaian Menengah Rendah"*, *"Sijil Rendah Pelajaran"*, "Lower Certificate of Education", *"Sijil Rendah Agama"*, or equivalent.
3	SPM or equivalent	Refer to *"Sijil Pelajaran Malaysia"* or equivalent (Senior Cambridge Certificate, GCE O Level and Malaysia Certificate of Vocational Education).
4	STPM or equivalent	Refer to *"Sijil Tinggi Persekolahan Malaysia"*, Higher School Certificate or equivalent (*"Sijil Tinggi Agama"* and GCE A Level).
5	Certificate	Refer to certificate obtained from a college, polytechnic, or other institutions which offer formal education. Duration of study should not be less than six months.
6	Diploma	Refer to diploma or an equivalent certificate obtained after categories 3, 4, or 5 from a university, college, or polytechnic prior to a degree qualification.
7	Degree	Refer to bachelor's, master's, or doctorate degree obtained from a public or private higher institution or equivalent.

(Sources: LFS, DOSM)

Table 3 shows the example of mismatch identification based on the group of occupations. For instance, for Professionals groups, if the mode (frequent) of the highest level of education for Professionals groups is a bachelor's degree, thus the education level demanded by the industry for Professionals groups is considered as bachelor's degree. Compared it with the worker's level of education, then the incidence of mismatch can be identified. Let say if the worker's level of education is also Bachelor's Degree, then it assumes that worker's level of education matched with education level demanded by the industry.

Table 3: Example of mismatch identification for manufacturing sector

Group of occupations	Example of occupation	Required level of education	Worker's level of education	Incidence of mismatch
Legislators, senior officials, and managers	Manufacturing Managers	Bachelor's Degree	Bachelor's Degree	Matched
Professionals	Mechanical Engineers	Bachelor's Degree	Bachelor's Degree	Matched
Technicians and associate professionals	Electrical Engineering Technicians	Diploma	Bachelor's Degree	Overeducated
Clerical workers	Production Clerks	SPM or equivalent	Diploma	Overeducated
Service and sales workers	Security Guards	SPM or equivalent	PT3/PMR/SRP/LCE/SRA or equivalent	Undereducated
Craft and related trades workers	Welders and Flame cutters	SPM or equivalent	PT3/PMR/SRP/LCE/SRA or equivalent	Undereducated
Plant and machine-operators and assemblers	Electrical and Electronics Equipment Assemblers	SPM or equivalent	PT3/PMR/SRP/LCE/SRA or equivalent	Undereducated
Elementary occupations	Hand Packers	SPM or equivalent	PT3/PMR/SRP/LCE/SRA or equivalent	Undereducated

Result and Discussion

Descriptive Statistics

The total respondents are 60,185 employed persons for manufacturing sector. Their data were obtained from LFS 2010-2015 and detailed in Table 4. Male comprises 65% of respondents, which is equivalent to 38,904 individuals. One-third (36%) of respondents belong to the 25-34 age group. They are followed by the 35-44 (26%), 16-24 (20%), 45-54 (15%), and 55 and above (4%) groups. By education, almost half of the employed persons have attained at least secondary education (STPM or equivalent and SPM or equivalent). About 14% of respondents are tertiary-educated (diploma, bachelor's, master's, or doctoral degree), while the rest either hold at least a PT3/PMR/SRP/LCE/SRA or equivalent, or UPSR/UPSRA or equivalent, or no certificate at all.

Around 70% of the respondents work in middle-skilled jobs, 25% in high-skilled jobs, and 5% in low-skilled occupations. Plant and machine-operators and assemblers are the most represented (44%), followed by technicians and associate professionals (18%), and craft and related trades workers (16%). Looking at the distribution of employment by education level

and occupational group, it appears that Malaysian labour market still prefers middle-skilled manpower, even though the tertiary-educated labour force is constantly growing in size.

Table 4: Descriptive statistics of LFS 2010-2015 for manufacturing sector

	Group of occupations	Legislators, senior officials, and managers	Professionals	Technicians and associate professionals	Clerical support workers	Service and sales workers	Craft and related trades workers	Plant and machine-operators and assemblers	Elementary occupations	**Total**
Gender	Male	1,185	1,889	8,655	1,197	904	7,495	15,570	2,009	38,904
	Female	387	957	2,026	3,791	356	1,931	10,921	912	21,281
Age	16-24	24	213	1,149	894	212	2,019	6,737	695	11,943
	25-34	373	1,394	3,998	2,064	346	2,950	9,503	897	21,525
	35-44	581	860	3,502	1,318	257	2,383	5,969	645	15,515
	45-54	466	320	1,757	610	308	1,531	3,482	516	8,990
	55 above	128	59	275	102	137	543	800	168	2,212
Education Level	No certificate	6	5	125	46	133	996	2,531	610	4,452
	UPSR/UPSRA or equivalent	10	6	350	126	124	1,694	3,639	593	6,542
	PT3/PMR/SRP/LCE/SRA or equivalent	40	10	886	335	227	1,904	4,995	536	8,933
	SPM or equivalent	292	211	4,680	3,048	649	4,046	13,807	1,070	27,803
	STPM or equivalent	59	48	399	325	37	137	541	40	1,586
	Certificate	22	67	1,101	177	24	417	492	43	2,343
	Diploma	308	579	2,419	654	46	210	393	25	4,634
	Degree (bachelor's, master's or PhD)	835	1,920	721	277	20	22	93	4	3,892
Total		1,572	2,846	10,681	4,988	1,260	9,426	26,491	2,921	60,185

Incidence of Mismatch

For manufacturing sector, on average from 2010-2015, the level of educational mismatch in the manufacturing sector was at 0.500 (50%): with 14% of workforce were overeducated and 36% were undereducated as shown in the Figure 1. Specifically, for the group of legislators, senior officials, and managers, and professionals, there are no workers classified as overeducated as these groups have required the highest level of education to perform these jobs. However, on average 46% of Legislators, senior officials, and managers, and 33% of Professionals were undereducated respectively.

Figure 1: Incidence of mismatch - undereducated and overeducated in the manufacturing sector
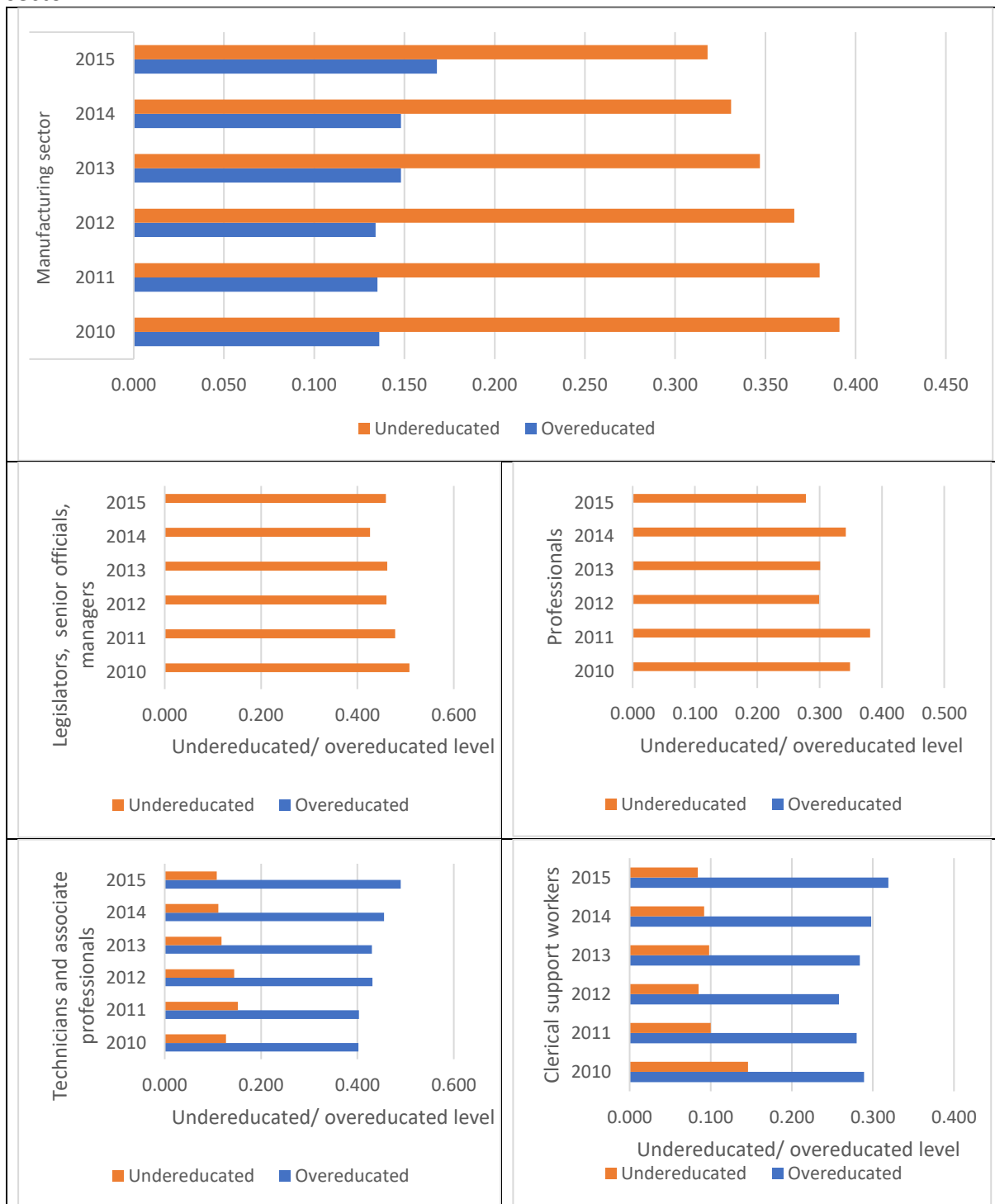
For the group of technicians and associate professionals, and clerical support workers the issue of overeducated are more prevalent. In 2010, only 40% of technicians and associate professionals are overeducated, however on 2015, this percentage reached up to 49%. While for clerical support workers, on average from 2010-2015 there were 29% of them were worked in the jobs that only required low level of education, compared to the level of education they had obtained, or could be classified as underemployment.

The issue of overeducation or underemployment, normally affected those who are with tertiary education level. Some of educated may involuntary work in lower-status jobs, which mismatch with their level of education. There are several reasons for overeducation or underemployment happened in the labour market. First, employers' tendency to hire better-educated workers to save training costs. Second, during times of high unemployment, even if job offers do not fit their educational background, most graduates have to accept them. Alternatively, graduates who enter the labour market during times of low unemployment are less likely to be mismatched. Therefore, the incidence of mismatch may signal inefficiencies in the labour market, or it may be part of an efficient labour market where workers search for jobs throughout their careers.

From the viewpoint of a single firm, employing an overeducated or overqualified worker may be beneficial for productivity; however, from the perspective of the economy as a whole, it could be harmful. In an economy where firms are quite heterogeneous, the reallocation of mismatched workers would be a problem and possibly affect aggregate productivity (McGowan & Andrews, 2015). The human capital resource is unexploited

because the marginal benefit received by the overeducated worker from his education costs more than the productivity that he can confer, given the jobs available (Mehta, Felipe, Quising, & Camingue, 2011).

Lastly, for other groups; they were suffering with the issue of undereducated. For the service and sales workers, on average, from 2010-2015, 38% of them were undereducated., craft and related trades (49%), plant and machine-operators and assemblers (38%), and elementary occupations (59%). For the issue of undereducated, it is commonly associated with the issue of skill shortage. To overcome this shortage, firms have to lower their recruitment standards and hire less productive workers (Bennett & McGuinness, 2009). As reviewed by many studies, skill shortage definitely significantly and negatively related to productivity (Haskel & Martin, 1993; Nickell & Nicolatsis, 1997). Besides that, both unfilled and hard-to-fill vacancies, which can be proxies of skill shortage, have decreased output per worker by 65-75% in high tech firms (Bennett & McGuinness, 2009). In term of wages, undereducated workers are suffering from the most, as there is a negative return to years of undereducation (Hartog, 2000).

Overall, these findings for manufacturing sector are consistent with that of Zakariya and Noor (2014). Based on the Second Malaysia Productivity Investment Climate Survey (PICS-2) 2007, they found that of the workforce in the manufacturing sector 18% were overeducated and 29% were undereducated. Comparing these two findings suggests that over the past nine years, despite the development of new technologies, the labour demand of the manufacturing sector still skewed towards low-skilled workers. This also supported by the Said, Haris, and McNabb (2008) that stressed technological change is also accountable to the rises in the relative labour demand for middle levels of education, yet diminished the relative labour demand at higher levels of education, particularly for this sector.

Conclusion

The results show that undereducation is more prevalent than overeducation in manufacturing sector. Around 36% of the workforce are undereducated and 14% are overeducated. However, the proportion of undereducation has been decreasing, while overeducation has been rising throughout the years. This suggests that employed workers who are stuck in underemployment is growing in quantity. As the incidence of mismatch affects salary, this could explain why local workers are still being paid less than employees in benchmark economies (e.g. Singapore and Australia), even after accounting for the different productivity levels across countries. The analysis also reveals among occupations, managers and professionals are the groups with the most matched workers, while technicians and associate professionals, and clerical support workers are the ones in which there is the highest proportion of overeducated. The remaining groups suffer from undereducation.

By measuring the mismatch, the proportion of undereducated and overeducated or underemployed workers can be computed. The mismatch trend can also be captured. Furthermore, the occupational groups with high incidence of overeducation or undereducation may also be identified. Specific and suitable programmes, such as upskilling and reskilling, could target specific occupational groups, such as those with the most undereducated workers, in order to boost their productivity and wages. Low-skilled and middle-skilled worker should be reskilled and upskilled, as it is likely that demand for them

will decline along with the increasing use of automation. The government also should ensure the continuous competency of trainers, up-to-date course contents, and high availability of infrastructure e.g. funding mechanism.

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