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Education, skills, and labour market outcome in Indonesia: An instrumental variable approach

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Abstract

Purpose — This study examines the contribution of schooling and skills to earnings. Importantly, this study captures the importance of observing cognitive skills and non-cognitive skills associated with personality traits in determining earnings.

Methods — A revised Mincer Model serves as a theoretical framework to explain the contribution of schooling and skills to earnings. Using the Indonesian labour data from the 5th wave of Indonesian Family Life Survey (IFLS), the 2-Stage Least Squares is employed to measure the effects of schooling, cognitive and non-cognitive skills on earnings.

Findings — The results show that schooling and skills, both cognitive and personality traits determine the labour market outcomes. In addition, the relationship between education and earning is nonlinear, suggesting that the returns on education varied across education levels.

Implication — The policy should aim to enhance human capital by improving knowledge, cognitive and non-cognitive capacities to assist students in achieving their full potentials.

Originality — This study contributes to the literature by measuring the effects of unobservable cognitive skills and non-cognitive skills on earnings in developing countries absent in the previous studies. This study also utilizes the instrumental variable approach of 2-Stage Least Squares to deal with omitted variable bias and the endogeneity problem in the basic Mincer model.

Keywords — earnings, cognitive & non-cognitive skills, big five personality traits, Mincer equation

Introduction

Slower economic growth and middle-income trap are likely due to the lack of productivity in the Indonesian economy. A published document by Asian Development Bank (Asian Development Bank, 2018) shows that the slow transformation of Indonesia's economy and the labour market in the post-New Order Period is due to low productivity. Enhancing productivity is becoming the main strategy as Indonesia could not rely on commodities similar to the first decade of the 2000s that contributed to high economic growth. The data from the OECD reveals that labour productivity in Indonesia in 2018 is US$ 25,143 of GDP per person employed while the OECD countries on average have labour productivity of US$ 97,250 of GDP per person. Indonesian labour productivity is only a quarter of developed countries.

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Labour productivity is determined by workers' capacity that in turn depends on workers' knowledge and ability to perform the tasks. Despite the Indonesian high literacy rate of 99.67 percent (Nambiar, Karki, Rahardiani, Putri, & Singh, 2019), Indonesia's quality of human capital is low compared to developed countries and neighbouring Asian countries. The PISA (Programme for International Student Assessment) for students aged 15 years in 2019 shows that the Indonesian students' performance in three main skills of reading, numeracy, and science is ranked 72 out of 78 countries. On average, Indonesian students' reading score is 371, much lower than the score in the OECD countries, 487. In terms of numeracy skills, the average score is 379, more than 100 points lower than in the OECD countries, 489.

Further, the performance in science is also lower, 396 compared with 489. In addition, Indonesia has the second-highest youth unemployment rate in the Asia-Pacific region, 15 percent (International Labour Organization, 2018). Moreover, skills mismatch has persisted in Indonesia's labour market. ILO survey shows a mismatch between the education qualification and job requirements (International Labour Organization, 2018).

In order to improve labour productivity, it is essential to measure the role of human capital in the labour market outcome. In the labour economics literature, the basic Mincer model is frequently employed to understand the determinants of labour market outcome measured by earnings. The model stipulates that wages are determined by schooling measured by years of education. Generally, the model highlights the role of human capital in the labour market outcome. Specifically, the first model developed by Mincer (1958) focused on schooling as a representation of human capital and its effect on earnings. The model was further developed by incorporating training and working experiences to have more comprehensive measures of human capital (Mincer, 1958).

In addition to schooling, this study incorporates a direct measure of cognitive and non-cognitive (personality traits) skills in the Indonesian labour market. Referring to literature, the Mincer model should be improved by managing the problem of endogeneity and omitted variable bias (Humphreys, 2013). The endogeneity issue emerged as there is a relationship between individual characteristics, such as ability and residuals. Dickson (2009) argues that education measured by schooling was an endogenous variable since there was a possibility that unobserved characteristics influence the schooling choice that may correlate with earnings.

Further, Harmon (2011) mentioned the potential endogeneity problem of employing the basic Mincer model due to "ability bias." However, the bias can be explained by the contribution of hidden ability in earnings. The paper argues that students with greater hidden and unobservable abilities likely have higher education, allowing them to receive higher earnings. Thus, a simple relation failed to explain the causal relationship between schooling and earnings. Furthermore, Harmon, Oosterbeek, and Walker (2003) and Maluccio (1998) suggested including more variables capturing the natural ability, such as IQ test scores and school grades.

The recent literature examining the role of human capital in earnings argued that research in this area should include skill capacities as a direct measure of human capital. Skills consist of both cognitive and non-cognitive (i.e., personality traits). Blazquez, Herrarte, and Llorente-Heras (2018) showed that cognitive and non-cognitive skills influenced occupational status and earnings among European university graduates. Further, Gensowski (2018) provided evidence of a significant effect of personality traits on lifetime earnings, and the effect was the largest for workers between 40 and 60 years old. Additionally, Checchi and van de Werfhorst (2018) study suggested that both education inequality and skill inequality contribute to widening earning inequality.

In order to manage endogeneity issues, this study employs the Instrumental Variable approach (IV) as suggested by Lall and Sakellariou (2010). The study selects the instruments closely correlated with schooling, but it is not correlated with the ability (as unobserved characteristics) and earnings, which is the distance of schooling. Further, this study incorporates the nonlinear relationship between wages and education, referring to Maluccio (1998) as there may be a condition where different experience premiums arise for people with different levels of education.

By acknowledging the recent development of the Mincer model, this study aims to measure the role of human capital on labour market outcome by incorporating education (schooling) as an indirect measure of skills and direct measures of cognitive and non-cognitive (personality traits) skills in the Indonesian labour market. In addition, this study manages the endogeneity problem by utilizing an instrumental variable approach 2-Stage Least Squares (2-SLS) by using the distance to school as an instrument of schooling (Humphreys, 2013; Lall & Sakellariou, 2010). The previous studies on this topic in developing countries, especially Indonesia, have been absent. Therefore, this study is an attempt to fill in the literature gap. The rest of the paper presents the data and empirical methods, followed by results and discussion, and conclusion.

Methods

This study employs the 5th wave Indonesian Family Life Survey. There are more than 7,000 samples suitable for this study representing 83% of the population aged between 15 and 50 years. The samples are waged workers both in private and public institutions and as full-time and casual workers. The samples resided in 13 provinces in Indonesia, distributed in Java Island, Bali, Nusa Tenggara Barat, South Sulawesi, South Kalimantan, South Sumatera, Lampung, West Sumatera and North Sumatera.

To examine the role of schooling in earnings, the Mincer model is estimated to generate the rate of return on education. The basic empirical model (equation 3) regresses wage on education, year of experience, tenure, and the square of experience of training and tenure. The return on education is the value of the coefficient of β_1 that shows the percentage increase in wage as workers' education increases. Further, the coefficient of β_3 reflects the percentage increase in wage as workers have additional work experience.

The model also controls the demographic information, such as urban/rural, marital status, and parents' education. In addition, this study also estimates the model across gender to further examine whether there is a different influence between male and female workers. In order to investigate the determinants of schooling and abilities to earning, this study modifies the Mincerian earning equation by adding cognitive and personality traits information to capture the unobservable factors of individuals' capacities. Specifically, this study incorporates the individuals' unobservable characteristics of the cognitive test scores and personality traits information into the model. The cognitive skills are measured by four variables, namely episodic memory of immediate (EPI) and delay (EPR), the Woodcock-Johnson test, and the Raven's Progressive Matrices (RPM). Episodic memory test is proposed to assess conjointly semantic and episodic knowledge across multiple tasks: semantic matching, naming, free recall, and recognition (Tulving, 1993). The Woodcock-Johnson sets a new standard for evaluating individual strengths and weaknesses among contemporary, theory-based measures of academic achievement, oral language, and cognitive abilities (Schrank, 2014). The Raven's Progressive Matrices (RPM) test is a standardized intelligence test that consists of visually presented and geometric-analogy-like problems in which a matrix of geometric figures is presented with one entry missing, and the correct missing entry must be selected from a set of answer choices (Kunda, McGreggor, & Goel, 2009).

In addition, the non-cognitive capacities are represented by five factors of personality traits which were first surveyed in 2014. The data are collected using 15 specific questionnaires concerning the big five personality factors (Strauss, Witoelar, & Sikoki, 2016). The questions are adopted from the big five personality questions in John and Srivastava (1999). The respondents were questioned using statements that were more appropriate in representing their personality. Those five personalities are extraversion, conscientiousness, openness, agreeableness, and neuroticism. The literature suggests that the first three factors—extraversion, conscientiousness, and openness—positively influence labour market outcomes (Ravianto, 1985). Individuals with extraversion personalities are observed as persons with positive emotionality, greater social activity, and willingness to take the leadership role (Barrick & Mount, 1991). Persons with

conscientious personalities are hard-working, productive, punctual, organized, result-oriented, and responsible.

Meanwhile, individuals with an open personality are creative with many ideas, aesthetic, smart, thoughtful, curious, artistic, and concerned with values (John & Srivastava, 1999). Their excessive negative feelings would lead to psychological stress that is prone to lower productivity. In contrast, neuroticism is associated with low productivity because workers with such a personality tend to lack positive psychological adjustment and emotional stability, and this has a negative influence on both intrinsic and extrinsic career success accordingly (Ham, Junankar, & Wells, 2009).

Further, schooling contribution to earnings is examined by incorporating the potential endogeneity issue in the basic Mincer model (empirical model). Considering the development in the methodology aspect of the earnings model, this study employs both approaches suggested by Humphreys (2013) and Lall and Sakellariou (2010). The 2-Stage Least Squares (2-SLS) is employed to manage the endogeneity problem by including the distance to school as an Instrumental Variable (IV).

By construction, the Ordinary Least Squares (OLS) model ignores the underlying accumulation process for education, as the latter is assumed to be exogenous. One of the alternatives to avoid OLS inconsistency, proposed initially in the context of cross-section data, is the use of Instrumental Variable (IV) procedures, where education is treated as an endogenous regressor, in the econometric sense of being correlated with the residual (Caparrós Ruiz, Navarro Gómez, & Rueda Narváez, 2010). Another common approach is to use an Instrumental Variable (IV) that correlates closely with schooling but is not correlated with ability or wages. Possible confounding instrumental variables include ability, health, and family background characteristics. Then, any resultant correlation between education and the wage can no longer be reliably interpreted as a causal effect (that is, an economic return).

Dickson (2009) explained that instruments must be correlated with the endogenous variables but not with the random error (rank condition), legitimately excluded from the wage equation (exclusion restriction) and be more numerous than the endogenous regressors (order condition). Suppose that Z1 and Z2 are two possible instruments for a variable X. The empirical model adopted from Dickson (2009) is as follows:

$$Cov\,(Z_1, \mu) \;=\; 0 \;=\; Cov\,(Z_2, \mu) \tag{1}$$

$$Cov\,(Z_1, X) \neq\; 0\,, Cov\,(Z_2, X) \;\neq\; 0 \tag{2}$$

The IV used in this study is the distance to school, as Lall and Sakellariou (2010) suggested. This instrument affects education but does not independently enter into the earnings equation and is uncorrelated with the error term in the wage equation. Recalling the model from the start of this section, the moment conditions that we want to impose:

Empirical Model

$$\begin{aligned} Log(wage) = \; & \beta_0 + \beta_1 educ_i + \beta_2 educ_i^2 + \beta_3 expr_i + \beta_4 expr_i^2 + \beta_5\, tenure_i + \\ & \beta_6 tenure_i^2 + \beta_7 male_i + \beta_8 married_i \; + \beta_9\, urban_i + \beta_{10} father_i + \\ & \beta_{11}\, mother_i + \beta_{12}\, openess_i + \beta_{13}\, conscientiousness_i + \\ & \beta_{14}\, extraversion_i + \beta_{15}\, agreeableness_i + \beta_{16}\, neuroticism_i + \beta_{17}\, WJ_i + \\ & \beta_{18}\, RPM_i + \beta_{19}\, EPI_i + \beta_{20}\, EPR_i + \mu_i \end{aligned} \tag{3}$$

The dependent variable is the natural logarithm of the monthly earnings or wages (Log(wage)). The independent variables are number of years of schooling (Educ) as a proxy of education; two measures of experience of the number of working experiences ((potential) Expr) and the quadratic of working experiences ((potential) Expr^2); two measures of tenure: number of years of tenure (Tenure) and quadratic number of years of tenure (Tenure^2); dummy variable for male workers (1= male, 0= female); dummy variable for married (1= married, 0= single/ divorce/ widow/ others); dummy variable for urban (1= urban, 0= rural); parents' education background measured by number of years of schooling of father (Fathers) and for mothers (Mothers); measures of non-cognitive capacities of personality traits of five dummies of Openness (1=

openness, 0= others), Conscientiousness (1= conscientiousness, 0= others), Extraversion (1= extraversion, 0= others), Agreeableness (1= agreeableness, 0= others), Neuroticism (1= neuroticism, 0= others); four measures of cognitive capacities of The Woodcock-Johnson Battery Cognitive test scores (WJ), Standardized intelligence test (RPM), Immediate word recall memory (EPI) and Delayed word recall memory (EPR); and instrumental variable of distance to school measured by the time required to reach school in minutes (Distance).

Results and Discussion

The total number of individuals observed is 7,727 with age between 15 to 50 years old. The sample consists of individuals employed in the past one month and worked as full-time employees in public and private sectors. In addition, the average age was 25 years old, and most workers have at least 12 years of education or equivalent to high school. Concerning their monthly earnings, the average wage was IDR 1.87 million. Furthermore, on average, the observed workers had 12 years of experience and four years of tenure.

In terms of cognitive capacities, this study reports three test scores of Woodcock-Johnson (WJ) test, Raven test (RPM), and Episodic Memory test, both immediate and delayed word recall. Regarding individual strengths among academic achievement, oral language, and cognitive abilities measured by the Woodcock-Johnson test, the average score is 543. Considering the standardized intelligence score for visual measured by RPM, the means is 12.9. Finally, in terms of memory tests capturing the conjointly semantic and episodic knowledge, the average score for immediate memory (EPI) is 5.97, and the average score for delay memory (EPR) is 5.07 (Table 1).

Table 1. Summary Statistics of Main Variables

	Means	Standard deviation	Minimum	Maximum
Dependent Variables				
Wage	1,871,095	2,060,161	2,500	30,000,000
Log wage	13.98	1.08	7.82	17.22
Independent Variables				
Education	12.93	2.80	0	16
Education^2	175.15	68.06	0	256
(Potential) Expr	12.57	5.81	2	39
(Potential) Expr^2	191.78	201.45	4	1521
Tenure	4.29	5.02	0	37.17
Woodcock-Johnson (WJ)	543.04	54.74	299	635
Raven test (RPM)	12.90	3.09	0	17
Episodic Memory Immediate (EPI)	5.97	1.48	1	10
Episodic Memory Delay (EPR)	5.07	1.67	1	10
Fathers (education)	9.14	6.29	0	16
Mothers (education)	9.37	6.43	0	16
Instrument Variable (IV)				
Distance to school (Distance)	21.51	24.98	1	720

Source: IFLS Wave 5

Table 2 presents the results of the estimated seven variants of the Mincer model. The first variant (column1) presents the basic Mincer model by controlling demographic factors, non-cognitive skills, and cognitive skills. The estimation shows that schooling significantly influences workers' earnings with a coefficient of 0.079, implying that the increase in earnings is associated with an increase in education. Every additional one year of education increases earnings by 7.9 percent. The level of education has a positive and statistically significant effect on monthly wages for male and female workers. These findings support the human capital theory that investment in

education contributes to increased labour market outcomes. The findings correspond with a previous study by Purnastuti, Miller, and Salim (2013) that the returns on education in the Indonesian labour market are lower than the international average of 9.7 percent (Patrinos, 2016).

Table 2. The Estimation of Schooling, Cognitive and Personality Traits on Earning across Gender (OLS and 2-SLS)

Variables	All Respondents (OLS)	Male Workers (OLS)	Female Workers (OLS)	All Respondents (OLS)	Male Workers (OLS)	Female Workers (OLS)	All Respondents (2SLS)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Educ	0.079***	0.106***	0.041***	0.170***	0.029	0.290***	0.297*
	(0.007)	(0.009)	(0.011)	(0.041)	(0.049)	(0.072)	(0.161)
Educ^2				-0.004**	0.003	-0.010***	
				(0.002)	(0.002)	(0.003)	
Expr	0.305***	0.407***	0.245***	0.291***	0.421***	0.238***	0.315***
	(0.042)	(0.054)	(0.065)	(0.042)	(0.054)	(0.065)	(0.057)
Expr^2	-0.010***	-0.014***	-0.009**	-0.009***	-0.015***	-0.008**	-0.007
	(0.002)	(0.003)	(0.003)	(0.002)	(0.003)	(0.003)	(0.005)
Tenure	0.179***	0.193***	0.174***	0.179***	0.194***	0.177***	0.125*
	(0.017)	(0.021)	(0.027)	(0.017)	(0.021)	(0.027)	(0.071)
Tenure^2	-0.014***	-0.013***	-0.017***	-0.014***	-0.013***	-0.017***	-0.010**
	(0.001)	(0.002)	(0.002)	(0.001)	(0.002)	(0.002)	(0.005)
Male							0.117
							(0.104)
Married	-0.327***	0.070	-0.591***	-0.326***	0.067	-0.587***	-0.426***
	(0.045)	(0.062)	(0.064)	(0.045)	(0.062)	(0.064)	(0.121)
Urban	0.346***	0.224***	0.496***	0.344***	0.224***	0.486***	0.280***
	(0.036)	(0.046)	(0.054)	(0.036)	(0.046)	(0.054)	(0.055)
Father (education)							-0.019
							(0.014)
Mother (education)							-0.018*
							(0.010)
Openness	-0.156	-0.270	-0.357	-0.147	-0.254	-0.263	-0.198
	(0.167)	(0.226)	(0.236)	(0.167)	(0.226)	(0.237)	(0.243)
Consciousness	0.089***	0.132***	0.034	0.087***	0.134***	0.030	-0.027
	(0.033)	(0.043)	(0.049)	(0.033)	(0.043)	(0.049)	(0.077)
Extraversion	0.126***	0.109**	0.263***	0.127***	0.109**	0.261***	0.123***
	(0.036)	(0.049)	(0.051)	(0.036)	(0.049)	(0.050)	(0.047)
Agreeableness	0.003	0.017	0.037	0.009	0.012	0.046	-0.084
	(0.033)	(0.043)	(0.049)	(0.033)	(0.043)	(0.049)	(0.071)
Neuroticism	-0.076	0.313**	-0.232*	-0.083	0.323**	-0.236*	0.075
	(0.101)	(0.159)	(0.127)	(0.101)	(0.159)	(0.126)	(0.143)
Woodcock Johnson (WJ)	0.002***	0.001**	0.003***	0.002***	0.001**	0.003***	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
Raven Test (RPM)	0.014**	0.016**	0.005	0.013**	0.016**	0.004	-0.006
	(0.006)	(0.007)	(0.008)	(0.006)	(0.007)	(0.008)	(0.015)
Episodic Memory	-0.024	-0.051**	0.006	-0.023	-0.052**	0.004	-0.019
Immediate (EPI)	(0.016)	(0.021)	(0.025)	(0.016)	(0.021)	(0.024)	(0.023)
Episodic Memory Delay	0.001	0.051***	-0.054**	0.002	0.051***	-0.054**	-0.006
(EPR)	(0.015)	(0.019)	(0.021)	(0.015)	(0.019)	(0.021)	(0.019)
Constant	9.436***	8.902***	9.880***	8.962***	9.276***	8.410***	8.337***
	(0.258)	(0.337)	(0.388)	(0.332)	(0.410)	(0.573)	(0.960)
Observations	3,917	2,185	1,732	3,917	2,185	1,732	2,724
R-squared	0.183	0.270	0.195	0.184	0.271	0.201	0.048

Standard errors in parentheses; ***, **, * denote significance at 1%, 5%, and 10%, respectively.
Source: IFLS Wave 5 estimated by Ordinary Least Square (OLS) and Two Stages Least Square (2SLS) using STATA

The Mincer model also underlines the importance of skills accumulation through working experience. The coefficients of experience variables are positive in all seven models in table 2. Further, the contribution of skills accumulation through experience to earnings is higher than education. In the first model, an increase of working experience contributes to 30 percent of earnings. In addition to experience, this study also estimates the return on skill accumulation from the current jobs measured by tenure. The estimations show that tenure has a positive and

significant influence on earnings by 17.9 percent (column 1). These findings provide evidence of the importance of skills accumulation acquired from job experience in improving workers' competency.

As the workers get older, the ability to absorb new skills is lower, which may explain the declining return from additional years of experience. That is, the contribution of skills accumulation through experience becomes less as they work longer. This tendency is reflected in the estimated coefficients on the quadratic years of experience of both working and tenure, which are negative and statistically significant, -0.01 for experience (column 1) and -0.014 for tenure (column 1).

Further, demographic information is important to examine the determinants of earnings. The estimations in Table 2 show that marital status and residential areas influence earnings, and the coefficients are statistically significant. Being married is associated with lower earnings, particularly for female workers (columns 3 and 6). Female workers have double tasks both in working places and in the families, which may explain their lower productivity in the workplace. In contrast, the marital status of male workers has no significant effect on earnings because they can work as full-time workers after being married (columns 2 and 5). Furthermore, working in urban areas positively affects the workers' earnings both for males and females.

The fourth model variant (column 4) estimates the Mincer model by adding the quadratic of education to test the nonlinearity assumption of education and earnings relationship. The nonlinearity assumption test is conducted to capture the possible convex relationship between schooling and earnings (Lemieux, 2006). The estimation shows that after controlling for nonlinearity of schooling, education remains important, and the return on education becomes higher of 17 percent. However, the returns on education are nonlinear that the coefficient of squared of education is negative and statistically significant. The findings correspond with the study by Park (1999) that found the nonlinearities of schooling on earnings. The study shows that the wage returns from years of schooling between completing high school and completing college or university are varied. The marginal return on education is not constant. Instead, it has a slope between two points of transition.

Further, the estimation of nonlinearity of education is conducted separately for male and female workers. The results show that the coefficients of squared education are no longer significant for male workers, but it is significant for female workers. Thus, the nonlinearity is particularly relevant for female workers in that the relationship between education and earnings forms a concave curve, indicating that an increased year of education generates a lower premium after a certain point. This may be due to over-education, making the supply of labour have qualifications far exceeding the one required by the jobs, thereby likely reducing the premium enjoyed by higher educated workers.

The gender wage gap is confirmed by the difference of return on education between male and female workers. The return on education for male workers is 10.6 percent (column 2) and for female is 4.1 percent (column 3). Nevertheless, after controlling for the endogeneity issue, the gap is no longer statistically significant, as shown by the coefficient of the male dummy variable in model 7 (column 7). This finding is similar to Purnastuti et al. (2013) that the variation between male and female workers' returns on education may indicate the existence of gender wage gaps that favour male workers. They found that the changing return on education between males and females differs. In addition, their study shows that the return across different education levels was significantly different between male and female workers. Female workers generated higher returns after completing junior high school compared to male counterparts. In addition, the return for females with college and university education was also above male workers. Nonetheless, their study concluded that, on average, males received higher wages compared to female workers, which indicated a gender gap. However, the gap was shrinking for workers with higher education.

Finally, this study deals with omitted variable bias by directly measuring the unobserved individual characteristics using both cognitive and non-cognitive capacities and performing an instrumental variable approach (column 7). Including individual capacities improves the

estimation of earnings function as the model controls for the individual ability. Regarding the measures of personality traits, the estimation results indicate that consciousness and extraversion have positive effects on workers' earnings. Thus, in addition to schooling, good working attitudes contribute to the variation in workers' earnings. The workers' productivity is higher if they work hard, are punctual, well-organised, result-oriented, and responsible. These are the characteristics of individuals with consciousness characteristics. In addition, being positive emotionally, having greater social activities, and being willing to take the leadership role—all of which are the characteristics of extraversion personality—will boost the workers' productivity accordingly. Meanwhile, neuroticism personality negatively affects workers' earnings, particularly for females, because they lack positive psychological adjustment and stable emotion, leading to stress and lower productivity.

Further, Table 2 also shows that the inclusion of a direct measure of cognitive capacities is proven to be important. According to Woodcock-Johnson (WJ) measurement, individual strengths, such as academic achievement, oral language, and cognitive abilities, are positively and statistically significant, as they can explain earning variation across different specifications. Correspondingly, the measure of intelligence visual capacity of Raven test score also positively contributes to earnings. Individuals with higher visual intelligence earn higher than those with lower intelligence.

Finally, following the related literature, such as Lall and Sakellariou (2010), this study can deal with potential endogeneity problems in the basic Mincer model by employing the instrument variable approach. The instrument is estimated using the 2-Stage Least Square method and 'distance to school' as instrument to schooling (column 7). Moreover, the parents' educations are included in the explanatory variables to capture the socio-economic status. The schooling variable remains positive and statistically significant in explaining the earning variation. In addition, experience, tenure, demographic factors, such as marital status and urban, are still good predictors of earnings. In terms of individual capacities, only extraversion personality positively affects earnings.

Conclusion

This study aims to examine the determinants of workers' earnings in Indonesia by incorporating the direct measures of cognitive abilities and non-cognitive capacities and managing the endogeneity issue of schooling. The current literature in economics has acknowledged the role of non-cognitive capacities in determining workers' performance. The modified Mincer equation was estimated to examine the effect of schooling, working experience, tenure, demographic factors, personality traits, and cognitive capacities on monthly wages. The results show that schooling, cognitive and non-cognitive personality traits determine the labour market outcomes. The level of education has a positive and statistically significant influence on monthly wages. In addition, the relationship between education and earning is nonlinear, suggesting that the returns on education varied across education levels. The coefficient of squared education is negative, implying that the returns on education increase only up to a certain level of education and decline beyond that level.

Furthermore, including the direct measure of cognitive capacities and personality traits is important to deal with the issue of omitted variable bias. The individual strengths among academic achievements, such as oral language and cognitive abilities measured by the Woodcock-Johnson (WJ) test, are positive and statistically significant in explaining earning variation across different specifications. In addition, the visual capacity of an individual's intelligence as measured by the Raven test score is also a significant predictor of earnings. The findings also support the literature that personality traits contribute to explain the earning variation. Three characteristics are good predictors of the earnings model. Consciousness and extraversion have positive effects on workers' earnings, while neuroticism personality has a negative influence on workers' earnings.

The estimation using the instrument variable approach of two Stage Least Square (2SLS) reveals that schooling is affected by other individual characteristics such as access to education and the socio-economic status of parental education. This is consistent with a PISA 2018 from

the OECD that the academic performance is unequal and that more affluent students on average have better performance than disadvantaged groups. Finally, this study also reveals that the contribution of schooling to earnings varies across gender. The schooling coefficient is larger for male workers than female workers, indicating a possible gender wage gap. In addition, the nonlinearity of schooling and earnings is particularly observed among female workers.

There are some policy implications derived from this study. The policy should be directed to develop human capital by putting more investment in the education sector and improving allocation effectiveness. The policy intervention, for example, is targeted at socio-economically disadvantaged students. Further, education should develop knowledge, cognitive and non-cognitive capacities to assist students in achieving their full potentials. Additionally, access to education is made available not only for young people but also for adults by providing lifelong education. This current study relies on a cross-sectional dataset of the 2015 survey. Accordingly, the future study may utilize a longitudinal dataset to examine policy changes and their impact on labour market outcomes.

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