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Mismatch effect between education, workers, and occupations on the labor market in Indonesia

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Abstract

Indonesia experiences an increasing trend in the number of educated workers which has not been accompanied by a rise in occupations. Finding a suitable job without an educational background is quite hard. A rise in education created a situation of overeducated workers, where those with a higher education background are working in lower-skilled jobs. This is contrary to undereducated workers who have jobs in which more skills and knowledge are needed than provided by their educational background. Considering these situations, this study aims to determine the effect of the mismatch between the educational background of workers and their occupation on the labor market in Indonesia. This study uses the 2018 Sakernas data, specifically, workers aged 18-64 years and working full-time, and employs instrumental variable (IV) regression. The results showed a mismatch in the labor market between the educational background of the worker and occupations in Indonesia. Male workers tend to be overeducated in their occupation compared to female workers, and workers less than 35 years old tend to be overeducated. In addition, overeducated workers have a negative effect on wages, while undereducated workers have a positive effect.

Keywords: mismatch, overeducated worker, undereducated worker, instrumental variable.

1. Introduction

Education is important for improving the quality of human capital. According to Weisbrod (1964), education can lead to higher economic growth and better living standards. Some literature states that there is a positive influence of education on income. According to Mincer (1974), education is an essential contribution to income. Schultz (1961) argues that knowledge and skills acquired through education are the main components of human capital. Wannakrairoj (2013) found that education and experience are positively correlated with the wages of labor in both urban and rural labor markets in Thailand. In addition, with the development of the digital era, the options for human capital and skills should be considered as the rapid diffusion of new technologies can replace labor in the production process by using capital, especially for low-skilled workers (Jithitikulchai, 2020).

Various policies have been carried out by the government to increase school participation and improve the quality of human capital. Furthermore, according to the human capital theory, individuals should choose to invest in various activities in education such as schools, job training, medical care, consumption of vitamins, and others (Becker, 1962). Investment in education will result in future returns as income rises. According to Poteliene and Tamasauskiene (2014), individuals who continue their education up to the tertiary level seem to lose income compared to high school graduates who get a job directly; after graduating from university, the individual will receive higher wages when compared to high school graduates. Consequently, the higher the education, the higher the wages. Furthermore, according to Borjas (2008), individual decisions in determining the level of education play an important role in income. The choice of education level is closely related to the benefits to be gained from the level of education.

Recently, there is an increasing number of the adult population in the labor force, especially at the high school education level. Unfortunately, the rise in educated workers in Indonesia has not been accompanied by the rise in occupations. The process of finding a job that matches with educational background is quite hard, especially in developing countries. Persons that have been unemployed for a long time are more likely to become workers who are undereducated (Iriondo & Perez-Amaral, 2016). Furthermore, those who find difficulty in procuring jobs will tend to accept work that does not match their level of education. Some prefer to work at any job rather than be unemployed, even though the work could be carried out by someone with a lower level of education.

The proportion of workers with junior high school education and below still dominates the share of employment by educational background, although the trend shows a decline. The proportion of workers with a junior high school education level is around 59 percent; the highest is workers with primary school education, around 25 percent. This condition indicates the possibility of undereducated workers in Indonesia to be quite high. The mismatch between education and occupation is the inefficiency of socioeconomic costs that can create low involvement and productivity as well as a lack of skill utilization (Farooq, 2011).

This situation makes the economy decline at the individual and aggregate levels (ILO, 2017). Allen and van der Velden (2001) similarly found the problem of mismatch, especially with overeducated workers, related to the issue of licensing, where the workers cannot utilize all the benefits of all knowledge, skills, and education they have acquired for themselves and the whole community. At the macroeconomic level, national welfare is potentially lower than it should be because the skills of all overeducated workers are not fully utilized in the economy (McGuinness, 2006).

In addition, Duncan and Hoffman (1981), Rumberger (1981), Bauer (2000), and Reis (2017) find that the estimated rate of return on education is positive. In another study, it was found that the economic impact of

overeducated workers was negative, where overeducated workers tended to receive lower wages than they should get with their education (Bauer, 2002; Kiker, Santos, & Mendes De Oliveira, 1997; Verdugo & Verdugo, 1989). According to the International Labour Organization (ILO, 2017), the qualification of mismatch between the educational background of workers and the occupations in Indonesia was high, around 60 percent. The problem of mismatch also reflects on other important issues such as the quality of education and the condition in the labor market (Safuan & Nazara, 2005).

According to Alba-Ramirez (1993), Hartog (2000), and Black (2000), there are three types of matching between work and education. First, in well-matched, the level of education achieved by workers matches the qualifications of work. Second, with the overeducated worker, the level of education achieved by workers is higher than the qualifications of the work. Third, with the undereducated worker, the level of education achieved by the worker is lower than the qualifications of the work. Overeducated and undereducated workers are the mismatch of educational backgrounds with the occupation in the labor market. Some workers with the same level of education receive different wages.

The mismatch between education and occupation can be caused by several factors, e.g., the high cost of finding work (Dolado, Jansen, & Jimeno, 2009), the imperfection of information in the labor market (Bender & Heywood, 2006), lack of work experience (Groot & Van den Brink, 2000), and limited choices and lack of employment opportunities while people have to fulfil their daily needs (Safuan & Nazara, 2005). The limited information on the labor market and the lack of prediction of labor needs in the future cause the mismatch.

According to Alba-Ramirez (1993), Bauer (2002), and Verhaest and Omey (2012), overeducated workers tend to receive lower wages. Conversely, undereducated workers tend to receive higher wages, which has a positive effect on income. Furthermore, Kiker et al. (1997) and Bauer (2002) found that overeducated workers had lower incomes while undereducated workers

had higher incomes compared to workers with the same education level who worked in jobs that matched the required educational qualifications. Similar findings were also mentioned by Verdugo and Verdugo (1989), Hung (2008), Iriondo and Pérez-Amaral (2016), and Sellami, Verhaest, Nonneman, and Van Trier (2017). Furthermore, Dolton and Silles (2008) examined the impact of the overeducated worker on wages using the instrumental variable method. They found that education reduces income by 35-40 percent. Therefore, Dolton and Silles (2008) conclude that a level of education higher than the work requirements cannot be used as something beneficial (necessarily unbeneficial).

The previous studies in developing countries that discuss the mismatch between education and occupations are still very limited, especially when discussing the relationship between overeducated and undereducated workers and their income. There is an indication of mismatches in supply and demand in the labor market. Considering the discussion above, the purpose of this study is to determine the mismatch between the education of workers and their occupations and to estimate the effect on labor income.

2. Data

This research uses the August 2018 Sakernas data from Statistik Indonesia. The unit of analysis is Indonesian workers ages 18-64 years who have working hours above 35 hours per week. Based on these criteria, a total of 89,552 observations were obtained.

3. Overeducated and Undereducated Worker Measurements

The mismatch between the educational background of workers and the occupation is calculated by using mean and mode approaches. The mean value was proposed by Verdugo and Verdugo (1989), and the requirement of work for the level of education (years of schooling) is inferred from the mean years of schooling completed by all workers on the same type of work. Workers who have years of schooling in the range of one standard deviation from the

mean are considered well-matched. An undereducated worker is a worker with years of schooling less than the mean values, while an overeducated worker is a worker with years of schooling more than the mean values. Other researchers have used this method as well, e.g., Bauer (2002), Safuan and Nazara (2005), Farooq (2011), and Hidayatunnismah (2014).

In addition to the mean approach is the mode approach developed by Kiker et al. (1997). The mode approach is used when the requirement of work for the level of education (years of schooling) is inferred from most workers' education completed by all workers on the same type of work. Workers with years of schooling higher than the mode values are defined as overeducated workers, while workers whose years of schooling are less than the mode values are defined as undereducated workers.

The classification of overeducated, undereducated, and well-matched workers in this study was carried out through several stages. First, calculating the highest level of education attended by the workers using years of schooling measurement from each worker (Hidayatunnismah, 2014; Safuan & Nazara, 2005); second, calculating the mean and mode values of years of schooling from workers; and third, categorizing workers as overeducated, undereducated, and well-matched.

4. Model

This study uses the Verdugo and Verdugo (1989) model approach. The full equation of this research model is as follows:

$$ln\_nwage = \beta_0 + \beta_1\widehat{S_o} + \beta_2\widehat{S_u} + \beta_3 S_a + \beta_4 experience + \beta_5 experience^2 + \beta_6 disabilitas + \beta_7 d\_married + \beta_8 sektor + \varepsilon_i \quad (1)$$

where *In_nwage* is the logarithm of individual nominal wages, S_a is the level of education attained by the individual, $\widehat{S_o}$ is the overeducated worker, $\widehat{S_u}$ is the undereducated worker, the experience is the number of years of work, disability is a dummy variable (1 = disability, 0 = no disability), d_married is a dummy variable of the marital status of workers (1 = married, 0 = single), and Sector is the sectoral fixed effect (17 sectors).

The Verdugo and Verdugo model (VV model) is considered better for several reasons. The model includes the level of education attained by the individual as a control and is measured by using years of schooling. The basic model above is estimated by using instrumental variable regression. The method is used to anticipate two potential problems, omitted variable bias and measurement error toward education. The first problem is when individual heterogeneity (unobserved variables), for example, motivation, and ability are ignored, the estimated overeducated worker will be too high. According to Wooldridge (2013), estimation with instrumental variables can overcome the problem of endogeneity. The OLS (Ordinary Least Squares) estimator will be biased and inconsistent if an important variable is not included in the model. The next problem is measurement error, where overeducated and undereducated workers are measured by different methods. Measurements by different methods tend to result in underestimated values. The existence of measurement errors can be overcome by applying the instrumental variable approach.

This study uses instrumental variables in which the years of schooling in overeducated (*So*) and undereducated (*Su*) workers are measured by the mean values and will be instrumented by using mode measurement for overeducated and undereducated workers. Equations in the first stage regression with instrumental variables can be written as follows:

$$\widehat{S_o mean_\iota} = \beta_0 + \beta_1 S_o\_mode_i + \beta_2 S_u\_mode_i + \beta_3 S_a + \beta_4 X_i + \mu_i$$
$$\widehat{S_u mean_\iota} = \beta_0 + \beta_1 S_o\_mode_i + \beta_2 S_u\_mode_i + \beta_3 S_a + \beta_4 X_i + \mu_i \quad (2)$$

where ($\widehat{S_o mean}$) is years of schooling for the overeducated workers in the mean values, ($\widehat{S_u mean}$) is years of schooling for the undereducated workers in the mean values, is years of schooling for the overeducated workers in the mode values, and is years of schooling for the undereducated workers in the mode values. Mode values for the overeducated and undereducated workers are chosen as instrument variables since mode measurement can capture the actual situation of most workers' highest education level attended, which is measured by years of schooling held by workers.

5. Results and Discussion

5.1 Descriptive analysis

The average years of schooling for male overeducated workers are higher for female. On average the surplus of years of schooling for male overeducated workers is around 0.72 years and around 0.19 years for female workers. Meanwhile, the deficit of years of schooling for male undereducated workers is 0.84 years and 0.79 years for female workers. Furthermore, for the mode approach, it provides a different picture related to the incidence of mismatch between education and occupation in Indonesia. On average for the mode approach, individuals in each category will have a higher number of years of schooling surplus and deficit than the mean values of years of schooling surplus and deficit (Table 1).

Table 1. Summary statistics

Variable	Total				Men	Women
	Mean	Std. Dev	Min	Max		
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Mean method						
Years of well-matched	11.02	2.84	7.01	15.52	10.59	11.85
Years of overeducated	0.51	1.46	0	12.35	0.72	0.19
Years of undereducated	0.81	2.24	0	15.52	0.84	0.79
Mode method						
Years of well-matched	11.17	3.27	6	16	12.23	12.86
Years of overeducated	1.14	2.01	0	12	0.53	0.52
Years of undereducated	1.28	2.57	0	16	2.16	1.52
Observation	89,552				59,310	30,242

Source: Badan Pusat Statistik (2018a, 2018b, 2018c, 2018d).

Based on the calculation of the mean approach, around 75 percent of workers in Indonesia have well-matched occupations, 11 percent were identified as overeducated, and 14 percent were identified as undereducated workers (Table 2). The proportion of well-matched workers is higher by using mean values than mode values, but for overeducated and undereducated workers the proportions are lower than mode values.

Table 2. Matching status

Approach	Educational Match						Total	
	Overeducated		Well-matched		Undereducated			
	N	%	N	%	N	%	N	%
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Mean	10,235	11.4	67,203	75	12,114	13.5	89,552	100
Mode	24,365	27.2	42,064	47	23,123	25.8	89,552	100

Source: Badan Pusat Statistik (2018a, 2018b, 2018c, 2018d).

Based on the two measurement approaches, mean and mode approaches (see Appendix 1), it was found that male workers tended to experience more mismatches, both as overeducated workers and undereducated workers than female workers. This is presumably because, in general, men have the role of head of household and are tasked with supporting the family. The existence of these obligations encourages men to be less likely to choose the type of work (Hidayatunnismah, 2014). In addition, there is an inequality in the distribution of well-matched workers among regions. For western regions, the number of well-matched workers is higher than the other two regions, the central and eastern regions, yet all three regions show that the highest percentage is the well-matched workers, and the percentages are similar from the two regions. This means most people can find a job that matches their education.

When looking at age groups, the age groups less than 35 years and above 35 years result in different findings. According to the mean and mode values, workers less than 35 years tend to be overeducated compared to undereducated workers. The higher the age group, the lower the tendency to be overeducated except in the age 18-24 years age group. The 25-34 age group experiences the highest tendency to be overeducated compared to other age groups; this is likely, because in this age group, a person has less work experience and a tendency to accept any job. This is consistent with Hartog (2000), who stated that overeducated workers are usually in the transition phase between school and work. The cause of being overeducated is due to the high cost of finding work (Dolado et al., 2009), imperfections of information in the labor market (Bender & Heywood, 2006), and lack of work experience (Groot & Van den Brink, 1996). Conversely, workers in age groups over 35 years tend to be more undereducated than overeducated.

In addition, Verhaest and Omey (2011) state that work experience is one skill that can be used to compensate for a lack of formal education. Workers with a high school education level and above tend to be categorized as overeducated workers. Workers with postgraduate and doctoral educational backgrounds are all categorized as overeducated workers. Meanwhile, workers with education levels below elementary school are categorized as undereducated workers. Furthermore, when looking at marital status, married workers tend to be more overeducated than single workers. It is suspected that a married person will have a greater responsibility for the needs of his family than a person who is not married. This demand ultimately drives a person to work and accept a job with qualifications below his educational standard.

Table 3. Mismatch by Job Classification

Job classification	Mean approach				Mode approach			
	Overeducated		Undereducated		Overeducated		Undereducated	
	N	percent	N	percent	N	percent	N	percent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)

Legislative Officers, High Officers, and Managers	413	1.85	926	4.14	413	0.87	1,131	2.38
Professional Staff	850	3.80	1,548	6.93	850	1.79	3,031	6.38
Professional Technicians and Assistants	170	0.76	458	2.05	2,935	6.18	458	0.96
Administrative Staff	316	1.41	563	2.52	6,364	13.40	563	1.19
Service Workers and Sales Force in Stores and Markets	1,371	6.13	2,365	10.58	1,518	3.20	4,672	9.84
Agriculture and Animal Husbandry Workers	607	2.72	489	2.19	1,189	2.50	489	1.03
Processing and Craft Workers	249	1.11	842	3.77	249	0.52	5,694	11.99
Machine Operators and Assemblers	286	1.28	2,019	9.03	286	0.60	4,181	8.80
Crude Workers, Cleaning services Workers	5,973	26.73	2,904	12.99	10,561	22.24	2,904	6.12
Total	10,235	45.80	12,114	54.20	24,365	51.31	23,123	48.69

Source: Badan Pusat Statistik (2018a, 2018b, 2018c, 2018d).

Table 3 shows that the number of overeducated workers with the mean approach tends to be higher than unskilled workers and cleaning staff (26.73 percent). Similar to overeducated workers, the number of undereducated workers also tends to be higher in unskilled workers and cleaning staff (12.99 percent). There is an interesting phenomenon that the highest share of mismatch between educational background and occupation is the same for both overeducated and undereducated workers. This is because the majority

of these types of work require more strength/physical endurance and do not really need special skills and expertise. This type of work only requires basic skills acquired in the first stage of basic education, e.g., reading, writing, and arithmetic, but these are not important requirements. Thus, it can be explained that this work can be carried out by any individual with any level of education.

Meanwhile, the lowest share of mismatch in the mean approach is technicians and assistant professional staff contributing around 0.76 percent for overeducated workers and 2.05 percent for undereducated workers. It can be explained that in this category most workers are well-matched between educational background and occupation. This type of work generally requires extensive factual, technical, and procedural knowledge in a particular field and good interpersonal communication skills.

According to the mode approach, the share of overeducated workers is mostly dominated by unskilled workers and cleaning staff (22.24 percent), followed by administrative staff (13.40 percent) and technicians and professional assistants (6.18 percent). Meanwhile, the highest share of undereducated workers was craft workers (11.99 percent), followed by service and sales force workers (9.84 percent) and machine operators and assemblers (8.80 percent). Furthermore, the lowest share of mismatch in the mode approach is technicians and assistant professional staff (0.96 percent). These results are similar to the findings of measurements using the mean approach, indicating that these types of jobs require special skills and expertise.

Table 4 presents the mismatch of educational background and occupation by business sectors. According to the mean approach, the highest share of overeducated workers is in the manufacturing industry (7.53 percent), followed by agriculture, forestry, and fisheries (5.87 percent) and government administration (5.59 percent). For undereducated workers, the biggest share is in the manufacturing industry (8.05 percent), followed by forestry agriculture and fisheries (7.77 percent) and construction (5.42 percent).

Meanwhile, according to the mode approach, the highest share of overeducated workers is in government administration (11.53 percent),

followed by the manufacturing industry (6.49 percent) and agriculture, forestry, and fisheries (5.88 percent). For undereducated workers, the highest share is in the manufacturing industry (12.07 percent), followed by wholesale and retail trade (6.34 percent) and construction (5.56 percent). The real estate sector experienced the lowest share of educational mismatch for both measurements using the mean and mode approaches, under 0.25 percent.

Table 4. Mismatch by International Standard Industrial Classification (ISIC)

ISIC	Mean approach				Mode approach			
	Overeducated		Undereducated		Overeducated		Undereducated	
	N	percent	N	percent	N	percent	N	percent
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Agriculture, forestry and fisheries	1,311	5.87	1,736	7.77	2,792	5.88	1,961	4.13
Mining and excavation	313	1.40	553	2.47	638	1.34	809	1.70
Processing industry	1,683	7.53	1,800	8.05	3,080	6.49	5,730	12.07
Electricity and gas procurement	79	0.35	85	0.38	163	0.34	131	0.28
Water supply, waste management, waste and recycling	56	0.25	64	0.29	120	0.25	91	0.19
Construction	1,189	5.32	1,211	5.42	2,508	5.28	2,641	5.56
Wholesale and retail trade	1,027	4.60	1,429	6.39	1,735	3.65	3,011	6.34
Transportation and warehousing	501	2.24	881	3.94	874	1.84	1,557	3.28
Provision of accommodation and food and drink	424	1.90	713	3.19	721	1.52	1,226	2.58

Information and communication	81	0.36	121	0.54	255	0.54	165	0.35
Financial and insurance services	257	1.15	199	0.89	1,359	2.86	271	0.57
Real estate	46	0.21	46	0.21	91	0.19	76	0.16
Company services	236	1.06	179	0.80	540	1.14	316	0.67
Government administration	1,250	5.59	857	3.83	5,474	11.53	1,148	2.42
Educational services	860	3.85	914	4.09	1,449	3.05	1,213	2.55
Health services and social activities	378	1.69	191	0.85	1,326	2.79	1,254	2.64
Other services	544	2.43	1,135	5.08	1,240	2.61	1,523	3.21
Total	10,235	45.80	12,114	54.20	24,365	51.31	23,123	48.69

Source: Badan Pusat Statistik (2018a, 2018b, 2018c, 2018d).

5.2 The effect of education mismatch on wages

In general, the average wages of overeducated workers tend to be higher than the average wages of well-matched workers, while the average wages of undereducated workers tend to be lower than the average wages of well-matched workers (Appendix 2). Similar patterns can be observed across gender, marital status, age group, and rural-urban areas.

The finding shows that overeducated workers receive wages 3.5 percent less than the well-matched workers, and undereducated workers receive wages 7.3 percent higher than well-matched workers. These findings are in line with Alba-Ramirez (1993). The findings show that overeducated workers have lower incomes, and undereducated workers produce more than well-matched workers.

Table 5. Estimation results

Variable	OLS ln nominal wage	IV ln nominal wage
(1)	(2)	(3)
Overeducated_W (So)	-0.035***	-0.069***
	(0.0015)	(0.0022)
Undereducated_W (Su)	0.073***	0.082***
	(0.0014)	(0.0021)
Education attained (Sa)	0.123***	0.132***
	(124.45)	(0.0013)
Experience	0.041***	0.042***
	(0.0006)	(0.0006)
Experience2	-0.0005***	-0.0005***
	(0.00001)	(0.0000136)
Disability	-0.040***	-0.040***
	(0.01094)	(0.0105)
Married	0.070***	0.068***
	(0.0706)	(0.0056)
Sectors		
Agriculture, forestry, and fisheries	0.320***	0.293***
	(0.0141)	(0.0143)
Mining and excavation	-0.079***	-0.107***
	(0.0084)	(0.0091)
Processing industry	0.048**	0.004
	(0.0214)	(0.02535)
Electricity and gas procurement	-0.193***	-0.222***
	(0.0305)	(0.03260)
Water supply, waste management, waste and recycling	0.043***	0.0321***
	(0.0430)	(0.0102)
Construction	-0.205***	-0.245***
	(0.0091)	(0.01019)

Wholesale and retail trade	0.003	-0.025**
	(0.0115)	(0.01263)
Transportation and warehousing	-0.257***	-0.292***
	(0.0120)	(0.0132)
Provision of accommodation and food and drink	-0.089***	-0.148***
	(0.0217)	(0.0228)
Information and communication	-0.005	-0.068***
	(0.0131)	(0.0151)
Financial and insurance services	0.005	-0.030
	(0.0324)	(0.0353)
Real estate	-0.093***	-0.135***
	(0.0165)	(0.0173)
Company services	-0.307***	-0.371***
	(0.0105)	(0.01163)
Government administration	-0.596***	-0.675***
	(0.0126)	(0.01311)
Educational services	-0.417***	-0.485***
	(0.0143)	(0.0146)
Health services and social activities	-0.488***	-0.508***
	(0.0117)	(0.01189)
Constanta	12.825***	12.780***
	(0.0134)	(0.0155)
R^2	0.279	0.271
Observation	89,552	89,552

Note: Control variables are working experience, the quadratic of working experience, disability, marriage, and business sector (Appendix 2). The value in parentheses is the standard error. Notation of significance level * p <0.05, ** p <0.01, *** p <0.001.

Furthermore, Instrumental Variable (IV) Estimation shows that the findings are close to the OLS estimation, although the magnitude of parameters is higher for IV estimation. IV is preferred since it can deal with the endogeneity problem. According to Becker (2016), the estimation of OLS is the average

treatment effect (ATE) or estimate of the total population, while IV estimates the local average treatment effect (LATE). LATE can be interpreted as the average treatment effect of a sub-population that is instrumented.

Overeducated worker wages are 6.9 percent lower than well-matched workers. This result is in line with previous research (Alba-Ramirez, 1993; Dolton & Silles, 2008; Kiker et al., 1997; Sellami et al., 2017), which states that the effect of overeducated workers on wages is negative, or interpreted that overeducated workers get lower wages than well-matched workers.

According to Verdugo and Verdugo (1989), there are at least two reasons why workers categorized as overeducated workers tend to receive lower wages than well-matched workers. First, the occupations of overeducated workers are tough and with low wages. The average worker is poorly educated, so the wages are very low. Second, the overeducated worker is less productive. Furthermore, Rumberger (1987) found that years of schooling in excess of the requirements in the occupation did not always increase productivity and, therefore, would not automatically mean higher wages.

Conversely, undereducated workers' wages are 8.2 percent higher than the well-matched workers. Undereducated workers tend to have more wage benefits than overeducated workers. According to Verdugo and Verdugo (1989), undereducated workers are responsible for their work that needs more skills than they have. Moreover, there is a negative relationship between ability and the overeducated worker and a positive relationship between ability and the undereducated worker (Groot & Van den Brink, 1996). The effect of overeducated and undereducated workers on income by gender is estimated by using instrumental variable estimation. Table 6 shows that male overeducated workers will receive wages on average 6.9 percent lower than the male well-matched workers, while male undereducated workers will receive wages on average 9.1 percent higher than male well-matched workers. In addition, female overeducated workers will receive wages on average 7.2 percent lower than female well-matched workers. Female undereducated workers will receive wages on average 5.5 percent higher than female well-matched workers.

Table 6. The Impact on Wages by Gender

Ln nominal wage	Male	Female
(1)	(2)	(3)
Overeducated (So)	-0.069***	-0.072***
	(0.0023)	(0.0055)
Undereducated (Su)	0.091***	0.055***
	(0.0024)	(0.0040)
Education attained (Sa)	0.127***	0.140***
	(0.0015)	(0.0026)
Experience	0.033***	0.047***
	(0.0008)	(0.0011)
Experience2	-0.0004***	-0.0006***
	(0.00001)	(0.00002)
Disability	0.00001***	-0.0409**
	(0.0125)	(0.0202)
Married	0.113***	-0.004
	(0.0070)	(0.0096)
Sectors		
Agriculture, forestry, and fisheries	0.259***	0.272***
	(0.0146)	(0.0650)
Mining and excavation	-0.049***	-0.078***
	(0.0092)	(0.0198)
Processing industry	-0.026	0.140**
	(0.0228)	(0.0677)
Electricity and gas procurement	-0.210***	-0.210***
	(0.0332)	(0.0739)
Water supply, waste management, waste and recycling	-0.006	0.094**
	(0.0096)	(0.0431)

Construction	-0.211***	-0.184***
	(0.0102)	(0.0218)
Wholesale and retail trade	-0.066***	0.149***
	(0.0122)	(0.0375)
Transportation and warehousing	-0.168***	-0.259***
	(0.0144)	(0.0235)
Provision of accommodation and food and drink	-0.142***	-0.071
	(0.0256)	(0.0440)
Information and communication	-0.095***	0.101***
	(0.0158)	(0.0291)
Financial and insurance services	-0.099***	0.258***
	(0.0381)	(0.0624)
Real estate	-0.128***	-0.079**
	(0.0183)	(0.0381)
Company services	-0.336***	-0.308***
	(0.0127)	(0.0258)
Government administration	-0.594***	-0.585***
	(0.0168)	(-0.5852)
Educational services	-0.398***	-0.357***
	(0.0221)	(0.0270)
Health services and social activities	0.022***	-0.413***
	(0.0170)	(0.0206)
Constanta	12.930***	12.465***
	(0.0178)	(0.0314)
R^2	0.258	0.303
Observation	59,310	30,242

Note: Control variables are work experience, quadratic work experience, disability, marriage, and business sector. The value in parentheses is the standard error. Notation of significance level * p <0.05, ** p <0.01, *** p <0.001.

Table 6 shows the effect of male undereducated workers on wages tends to be greater than overeducated. This implies that male workers tend to be the main source of household income and try hard to find the best jobs. Although they are undereducated workers, they will work hard to receive maximum wages. This is in line with Verdugo and Verdugo (1989), who state that undereducated workers tend to be very good workers and are responsible for their work.

Meanwhile, female workers have the opposite pattern. Female over-educated workers experience a greater effect than undereducated workers on wages. This can be interpreted that although female workers have a higher level of education than males, their work is not the main source of household income. Female workers tend to be willing to accept any work that does not interfere with their main tasks in taking care of the household even though it is below their level of education. This can be seen from the percentage of female labor force participation rate (51.88 percent) which is lower than male (82.69 percent).

In addition to gender analysis, this paper also tries to estimate by age group of workers for less than 35 years and workers more than or equal to 35 years. The findings show that overeducated workers who are less than 35 years old will receive wages on average 4.2 percent lower than the well-matched workers. Meanwhile, undereducated workers who are less than 35 years old tend to receive wages on average 5.5 percent higher than the well-matched workers.

Furthermore, overeducated workers who are 35 years old and over tend to receive wages on average 9.4 percent lower than the well-matched workers. Undereducated workers who are 35 years old and over receive wages on average 9.9 percent higher than the well-matched workers (Table 7).

Table 7. The Impact on Wages by Age of Group

Ln nominal wage (1)	Age <35 (2)	Age 35 (3)
Overeducated (So)	-0.042***	-0.094***
	(0.0028)	(0.0033)
Undereducated (Su)	0.055***	0.099***
	(0.0038)	(0.0026)
Education attained (Sa)	0.098***	0.148***
	(0.0020)	(0.0017)
Experience	0.042***	0.051***
	(0.0019)	(0.0018)
Experience2	-0.0009***	-0.0006***
	(0.00008)	(0.00003)
Disability	-0.039***	-0.060***
	(0.0336)	(0.0112)
Married	0.0808***	0.155***
	(0.0074)	(0.0090)
Sectors		
Agriculture, forestry, and fisheries	0.3001***	0.284***
	(0.0212)	(0.0189)
Mining and excavation	-0.073***	-0.148***
	(0.0128)	(0.0113)
Processing industry	0.086***	-0.053*
	(0.0283)	(0.0310)
Electricity and gas procurement	-0.252***	-0.205***
	(0.0542)	(0.0364)
Water supply, waste management, waste and recycling	0.008	0.054***
	0.0150	(0.0116)

Construction	-0.239***	-0.295***
	(0.0136)	(0.0134)
Wholesale and retail trade	0.038***	-0.064***
	(0.0175)	(0.0153)
Transportation and warehousing	-0.227***	-0.399***
	(0.0166)	(0.0180)
Provision of accommodation and food and drink	-0.151***	-0.114***
	(0.0281)	(0.0384)
Information and communication	-0.004	-0.098***
	(0.0184)	(0.0215)
Financial and insurance services	0.018***	-0.091**
	(0.0459)	(0.0447)
Real estate	-0.103***	-0.153***
	(0.0237)	(0.0235)
Company services	-0.538***	-0.259***
	(0.0182)	(0.0144)
Government administration	-1.018***	-0.504***
	(0.0226)	(0.0169)
Educational services	-0.570***	-0.280***
	(0.0220)	(0.0188)
Health services and social activities	-0.375***	-0.547***
	(0.0187)	(0.0145)
Constanta	13.235***	12.285***
	(0.0254)	(0.0375)
R^2	0.189	0.342
Observation	39,992	49,560

Note: Control variables are work experience, quadratic work experience, disability, marriage, and business sector. The value in parentheses is the standard error. Notation of significance level * p <0.05, ** p <0.01, *** p <0.001.

Based on this age group, there is no significant difference in the effect of overeducated and undereducated workers by the age groups (less than 35 years and above 35 years).

Conclusion

From the discussion above, it can be concluded that the number of overeducated workers and undereducated workers is still quite high. By gender, male workers tend to be more overeducated than female workers. In addition, female overeducated workers experience higher salaries than male workers. Furthermore, workers 35 years old or younger tend to be overeducated. Overeducated workers have a negative effect and undereducated workers have a positive effect on wages. Overeducated workers tend to receive lower wages, and undereducated workers tend to receive higher wages than well-matched. Furthermore, some suggestions to policymakers include strengthening the relationship between vocational education and the industry so vocational graduates can match the needs of the labor market. The government could encourage the private sector to provide training and internships for prospective workers. The government needs to review the existing curriculum and ensure that it matches the skills needed in the labor market.

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Appendix 1. Mismatch between education and occupation

Variable	Mean approached						Mode approached						Total
	Overeducated		Well-matched		Undereducated		Overeducated		Well-matched		Undereducated		
	N	per-cent	N	per-cent	N	per-cent	N	percent	N	per-cent	N	per-cent	
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Gender													
Male	7,625	12.86	43,152	72.76	8,533	14.39	16,199	27.31	27,310	46.05	15,801	26.64	59,310
Female	2,610	8.63	24,051	79.53	3,581	11.84	8,166	27.00	14,754	48.79	7,322	24.21	30,242
Age group													
18-24	1,973	13.44	11,549	78.67	1,159	7.89	3,795	25.85	8,126	55.35	2,760	18.80	14,681
25-34	3,146	12.43	19,846	78.41	2,319	9.16	8,274	32.69	11,417	45.11	5,260	22.20	25,311
< 35	5,119	12.80	31,395	78.50	3,478	8.70	12,069	30.18	19,543	48.87	8,380	20.95	39,992
35-44	2,573	10.39	18,794	75.89	3,398	13.72	6,834	27.60	11,117	44.89	6,814	27.51	24,765
45-54	2,054	11.10	13,148	71.03	3,309	17.88	4,393	23.73	8,773	47.39	5,345	28.87	18,511
55+	489	7.78	3,866	61.52	1,929	30.70	1,069	17.01	2,631	41.87	2,584	41.12	6,284
>=35	5,116	10.32	35,808	72.25	8,636	17.43	12,296	24.81	22,521	45.44	14,743	29.75	49,560
Marital status													
Married	6,716	10.76	46,517	74.51	9,201	14.74	16,548	26.50	28,494	45.64	17,392	27.86	62,434
Not Married	3,519	12.98	20,686	76.28	2,913	10.74	7,817	28.83	13,570	50.04	5,731	21.13	27,118
Pendidikan													
<Elementary school	-		-		5,385	100.00	-		-		5,385	100.00	5,385

Elementary school	-		9,284	71.89	3,630	28.11	-		6,853	53.07	6,061	46.93	12,914
Junior high school	-		12,060	93.80	797	6.20	5,170	40.21	-		7,687	59.79	12,857
Senior high school	6,257	18.12	26,308	76.20	1,962	5.68	6,257	18.12	26,308	76.20	1,962	5.68	34,527
Diploma I / II / III	756	14.71	4,044	78.68	340	661	3,112	60.54	-		2,028	39.46	5,140
Bachelor degree	1,447	8.53	15,507	91.47	-		8,051	47.49	8,903	52.51	-		16,954
Postgraduate/Doctoral (S2/S3)	1,775	100.00	-		-		1,775	100.00	-		-		1,775
Residential area													
Urban	3,377	5.89	47,598	82.97	6,394	11.15	10,465	18.24	28,739	50.09	18,165	31.66	57,369
Rural	5,919	18.39	21,652	67.28	4,612	14.33	7,879	24.48	14,208	44.15	10,096	31.37	32,183
Region of residence													
Western Indonesia	8,594	13.29	47,451	73.35	8,642	13.36	17,249	26.67	30,160	46.62	17,278	26.71	64,687
Central Indonesia	2,413	11.15	16,478	76.12	2,755	12.73	4,132	19.09	10,436	48.21	7,078	32.70	21,646
Eastern Indonesia	149	4.63	2,726	84.68	344	10.69	525	16.31	1,617	50.23	1,077	33.46	3,219

Source: Badan Pusat Statistik (2018a, 2018b, 2018c, 2018d) (authors' calculation).

Appendix 2. Average Wages for the Mismatch between Education and Occupation

Variable	Mean approached						Mode approached						Total	Average Wages (million)
	Overeducated		Well-matched		Undereducated		Overeducated		Well-matched		Undereducated			
	N	Average Wages (million)	N	Average Wages (million)	N	Average Wages (million)	N	Average Wages (million)	N	Average Wages (million)	N	Average Wages (million)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
Gender														
Male	7,625	3.42	43,152	3.06	8,533	2.48	16,199	3.40	27,310	3.12	15,801	2.48	59,310	3.02
Female	2,610	3.23	24,051	2.57	3,581	1.67	8,166	3.01	14,754	2.60	7,322	1.84	30,242	2.52
Age group														
Age <35	5,119	2.42	31,395	2.29	3,478	1.99	12,069	2.50	19,543	2.27	8,380	1.98	39,992	2.28
Age >=35	5,116	4.32	35,808	3.41	8,636	2.34	12,296	4.02	22,521	3.51	14,743	2.44	49,560	3.32
Marital status														
Married	6,716	3.90	46,517	3.20	9,201	2.40	16,548	3.66	28,494	3.31	17,392	2.44	62,434	3.16
Not Married	3,519	2.37	20,686	2.18	2,913	1.74	7,817	2.43	13,570	2.16	5,731	1.77	27,118	2.16
Level of education														
<Elementary school	-	-	-		5,385	1.71	-	-	-	-	5,385	1.71	5,385	1.71
Elementary school	-	-	9,284	1.85	3,630	2.11	-	-	6,853	1.83	6,061	2.04	12,914	1.93

Junior high school	-	-	12,060	2.07	797	2.71	5,170	1.97	-	-	7,687	2.20	12,857	2.11
Senior high school	6,257	2.22	26,308	2.71	1,962	3.51	6,257	2.22	26,308	2.71	1,962	3.51	34,527	2.66
Diploma I / II / III	756	3.05	4,044	3.48	340	3.67	3,112	3.34	-	-	2,028	3.57	5,140	3.49
Bachelor degree	1,447	3.38	15,507	4.30	-	-	8,051	3.94	8,903	4.47	-	-	16,954	4.22
Postgraduate (S2)	1,693	7.47	-	-	-	-	1,693	7.47	-	-	-	-	1,693	7.47
Doctoral (S3)	82	9.58	-	-	-	-	82	9.58	-	-	-	-	82	9.58
Residential area														
Urban	3,377	5.42	47,598	3.03	6,394	2.32	10,465	4.52	28,739	3.14	18,165	2.19	57,369	3.08
Rural	5,919	2.67	21,652	2.47	4,612	2.00	7,879	2.53	14,208	2.58	10,096	2.18	32,183	2.44

Source: Badan Pusat Statistik (2018a, 2018b, 2018c, 2018d) (authors' calculation).