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Workers' Ability Index and Optimal Level of Schooling in Malaysian Service Sector

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The objective of this paper is to examine the impact of workers' ability index on wages and optimal level of schooling in the service sector. Empirical analysis in this study is conducted on 611 households' data in Peninsular Malaysia collected in 2015. In this analysis, workers' ability index is divided into two categories, namely index of ability during schooling and index of ability at workplace. The analysis involves estimating four regression models comprising of the wage model, the marginal return to schooling model, the marginal cost model and the optimal level of schooling model. The result demonstrates that workers' ability index does not affect wages significantly but it is a positive and significant determinant for years of schooling. The study shows that the optimal years of schooling for the Malaysian service sector is about 14 years or at diploma level. The actual data reveals that 28.2 percent of respondents have actual years of schooling lower than the optimal level, while about 46.5 percent of them having actual years of schooling higher than the optimal level. The implication from this study is that workers in the service sector, particularly who are with level of schooling lower than the optimal level must increase their educational level in order to achieve the optimal wage.

Keywords: Workers' ability index, wages, optimal level of schooling, family education, service sector.

1. Introduction

Human capital investment is the central of economic development strategies. This investment will produce a better quality person and

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increase lifetime earnings of the investors. Education is a form of human capital investment that influences both the current consumption and future earnings prospect of its investors. Human capital theory postulates that individuals will invest in human capital to the extent where their marginal return (internal rate of return) and discounted rates of interest (cost of investment in human capital) are equal. Eventually, the level of schooling will be chosen in order to maximize their expected discounted future earnings stream.

Most of past studies used earnings function to calculate returns to education based on individual's characteristics such as years of education and experience, i.e. the demand side of human capital investment, and excluded the role of individual's ability. However, ability is particularly important in influencing individual's wage as well as the demand for human capital investment. Heckman (2006) has argued that high earnings are influenced by non-academic skills, personality and interaction between cognitive and non-cognitive skills.

Cognitive skill is the ability for understanding a complex idea, learning through experience, involving in various types of thinking, and solving problems through thinking. Cognitive ability is classified into numeric, abjad, computer, language, planning skills and ability to solve problems. These are considered to be brain-based skills (Michelon, 2006) that are required for completing tasks by different levels of complexity. For example, one needs perception in answering a phone call upon hearing the ring tone, and needs to decide if the call should be answered. By lifting the phone receiver and talking into the phone with the appropriate language, one actually practises motor skill and language skills. Finally, it takes one's social skill when interacting with the caller.

On the other hand, non-cognitive ability involves characteristics such as social, emotion, personality, behaviour, attitude and so on. These characteristics can be judged from working behaviour (efforts, discipline and commitment), social behaviour (confidence, friendship and emotional stability) and physical ability (physical strength, efficiency and capability). Rothstein *et al.* (2008) have identified a list of soft skills and behavioural skills as the potential example for non-cognitive ability, such as critical thinking skills, problem solving skills, emotional health, social skills, work ethic, and community responsibility. Besides that, as observed by Pianta *et al.* (2005), non-cognitive ability that affects

interpersonal relationship includes closeness, affection, open communication, self-control, and self-regulation. Non-cognitive ability represents one's "patterns of thought, feelings and behaviour" (Borghans et al. 2008) that are connected to one's educational process via schooling and cognitive skills development. However, characteristics of non-cognitive ability are not directly represented by cognitive skills since one's socio-emotional or behavioural characteristics are not unchangeable. Finally, technical skill is a combination of cognitive and non-cognitive abilities that is used to perform any kinds of tasks (Margolis, 2011).

An increase in the ability differences will affect income equality. Sensitivity of output towards ability is varied by jobs. Therefore, to increase output, firms will allocate their high-ability workers to jobs that are more difficult and complex (Costrell & Loury, 2004; Sattinger, 1975). The effect of workers' ability on income depends on, firstly, the sensitivity of work performance towards output (either performed by low- or high-ability workers), and secondly, the degree of complementarity of the teams towards job tasks. If they are highly complement, then the effect of ability on wage will be higher.

Empirically, income maximisation from individual human capital investment is achieved at a point where marginal returns equal to marginal cost (Regan et al. 2007; Biltagy, 2011). According to Becker and Thomas (2007), the low optimal level of schooling occurs for those who have low marginal benefit and high marginal cost, whereas those who have high marginal benefit and low marginal cost will obtain high optimal level of schooling and subsequently they will receive high returns from education. Optimal level of schooling shows years of schooling that would maximise individual's wage without causing over- or under-education for an individual to hold a specific job. In a way, optimal level of schooling will reflect the non-existence of educational mismatch in the labour market.

In the Malaysian context, the incidence of educational mismatch could be reflected by a comparison between the percentage composition of employed persons with different educational qualification and at different occupational categories. The percentage of employed persons with an educational qualification at the degree level (9.86% on average) is lower than that of employed persons working in managerial and professional categories (average of 14.42% in total). However, when combining with

those with diploma qualification, the percentages (18.29% on average) exceed that of the managerial and professional categories (Ministry of Finance, 2015). If it is a norm for workers at the managerial and professional level to possess at least a degree qualification, the statistic may indicate that workers at these occupational categories may have possessed educational qualification that is lower than degree, implying the incidence of under-education. With working experience, these undereducated workers may have advanced into higher positions through time. As such, the wage impact of under-education may not have been substantial.

On the other hand, percentages of employed persons working in clerical and sales and service categories (average 28.94% in total) are lower than percentages of employed persons with secondary school educational qualifications (average 54.12% in total) (Ministry of Finance, 2015). While these qualifications are commonly deemed to be minimum entry requirement for clerical and sales and services categories, one might question about the career path of these over-supplied secondary school leavers. It is, however, very unlikely for them to advance their career by holding managerial and professional job positions where a degree or at least a diploma is needed as minimum entry requirement. As such, one might question if these over-qualified workers had been distributed into any occupational categories requiring lower level of education than what they have readily possessed. In fact, the percentages of employed persons holding jobs as operator, assembler and elementary worker are large (average 24.16% in total). Had this speculation been valid, it may give rise to the incidence of over-education that may influence their labour market outcomes.

This paper attempts to construct an index of workers' ability and analyse the role of ability on returns to schooling in the service sector in Malaysia based on a field survey on 611 respondents conducted in 2015. In addition, the study will compute marginal returns to schooling and equate it with the discounted rate of interest to examine the effect of family background on the supply of schooling (proxied by discounted rate of interest). Finally, the study aims to determine optimal level of schooling in the service sector. In this study, individual's ability index is constructed and incorporated into the wage and schooling models. We will estimate the wage models to identify individual rates of returns to schooling. In order to identify the optimal years of schooling we need to know the discounted rates of

interest or the marginal cost of investment. Therefore, the model of marginal cost of investment in human capital (which reflects the ability to invest) is estimated using family characteristics such as parent's schooling level and family size, which have been empirically tested to have influenced the marginal opportunity cost of individual's schooling attainment. Finally, the optimal level of schooling is estimated by equating the marginal returns with the marginal cost of human capital investment to solve for the schooling model. The paper contains five sections. The next section reviews the literature related to the present study. Methodology and results will then follow. Finally, the discussion and conclusion will be presented in the last section.

2. Literature Review

This section reviews literature on two main topics, which are the role of ability on wages and returns to schooling and the role of ability and family background on years of schooling. In the second topic, the literature on the optimal level of schooling is also discussed.

The Role of Ability on Wages and Returns to Schooling

Empirical studies examining the effect of ability on the demand for schooling have pointed to the fact that more abled person tended to invest more in schooling (Akresh *et al*, 2012; Biltagy, 2012). However, ability may in turn exert positive and negative impact on the returns to schooling (Bronars & Oettinger, 2006; Sandewall, 2014). Notwithstanding the mixed results of the ability-returns nexus, failing to control for the measure of ability may bias the estimate of returns to schooling upward (Glewwe, 1996; Rouse, 1999; Patrinos & Sakellariou, 2011).

For instance, when specifying the demand functions for schooling in Egypt, Biltagy (2012) concluded that the number of years of schooling, ability differences and quality of education were the main explanatory variables in the individual's demand function for schooling. This result confirms that of Akresh et al. (2012) in that children would have higher likelihood to be enrolled in school if their ability was one standard deviation higher than the average ability of their siblings, thus giving rationale to their parents to allocate their limited resources to the most abled child rather than distributing them evenly among all children. These findings are based on the ground that schooling and test scores were dependent upon a common unobserved latent ability (Hansen et al., 2004).

Therefore, the impact of schooling on test scores, and hence, the demand for schooling, varies by levels of ability. Such an argument underscores the need to include ability in the analysis of schooling.

Besides benefitting the pre-market demand for education, ability plays a positive role in improving the post-market returns to schooling. Using sibling data, Bronars and Oettinger (2006) found that the ability-proxied aptitude test score generated large returns to schooling both for within and between families. This is because more abled persons tended to receive higher returns to college wage premium (Tobias, 2003) and that the shifts in relative supply of and demand for college labours have increased their returns to cognitive skills (Cunha et. al., 2011). The positive wage effect of ability lies with the possession of mechanic abilities (Anger & Heineck, 2010), literacy and numeracy skills (Vignoles et al., 2011), and personality traits like adulthood extraversion and childhood constructiveness (Viinikainen et al., 2010). In fact, the importance of ability outweighs that of education when Patrinos and Sakellariou (2011) showed that a lack of adult functional literacy skills had lowered the earnings contribution of education.

On the other hand, twins-based estimates of the return to schooling by Sandewall et al. (2014) revealed a negative role of ability when proxied with adolescent IQ test scores and birth weight, casting doubt to the validity of twins-based estimates. The declining role of ability on wage formation could be the result of the growth of technology use in the 2000s (Castex & Dechter, 2014), a competency that can be obtained through formal schooling. As such, education can act as a substitute for both observed and unobserved ability in reducing income inequality (Denny & O'sullivan, 2007).

Despite producing mixed results, the importance of incorporating ability measure into earning-schooling nexus is empirically and statistically justifiable on the ground of measurement bias resulted from omitting this variable. For instance, a Chilean's study of the effect of cognitive skills confirmed the returns-increasing role of ability which might otherwise inflict classical ability bias in the typical earnings function if ability measure was excluded (Patrinos & Sakellariou, 2011). This Chilean study echoes those of the earlier works in the measurement of biased returns, such as Glewwe (1996) and Isacsson (1999) who found positively-biased estimates of the returns to schooling when ability measure was omitted.

Such an upward bias and overestimation of returns, as observed by Rouse (1999) and Behrman and Rosenzweig (1999) based on twins study, was due to the omission of individual-specific component such as genetic ability. In fact, recent study has shown that the inclusion of childhood cognitive test scores has substantially accounted for the increasing income inequality among graduates within the same subject of study (Lindley & McIntosh, 2015).

Nordman et al. (2015), included cognitive ability (numeric and reading) and personality (open, conscientious, extrovert, agreeable, neurotic) in a wage model. They found that only the cognitive ability on reading was significant in affecting wages. The effect of personality on wages was quite weak. Castex dan Dechter (2011) on the other hand, used Arm Force Qualifications Test (AFQT) score which included mathematic and verbal as proxy for cognitive ability. Based on US data in 1979 and 1997, they found that a rise in AFQT score of 10 points had increased male's wage by 2.7 percent for 1979 cohort and 1.1 percent for 1997 cohort. For females, however, an increase of 10 points of AFQT score had decreased their wages from 3.6 percent to 2.2 percent. Meanwhile, Park (2012) supported the finding that AFQT score had positive effect on wages.

The inclusion of ability in the wage model will also reduce gender wage differentials (Grove et al. 2010, Paglin & Rufolo 1990). However, Heineck and Anger (2010) found that cognitive ability such as fluid intelligence did not statistically and significantly determine female wage, but it is a significant determinant of male wage. On the other hand, Heineck and Anger (2010) also found that non-cognitive abilities in terms of personality traits rewarded males and females differently. For instance, openness and positive reciprocity generated wage premiums for females, while conscientiousness and extraversion generated wage premiums for males. Besides that, agreeableness was not statistically related to males' wages while it affected females' wage adversely. Other personality traits affected males and females in a similar manner, such as neuroticism which was consistently not associated to wages for both males and females, while locus of control impacted both of them adversely. Following the outcome of these studies, it comes to us that both cognitive and non-cognitive abilities affect males and females differently, complicating further the extent to which gender wage differentials are accounted for by abilities.

The Role of Ability and Family Background on Years of Schooling

Empirical studies have emphasized the varying effects of years of schooling on the economic returns for individuals who are deemed to be comparable in human capital (Heckman and Vytlacil, 1998; Card, 1999). In fact, Behrman and Knowles (1999) have proven the significant role of family background in schooling outcome among children, while school quality plays an insignificant role in school performance (Hanushek, 1997) and socioeconomic outcomes (Glewwe, 2002). A more direct link between family background and accomplishment among their children has also been proven empirically (Deschenes, 2007; Regan et al., 2007; Chen, 2009). As educational resources of better quality are affordable among the well-affluent families, Behrman and Knowles (1999) contended that the household income is positively associated with the marginal benefits from educational investment in their children. Moreover, child education is given priority by parents who are better-educated, thus increasing their capability and willingness in nurturing their children. Given the greater role of family background and smaller role of school quality in accounting for one's educational outcome, the emphasis on family-side factor should be as relevant for academic research as it is for designing governmental intervention programs in developing countries.

Family background plays vital role in determining the level of children's education. Raitano and Vona (2015) argued that parents' background affected the wage of their children through three channels – probability of having higher level of education, probability of securing better jobs and a direct residual effect as a result of imperfection in market structure (Hudson and Session, 2011). Heineck and Riphahn (2009) studied education opportunity for children and found that education level of children from the low income group did not increase since the past 25 years. They concluded that the level of educational outcomes among children depended upon the parental educational background. Besides education, parents' wealth will also determine children's jobs and income (Karagiannaki, 2012; Kyui, 2013).

Regan et al. (2007) used human capital model to determine the optimal level of schooling which was basically explained by two important variables, namely family background and individual's ability. They found that individuals from wealthy family had higher optimal level of schooling and more able individuals would complete their schooling

faster than those with low ability. Using the United States data and AFQT as a measure of ability, they found that the mean of optimal schooling was 11.4 years. Biltagy (2011) suggested that the important determinants for the demand for schooling (rate of returns to schooling) in Egypt were years of schooling, ability differences and quality of education, while the supply for schooling (discounted interest rate) depended on family background (parental educational levels as proxies for family income) and family size. He found that all variables were positively and significantly determining the optimal level of schooling and the mean of optimal schooling was 12.6 years. The level of optimal schooling increased about 0.16 and 0.12 when the level of father's and mother's education increased by one year, respectively. Moreover, when family size increased by one person, the level of optimal schooling increased about 0.011. Finally when individual's ability increased by one point, the optimal level of schooling increased by 3.4 years. In a nutshell, the results of these studies underscore the importance of incorporating factors like family background and individual ability in determining the optimal level of schooling.

3. Theoretical Background, Model Specification and Source of Data

The following theoretical framework follows that of Regan et al. (2007).

Theoretical Framework

Earnings function

$$E = F(S, A) \tag{1}$$

Where, E is earnings, S is years of schooling and A is ability. The assumptions are positive returns to ability and diminishing marginal returns to schooling.

$$F_S, F_A > 0 \;\; and \;\; F_{SS} < 0 \tag{2}$$

and individual with greater ability will obtain higher returns to schooling

$$F_{SA} \;\; = F_{AS} \;\; > 0 \tag{3}$$

In terms of ln equation (1) becomes

$$lnE = lnF\ \ (S, A) \tag{4}$$

and marginal rate of returns to schooling

$$r = \partial lnF(S, A)/\partial S \tag{5}$$

All relevant costs are assumed to be forgone earnings, and an individual tries to maximize his lifetime earnings that are discounted to the present value, subject to constraints of equation (1).

$$Max\ \ V \int_S^{\infty} E e^{-it} dt$$
$$\text{Subject to}\ \ E = F(S, A) \tag{6}$$

where, V denotes the lifetime earnings discounted to a present value, i denotes a fixed discounted rate of interest, and t represents the index of integration.

Simplify the present value of lifetime earnings in equation (6) and taking ln, we derive;

$$lnV = lnE - iS - lni \tag{7}$$

Taking derivative with respect to S, we derive first order condition;

$$r = i \tag{8}$$

Optimal level of schooling for an individual is achieved at the point where his or her marginal rate of return to schooling and discounting rate of interest are equal.

An individual inverse demand function for schooling will be derived when taking the derivative of equation (4) with respect to schooling, as shown in Eq. (9).

$$r = r(S, A) \tag{9}$$

or

$$S^d = S^d(i, A)$$

Based on Eq. (7), we can derive the individual supply function for schooling investment as follows,

$$lnE = ln(iV) + iS \quad (10)$$

Differentiate with respect to S, and taking explanatory variables that can influence i, like family background we derive;

$$i = i(X) \quad (11)$$

Combining demand equation of (9) with supply equation (11) and considering at the equilibrium between demand and supply we obtain optimal level of schooling;

$$S* = f(X, A) \quad (12)$$

Model Specification

In achieving the objectives of the paper, six equations are established. The first model is wage model that is based on Mincer Earnings Model, which includes years of schooling and experience as independent variables. Model 2 adds ability variables, which comprise of ability during schooling and ability at workplace. The interaction term between ability during schooling and years of schooling is also added to look at the effect of ability on returns to schooling. In Model (3), we add workers' characteristics variables like gender, job status, training attendance and state where they are working to look at the effect of these variables on wages.

When Model (3) is differentiated with respect to years of schooling, Model (4), which is the marginal returns to schooling, is derived. The equation for the marginal returns to schooling which is denoted by r is shown in Eq. (16a). It should be noted that Eq. (16a) is calculated rather than estimated. By substituting years of schooling (SCH) and index of ability during schooling (ABLS) for each individual respondent into Eq. (16a), the marginal returns to schooling for each individual respondent can be calculated. Equation (16b) is presented to show the marginal effect of SCH and ABLS on r, and value of the marginal effect is presented in column 4 of Table 4. Subsequently, the calculated individual marginal

returns to schooling will set to be equalled to the marginal cost of schooling, i, to reflect the property of equilibrium in the demand and supply for schooling as shown in the Eq. (8) above. Since the i is not directly observable in our study, it is proxied by the calculated r and treated as the dependent variable in Model (5). By so doing, the individual value of i in Eq. (17) is directly obtained from the individual value of r calculated by Eq. (16a) – a procedure that is consistent with the notion that the marginal cost is equal to marginal returns to schooling in equilibrium. Finally, Eq. (16a) in Model (4) and Eq. (17) in Model (5) are equated to solve for years of schooling (S) in Model (6), which represents the optimal level of schooling.

Model 1

$$lnW_i = \beta_{01} + \beta_{11}SCH_i + \beta_{21}EXP_i + \beta_{31}EXP_i^2 + \mu_1 \quad (13)$$

Where, lnW is the monthly wage expressed in its natural logarithmic form, SCH denotes years of schooling, EXP denotes years of work experience, and EXP^2 is the square of years of work experience.

Model 2

$$lnW_i = \beta_{02} + \beta_{12}SCH_i + \beta_{22}SCH_i^2 + \beta_{32}EXP_i + \beta_{42}EXP_i^2 + \beta_{52}ABLW_i + \beta_{62}ABLS_i + \beta_{72}ABLSSCH_i + \mu_2 \quad (14)$$

Where SCH^2 is years of schooling squared, ABLW is workers' ability index at workplace, ABLS is workers' ability index at school, and ABLSSCH is interaction between ability index at school and years of schooling.

Model 3

$$lnW_i = \beta_{03} + \beta_{13}SCH_i + \beta_{23}SCH_i^2 + \beta_{33}EXP_i + \beta_{43}EXP_i^2 + \beta_{53}ABLW_i + \beta_{63}ABLS_i + \beta_{73}ABLSSCH_I + \beta_{73}GEN_i + \beta_{83}FULL_i + \beta_{93}TRN_i + \beta_{103}\ \ STATE + \mu_3 \quad (15)$$

Where GEN is dummy variable for gender (male=1 and female=0), FULL is dummy variable for job status (full-time=1 and part-time=0), TRN is dummy variable for training attendance (ever attended training=1 and never attended training=0), and STATE is dummy variable for states (1= more developed states, i.e. Federal Territory of Kuala Lumpur, Selangor, Penang and Johor, and 0= less developed states, i.e. Melaka, Perak,

Pahang and Terengganu).

Model 4

$$r = \beta_{13} + 2\beta_{23}SCH_i + \beta_{73}ABLS_i \quad (16a)$$

$$r = \gamma_{01} + \gamma_{11}SCH_i + \gamma_{21}ABLS_i \quad (16b)$$

Where $\beta_{13} = \gamma_{01}$, $2\beta_{23} = \gamma_{11}$, and $\beta_{73} = \gamma_{21}$.

Model 5

$$\hat{\imath} = \gamma_{02} + \gamma_{12}SCHF_i + \gamma_{22}SCHM_i + \gamma_{32}FS_i + \mu_5 \quad (17)$$

Model 6

$$S_1 = \gamma_{03} + \gamma_{13}\ ABLS_i + \gamma_{13}SCHF_i + \gamma_{23}SCHM_i + \gamma_{33}FS_i + \mu_6 \quad (18)$$

Where SCHF is father's years of schooling, SCHM is mother's years of schooling, and FS is family size. The subscript *i* denotes i^{th} individual, while μ is the error term in each model.

Source of Data

Structured questionnaires have been distributed in a field survey to collect the data used for empirical analysis in the present study. Based on Israel (1992), the minimum sample size was calculated. Sample selection was based on stratified sampling method. Labour Force Survey Report, Department of Statistics Malaysia, 2013, was where the sampling frame was obtained. We have chosen eight states in Peninsular Malaysia to represent four zones in this study – North (Penang and Perak), East (Pahang and Terengganu), West (Selangor, Federal Territory of Kuala Lumpur and Melaka) and South (Johor). The five major service subsectors selected were education, information and communication technology (ICT), tourism, finance and health. There were 611 workers surveyed in the services sector; out of the number, 116 were in the education subsector, 123 in health, 108 in finance, 78 in ICT and 186 in tourism. The data was collected between February and June 2015. A number of 20 respondents in Selangor and Federal Territory of Kuala Lumpur were selected to facilitate for pilot test aiming at validating the instruments used. The Cronbach's alpha is calculated for all four personal quality constructs measuring 'locus of control', 'type A behaviour', 'self-monitoring' and 'sensation seeking'. The results of the reliability test on all personality traits are greater than 0.7, indicating that all instruments used are of good fit in the present study due to their high reliability values.

Constructing Workers' Ability Index

In this study, index of ability during schooling and index of ability at workplace are constructed. Three dimensions are incorporated into constructing the index of ability during schooling, namely, experience at school, and the development of core skills and process skills. On the other hand, the index of ability at workplace constitutes two skill dimensions, namely, the competency in both core skills and process skills, and four other dimensions on personality traits comprising of 'locus of control', 'type A behaviour', 'self-monitoring', and 'sensation seeking'. The above mentioned dimensions are computed into indices that are normalised with the following equation:

$$\frac{(\sum_{s=1}^{j} X_{is})-\left(\sum_{s=1}^{j} Min_{is}\right)}{\left(\sum_{s=1}^{j} Max_{is}\right)-\left(\sum_{s=1}^{j} Min_{is}\right)} \quad (19)$$

Where X_{is} denotes the actual score, Min_{is} denotes the minimum score, and Max_{is} denotes the maximum score expressed by i^{th} respondent for s^{th} item covered in an array of j items measuring each dimension, respectively. Different weight, based on its relative importance in terms of its proportion to the total, is assigned to different dimensions when constructing the index of ability during schooling. On average, the proportion of the dimensional index of experience of schooling, core skills development and process skills development is around 25 percent, 40 percent and 35 percent out of the total. As such, weights of 0.25, 0.40 and 0.35 are assigned to experience of schooling, core skills development, and process skills development, respectively, when constructing the index of ability during schooling. On the contrary, equal weight is assigned to all six dimensions when constructing the index of ability at workplace, since the proportion of each dimension is almost equal out of the total. As such, the weight of 1/6 is assigned to each dimensional index when constructing the index of ability at workplace. It follows that the choice of weight is indeed not arbitrary in nature but is statistically justifiable.

The corresponding ability indicator indices are constructed by incorporating their respective dimensional indices based on two-step procedure. First, calculate the geometric mean with the assigned weight as proposed by the United Nations Development Programme [UNDP] (2015) when constructing the Human Development Index (HDI). The

formula is as follows:

$$(D_{i1})^{w1} \times (D_{i2})^{w2} \times (D_{i3})^{w3} \times \ldots \times (D_{in})^{wn} \quad (20)$$

Where D_i represents the first to n^{th} dimensional indices for i^{th} respondent while w represents the weight that is assigned for each of the n dimensional indices.

Second, identify the maximum value and minimum value for the dimensional indices that have been combined in Eq. (20) and apply Eq. (19) again when constructing the indices for the two ability indicator. Eq. (21) shows the formula used:

$$\text{Indicator Index of Ability} = \frac{[(D_{i1})^{w1} \times (D_{i2})^{w2} \times (D_{i3})^{w3} \times \ldots \times (D_{in})^{wn}] - (Min)}{(Max) - (Min)} \quad (21)$$

Where *Min* represents the minimum value of the combined dimensional indices, while *Max* represents its maximum value. Meanwhile, $(D_{i1})^{w1} \times (D_{i2})^{w2} \times (D_{i3})^{w3} \times \ldots \times (D_{in})^{wn}$ represents the actual value of the dimensional index for each of the i^{th} respondent that has been combined with geometric mean.

Equations 19 to 21 add value to this paper because they are the formula we used to construct the ability indices to be incorporated into the model proposed by Regan et. al. (2007). In another word, we augment the existing model by incorporating new elements for wage determination – i.e. ability during schooling and ability at workplace.

By definition, 'experience at schooling' elicits respondents' exposure in forming study group at school, participating in extra-curricular activities at school, representing their school in competition and the like. 'Core skills' and 'process skills' development elicit the perception held by respondents on how well their previous schooling experience had developed those skills, while 'core skill' and 'process skill' competency elicit the perception held by respondents on the level of their current competency on those skills. 'Locus of control' measures respondents' ability to control things happening around them. Respondents' aggressiveness towards their work is measured by 'Type A behaviour'. 'Self-monitoring' measures the extent to which respondents are adaptable

to their surrounding). Lastly, 'sensation seeking' measures the extent to which respondents are risk-takers and are able to take up challenging tasks. Table 1 shows the dimensions and sub-dimensions of the ability indicators considered in the present study.

Table 1: Dimensions and Sub-dimensions for Each of the Ability Indicators

Ability Indicator (Index)	**Dimension for each Indicator**	**Sub-dimension for each dimension (no. of items)**
Ability during schooling	Experience at schooling	10 items measuring respondents' involvement during their previous school time.
	Core Skill Development	Numeracy; Language skills; Critical analysis; Creativity; Written communication; Oral presentations
	Process Skill Development	Computer literacy; Planning; Applying subject understanding; Problem solving; Decision making ; Team work
Ability at Workplace	Core Skill Competency	Numeracy; Language skills; Critical analysis; Creativity; Written communication; Oral presentations
	Process Skill Competency	Computer literacy; Planning; Applying subject understanding; Problem solving; Decision making ; Team work
	Personality Traits	Locus of Control (7)
		Type A behaviour (10)
		Self-monitoring (10)
		Sensation Seeking (9)

4. Results

Descriptive statistics of variables in the model are shown in Table 2. The monthly wage has a mean value of about MYR2491. Respondents have, on average, 14 years of schooling and 7 years of work experience. The mean value of workers' ability at work and ability at school are almost of about 0.6. This shows a balance between these two abilities at the moderate level. About 41.9 per cent of respondents are males and 95 percent are working as full-time. About 72.5 percent have ever attended training and 61.2 percent are working in the more developed states like Federal Territory of Kuala Lumpur, Selangor, Johor and Penang. On average, educational level of fathers and mothers are almost equal at about 10 years and family size at about 6 persons per household. Number of observation for family background is less than 611 because there are some missing data for these three variables.

Table 2: Descriptive statistics

Variables	Mean	Standard deviation	Minimum	Maximum	N
Wage (W)	MYR2490.72	MYR2940.96	MYR400	MYR60000	611
Years of schooling (SCH)	14.2128	2.51759	6	21	611
Work Experience (EXP)	7.2081	6.69135	0.1	37	611
Ability at workplace (ABLW)	0.6501	0.12693	0	0.9401	611
Ability at schooling (ABLS)	0.6633	0.15795	0	1	611
Ability at schooling * Years of schooling (ABLSSCH)	9.5220	2.9949	0	17.8091	611
Gender dummy (GEN)	0.4190	0.49380	0	1	611
Job status dummy (FULL)	0.95	0.220	0	1	611
Training attendance dummy (TRN)	0.7250	0.44686	0	1	611
States dummy (STATE)	0.6121	0.48767	0	1	611
Mother's years of schooling (SCHM)	10.1414	2.95162	6	18	568
Father's years of schooling (SCHF)	10.4622	3.26571	6	18	568
Family size (FS)	5.8204	2.54888	1	19	568

The Estimation Results

Before the regression analysis is performed, the concepts of diagnostic tests for multicollinearity and heteroscedasticity are discussed. Heteroscedasticity problem occurs when variances are unequal and this will bias the regression estimates. To solve this problem, the Breuch-Pagan test is performed on the models and it is shown that models (1) to (3) have problem of heteroscedasticity when the test is significant at 5 percent level, while there are no heteroscedasticity problem for models (5) and (6). Therefore, heteroscedasticity-consistent white-test is performed on models (1), (2) and (3) to adjust the values of standard error and t-values for each variable to better reflect its significance. Table 4 shows the results after the white-test is performed.

Another problem suffered by the regression models is multicollinearity when there is a linear relationship between the explanatory variables. The presence of this problem will produce a high standard error. This will reduce t-values towards insignificant level even though the R^2 is relatively high. To tackle this problem, the Variance Inflation Factor (VIF) is calculated to see if its value for each variable is greater than 10. Multicollinearity problem occurs when the VIF is greater than 10. The VIF value of more than 10 is found for the interaction terms and the multicollinearity problem is solved through estimating the interaction term models to obtain their residual and replace it into the model. After this treatment, all VIF values are between 1 and 8.2 as shown in Table 3.

Table 3: Multicollinearity Test

Variable	Value of VIF				
	Model 1	**Model 2**	**Model 3**	**Model 5**	**Model 6**
Years of schooling (SCH)	1.007	1.075	1.175		
Ability at workplace (ABLW)		1.323	1.331		
Ability at schooling (ABLS)		1.432	1.508		
Ability at schooling * Years of schooling (ABLSSCH)		1.200	1.213		1.026
Work experience (EXP)	7.857	7.886	8.123		
Father's years of schooling (SCHF)				2.234	
Mother's years of schooling (SCHM)				2.253	2.234
Family size (FS)				1.018	2.276
Gender dummy (GEN)			1.066		1.018
Job status dummy (FULL)			1.049		
Training attendance dummy (TRN)			1.078		
States dummy (STATE)			1.156		

Table 4 presents the final regression results after solving the heteroscedasticity and multicollinearity problems. The R^2 for models (1) model (2) and model (3) are 0.378, 0.381 and 0.470 which indicate that 37.8 percent, 38.1 percent and 47.0 percent of the variation in the dependent variables are explained by the independent variables, respectively. However, for model (5) and model (6) the independent variables can only explain 14.9 percent and 19.4 percent of the dependent variables respectively. The results for model 1 show that years of schooling and working experience affect wages positively and significantly. A year increase in schooling rises wages by about 12.6 percent[4].

[4] The percentage is obtained by taking the exponent of the coefficient value of years of schooling, i.e. [exp(0.119) – 1]x100.

According to Psacharopoulos (1994), returns to investment in education decline by a country's per capita income. This implies that countries with lower per capita income, such as the less-developed countries and developing countries would generate higher returns to education since the increase in the private cost of education in these countries is slower than that of the social cost of education, while the increase in the private benefit of education is faster than that of the social benefit of education – a speculation that is supported by Todaro (1997). Since Malaysia is regarded as a developing country, higher returns to education is therefore justifiable.

In fact, the coefficient on years of schooling estimated for Malaysia in an international study done by Psacharopoulos and Patrinos (2004) using 1979 data was already 9.4 percent almost 40 years back. A recent international update carried out by Montenegro and Patrinos (2014) shows that the coefficient for Malaysia has been increased to 11.7 percent, 11.5 percent, 12.7 percent and 12 percent using 2007, 2008, 2009 and 2010 data, respectively. On the contrary, the coefficient on years of schooling estimated for developed countries like United Kingdom was 6.8 percent using 1987 data and 6.4 percent for Netherlands using 1994 data. The coefficient has only been increased to 10.8 percent, 11.8 percent, 11.4 percent and 9 percent for United Kingdom using 2007, 2008, 2009 and 2010 data, respectively, and increased to 8.9 percent, 9.2 percent, 9.3 percent and 9.5 percent for Netherlands in the respective years. In a nutshell, the coefficients on years of schooling for the developed countries are still lower than that for a developing country like Malaysia in the recent decade.

The 12.6 percent of the returns to education estimated in the present study is highly consistent with the returns estimated for Malaysia in comparison with other countries around the world. Moreover, our estimate for the returns to education is also similar to other empirical study conducted in Malaysia *per se*, such as Liew and Zulridah (2015) with the returns of 12.6 percent. The higher returns to education in Malaysia is due to the higher wage premium paid to workers with tertiary education as opposed to the lower cost of obtaining tertiary education following the provision of low-interest study loan by Malaysian government to almost all qualified Malaysian students pursuing their tertiary education in the public and private institutions. It follows that there is an incremental effect

of the returns to education in Malaysia for every subsequent level of education (Zainizam, Norasibah & Khoo, 2017), and it is higher for females than for males (Kenayathulla, 2013).

Meanwhile, a year increase in working experience rises wage by about 6.8 percent. The result is consistent with human capital theory and many past studies in Malaysia (see for example Zainizam, 2014). When years of schooling squared and workers' ability variables are included in model 2, return to schooling increases, but there is no affect from years of schooling squared and the effect of years of working experience does not change. The ability variables do not have any significant effect on wages.

Additional explanatory variables are added into the model 3, which includes gender, job status, training attended and states. Returns to schooling maintains its positive and significant effect but slightly lower. It is interesting to observe that in this model returns to schooling squared is significantly positive, which is against the theory. The human capital theory states that returns to schooling squared is negative due to diminishing returns on education, whereby the higher is the level of schooling, the higher will be the returns but the increase is at a decreasing rate and finally becomes negative. The contradictory result obtained from this study reflects that in Malaysian labour market higher level of education will not jeopardize wages but lowers returns. Workers still get rewarded from their higher level of education but at the decreasing rate. Male workers receive about 20.9 percent higher wage than the females and full time workers receive 52.9 percent higher wage than the part-time workers. Meanwhile, workers who ever attended training receives 12.5 percent higher wage than their colleague who do not attend any training and those who work in the developed states received 19.8 percent higher wage compared to those working in the less developed states.

The result for model (4) is just the first differential of model (3). In model (5), it is shown that mother's schooling, father's schooling and family size are positive and significant in affecting the marginal cost of human capital investment. But the impact is quite small. A one-year increase in schooling among fathers and schooling among mothers will increase schooling among children by 0.0005 year and 0.001 year, respectively. Also, a one-unit increase in family size will increase worker's schooling by 0.0005 year.

Model (6) presents the estimation results for the optimal years of schooling. This equation is derived from the equilibrium in human capital investment. Workers' ability during schooling plays a positive and significant role in determining optimal level of schooling. A one-point increase in worker's ability will increase years of schooling by 3.22 years. Father's education, mother's education and family size also positively and significantly determine the optimal level of schooling. The role of educational qualification among mothers is even greater than that of fathers, but all of these family background factors are significant only at 10 percent level. As shown in Table 3 a one-year increase in schooling among mothers will increase schooling among children by 0.096 but the effect from the schooling among fathers is 0.085. This study finds that the mean of optimal years of schooling in the Malaysian service sector is about 14 years or at diploma level.

Results from this study can determine if a worker in Malaysian service sector is over or under educated. Past studies compared workers' actual years of schooling with the level they perceive to be appropriate for their job to determine if there is any incidence of educational mismatch. This measure of educational matching is called the subjective method, which compares the respondents' actual educational attainment with the educational qualification self-perceived to be required in their jobs. In some other instances, respondents are also asked directly about the adequacy of the match between their educational qualifications and those required in their jobs. This method has been discussed in many studies in the past (see for example, Halaby, 1994; Hartog, 2000; Verhaest & Omey, 2006; Tsai, 2010; Kiersztyn, 2013). However, this approach may be biased because it is based on perception. In this analysis, optimal level of schooling is derived from the equilibrium condition in the human capital investment. Based on this finding, which is envisaged to be more accurate, the study shows that about 46.5 percent of respondents are overeducated and 28.2 percent are under educated. Only 17.4 percent respondents are having level of education that matches with their current jobs.

Table 4: Regression result

Variables	Wage model			r (4)	Estimated *i* (5)	Years of schooling model (6)
	1	2	3			
Constant	5.517*** (48.625)	5.597*** (40.076)	5.108*** (37.475)	0.103*** (13.187)	0.163*** (62.506)	9.884*** (16.756)
Years of schooling (SCH)	0.119*** (15.549)	0.120*** (15.280)	0.103*** (13.187)	0.0114** (5.53)		
Years of schooling squared (SCH^2)		0.003 (1.374)	0.0057* (2.765)			
Ability at schooling (ABLS)		-0.108 (-0.729)	0.038 (0.273)	-0.0112 (-0.296)		3.220*** (4.980)
Ability at schooling * Years of schooling (ABLSSCH)		-0.014 (-0.344)	-0.0112 (-0.296)			
Ability at workplace (ABLW)		-0.046 (-0.254)	-0.083 (-0.505)			
Work experience (EXP)	0.073*** (8.689)	0.073*** (8.631)	0.068*** (8.655)			
Work experience squared (EXP^2)	-.001*** (-4.700)	-0.001*** (-4.696)	-0.001*** (-4.971)			
Father's years of schooling (SCHF)					0.0005* (1.895)	0.085* (1.887)
Mother's years of schooling (SCHM)					0.001** (2.112)	0.096* (1.905)
Family size (FS)					0.0005* (1.818)	0.071* (1.825)
Gender dummy (GEN)			0.190*** (4.859)			
Job status dummy (FULL)			0.425*** (5.760)			
Training attendance dummy (TRN)			0.118*** (3.047)			
States dummy (STATE)			0.181*** (4.363)			
R^2	0.381	0.384	0.470		0.154	0.199
Adjusted R^2	0.378	0.377	0.461		0.149	0.1935
Number of Observation	611	611	611	611	568	568
Optimal Years of schooling						**14.296**
Breusch-Pagan test (Heteroscedasticity)	0.0077** [4.004]	0.0651** [1.913]	0.0239** [2.027]		0.5344 [0.730]	0.9076 [0.253]

Note: (t-statistic value), [f- statistic value]
*** Significant at 1% level of significance
** Significant at 5% level of significance
* Significant at 10% level of significance

5. Discussion and Conclusion

The paper examines the effect of workers' ability on wages and years of optimal level of schooling. Analysis also looks at the equilibrium level of human capital investment when the marginal returns to schooling is equal to marginal cost. Individuals and job characteristics are included in the wage model, while the family background is included in the years of schooling model. The results show that human capital variables like education, experience and training affect wage positively and significantly, which is in accordance with the human capital theory.

Workers' ability during schooling and at workplace do not affect wage significantly, which implies that the Malaysian service sector still relies on formal education in rewarding workers. While this finding seems to be inconsistent with some previous studies discussed earlier, it could be justifiable on the ground of higher returns to schooling found in the present study. Malaysia is a developing country that allocates greater amount of government spending on education each year to nurture knowledge-based workers, as a way of attracting foreign investors and to promote high-value production. As such, knowledge and skills obtained from the formal education and technical proficiency are much sought after in the labour market. While core skills and process skills competency can be nurtured through formal education at school, especially at the tertiary level, technical proficiency may not be directly nurtured through formal education, resulting in the incidence of skill mismatch and educational mismatch in Malaysia that impose much wage penalty on the affected workers (Zainizam, 2014; Zainizam et al., 2017).

Technical proficiency could be better nurtured through vocational education and workplace learning – an element that is absent and that falls out of the scope of the present study. In addition, all the nine ability dimensions considered in constructing the index of ability at schooling and index of ability at workplace are reflective of those abilities that could be obtained through formal education, but not those technical proficiency that could be obtained through vocational education and workplace learning. As such, the wage effect of ability may have been masked by the importance of years of schooling in the present study. Future study may consider incorporating technical skills obtained through vocational education and workplace learning as the measure of ability, as opposed to the set of ability used in the present study. Besides that, future study may

examine the wage effect of each separate dimension of ability used in the present study per se, as opposed to a combination of several ability dimensions used in the present study.

On the contrary, ability during schooling does affect optimal years of schooling significantly and the effect is quite substantial. Workers' and job characteristics do affect wages and the results are supportive of the hypothesis.

Parent's education affects optimal level of schooling, where educational attainment among fathers and mothers contribute positively towards years of schooling of their children. The family size also has a positive effect on years of schooling, indicating that the larger the family size is, the longer will be an individual's years of schooling. This could be due to the fact that larger family size reflects wealthier family status, which in turns supports for greater extent of investment in schooling. However, one should take such speculation with a grain of salt in the absence of family income as an intervening variable. This serves as the avenue for future research. A number of policy implications can be resulted from the outcome of this analysis. Based on the results, longer years of education and involvement in training are particularly needed to boost individual's wage. Education is also crucial for getting wage reward in the labour market since ability is not a significant determinant. However, individual's ability during schooling is important to guarantee longer years in schooling system. This can be improved through a better co-curriculum in school programmes and activities. There are some limitations of the study. Further study may include instrumental variable to capture other determinants of individual's wage.

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