Asia-Pacific Social Science Review 19(2) 2019, pp. 1–14

RESEARCH ARTICLE

Over-Skilling and Labor Market Impact: The Case of South Korea

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Abstract: Many previous studies in the literature concerning qualification-job mismatch have focused primarily on the effect of over-education on labor market outcomes such as wages, whereas the topic of over-skilling has received relatively little attention in the literature primarily due to the unavailability of data. Moreover, some previous studies in the literature have also been constrained by the absence of panel data providing controls for unmeasured heterogeneity that might otherwise bias results. In an attempt to resolve these issues, this paper places emphasis on the wage effect of being over-skilled and extends the analysis by making use of the panel element of the Youth Panel 2007 survey. The major findings confirm and support the findings of other studies as follows: For the whole sample, significant wage penalties exist when over-skilled college graduate workers are compared with their well-matched counterparts. The wage penalties associated with over-skilling are stronger for women than for men when the data is disaggregated by gender. It indicates that the problem of being over-skilled is generally more severe in the case of women. For both genders, the wage effects of being over-skilled are greatly reduced when accounting for unobserved individual-specific characteristics such as lower abilities. The results mentioned indicate that the use of appropriate panel methodology considerably reduces the size of the relevant coefficients and suggest that cross-section results should be viewed with caution, particularly in the Korean setting.

Keywords: Skill mismatch, over-education, over-skilling, wages, gender

This paper is motivated by trends and developments in higher education and labor market developments in South Korea (hereafter denoted as Korea). The vast majority of Korean youngsters graduate from high schools (i.e., currently more than 95% of 18-year-old children) and more than 70% of high school graduates advance to higher education institutions (e.g., 69.8% in 2016). The number of students enrolled in higher education institutions, including 2- to 3-year colleges, was only 201,436 in 1970 but enrollment increased substantially to more than 3.5 million in 2016. Even more remarkable was the increase in the prevalence of those enrolled in post-graduate programs, which increased from 6,640 in 1970 to 332,768 in 2016 (Ministry of Education, 2017). According to the 2016 Education at a Glance report published by the Organisation for Economic Cooperation and Development (hereafter denoted as OECD), 65%

of 25–34 year-olds hold a college degree or more advanced degree in Korea, which is the highest rate among the OECD.

The second half of this century has witnessed a global boom in higher education. The dramatic increase in the number of persons with qualifications over the past few decades has led to the question of whether the economy can successfully provide enough positions to accommodate the growing supply of college graduates. More specifically, the substantial improvement in average educational attainment has naturally given rise to concern that the mismatch will take the form of over-education, which happens when the level of education required for the job is lower than the level of education completed. Indeed, over-education has become an issue of particular policy concern in Korea, especially since the onset of the 1997–98 financial crisis. There are numerous news report on the over-education phenomenon and its costs because it is seen as damaging to competitiveness.

The main aim of this paper is to draw the correct inference on the wage effects of over-qualifications among young college graduates in the Korean labor market at an early stage of their career. In an attempt to resolve this issue, the current study places emphasis on over-skilling between workers and jobs, rather than over-education; and extends the analysis by making use of the panel element of the Youth Panel (hereafter denoted as YP) survey, while we generally follow existing conventional literature concerning over-education. If this study finds evidence that there is a sizable wage effect associated with over-skilling, then the results will raise the question of whether there exist significant wage penalties for being over-skilled. It has important implications for over-skilled young college graduates produced and the use that is made of them by employers.

As pointed out by Mavromaras, McGuinness, O'Leary, Sloane, and Fok (2010), over-skilling is a more direct and a more general measure of over-qualification than over-education, and the estimate of over-skilling seems less likely to be affected by the failure to control for unobserved individual factor differences. Failure to consider for individual-specific characteristics may lead to seriously biased estimates. In the empirical analysis, we, therefore, use information on over-skilling measured by workers reporting the degree to which they use their skills in their workplace. A worker's response to the over-skilling question should incorporate differences with regards to the real demand for jobs. For our purpose, we make use of the YP survey for the years of 2007–2015 (hereafter denoted as YP 2007), which includes appropriate information on over-skilling and young college graduates. The YP 2007 dataset also provides the current study an opportunity to control for unmeasured ability in the empirical analysis. Furthermore, this paper also examines whether the panel fixed-effects (hereafter denoted as FE) regression approach employed in the present study yields less biased results than conventional ordinary least squares (hereafter denoted as OLS) estimation in the Korean context. The problem of unobserved individual heterogeneity is in part addressed by using a panel data estimation in general.

The topic of over-skilling is particularly important in Korea where the government has traditionally emphasized the role and importance of human capital as a key resource for economic growth and social cohesion. Education is the primary mechanism for escalating human resources and accumulating human capital in general. The rationale for public investments in school education at the forefront policies aimed at pursuing these goals is done in the national strategy for turning Korea into the most competitive knowledge-based economy in the world. The efficiency with which human resources are developed in the educational system and used on the labor market must, therefore, be a priority for policymakers in Korea. The process of matching skilled workers to the demand of employers is central to this concern. Furthermore, the high rate of youth unemployment in Korea is largely due to a mismatch between workers' attained skills through school education and skills required by employers, although there are other contributing factors such as insufficient demand for high-quality labor and higher expectation on the part of young people (Kim, 2015).

This paper deals with this very interesting as well as important topic, which is potentially relevant for the current policy problem - youth unemployment, by investigating the causal effect of over-skilling on wages. The main question addressed in the analysis is whether there is a sizable wage penalty associated with over-skilling among young college graduates in the Korean labor market. The topic discussed here is the policy issue not only in Korea, but most likely be relevant for many other countries.

Literature Review

Since the concept of over-education among college graduates was first introduced by Richard Freeman in 1976, the economics literature on over-education has grown significantly over the years (e.g., Sicherman, 1991; Hartog & Oosterbeek, 1998; Hartog, 2000; Mavraomaras, McGuinness, & Fok, 2009b; Mavromaras, McGuinness, O'Leary, Sloane, & Fok, 2010; Mavromaras, McGuinness, O'Leary, Sloane, & Wei, 2013; Patrinos & Psacharopoulos, 2010; Cho & Lee, 2014). Evidence from several advanced economies has shown that over-education is a widespread phenomenon, although studies give various estimates of the incidence of over-education due to the dataset, time period considered, and definition of required education. A common result in the literature is that over-educated workers are paid less than their adequately educated counterparts with the same level of education (i.e., the wage penalty), which reflects the lower productivity of a sub-optimal job match but more than their matched co-workers (Sicherman, 1991).

Although most prior research on over-education shows consistent evidence of a wage penalty for over-educated workers over time and across countries, the majority of studies performed their analysis based on an unrealistic assumption of skill homogeneity among workers within an education level. These studies implicitly assumed that workers within a similar educational level achieve similar levels of skills when human capital is proxied by attained levels of education (e.g., Sicherman, 1991; Hartog; 2000; Cho & Lee, 2014). They view that there is a close relationship between over-education and over-skilling, and thus these two types of mismatch can be treated as equivalent phenomena in the labor market. However, formal education is not the only mechanism that promotes and develops skills and does not reflect the skills needed to perform a job in the workplace. In other words, over-education and over-skilling measures do not capture the same thing, and thus over-education does not necessarily imply over-skilling. Over-educated individuals may have lower skills levels, for example. Therefore, one of the major problems in the literature is that the level of formal education attained by a worker is often used as a proxy for skill level.

The literature to date indeed suggests that there is a less than perfect correlation between over-education and over-skilling and that both phenomena tend to have quite distinct implications for workers (e.g., Allen & Van der Velden, 2001; Di Pietro & Urwin, 2006; Green & McIntosh, 2007; Mavraomaras et al., 2013). Several previous studies attempted to show that over-education appears to be only weakly related to over-skilling by differentiating between over-education and over-skilling. For instance, Green and McIntosh (2007) claimed that the correlation between over-education and over-skilling is only 0.2, suggesting that over-education and over-skilling are two distinct mismatch phenomena with different labor market outcomes. The conventional measurement of over-education, therefore, is prone to imprecision due to skill heterogeneity among individuals within an educational level. Indeed, some workers have low skill levels for their educational attainment compared to their peers and, thus, become unable to obtain a job commensurate with their educational level. In such a case, workers may be over-educated, but may not necessarily be over-skilled. This suggests that there is a less than perfect correlation between over-education and over-skilling and that both phenomena tend to have quite distinct implications for workers. Accordingly, measuring over-education without considering the idea of skills' heterogeneity among workers within a similar level of education may produce biased estimates of the labor market effects of the over-education issue.

Numerous previous studies in the literature have examined the wage effects of over-qualifications in terms of over-education and over-skilling. The wage penalty of over-qualification has been confirmed in a large number of studies over many years and across countries, but virtually all of these have been based on the cross-section analysis (Mavraomaras et al., 2013). One potential problem with this existing literature is that the estimation results can be biased due to the problem of unobserved individual heterogeneity such as ability and motivation. As noted in Mavraomaras, McGuinness, and Fok (2009a), for instance, better-motivated workers may be more likely to work longer hours and be less over-qualified because they are more motivated. Less able workers may be less likely to find a job that matches their qualification credentials. Accordingly, lower-ability workers are also more likely to be classified as over-qualified. If so, the coefficient on over-qualification would be biased in OLS (Sicherman, 1991). The presence of unobserved individual factors can mislead if the results of cross-section data are wrongly interpreted.

In other words, it is possible that the significant wage penalties associated with over-qualified workers in the previous studies are biased due to the failure to control adequately for individual productivity differences.

In regards to this issue, a growing number of studies have indicated that the omission of unobserved individual characteristics overstates the pay penalty for being over-qualified. Once unobserved individual heterogeneity with appropriate methodologies is controlled, either panel data analysis with FE or instrumental variables in case of cross-sectional data, the coefficients of over-qualification should be lower (smaller in absolute value). For instance, Bauer (2002) argued that controlling unobserved individual-specific characteristics might be particularly important if the probability of over-qualification is related to unobserved (innate) lower ability. He further claimed that individuals with lower innate ability need more qualifications (education/skills) to acquire a job for which they are formally over-qualified (over-educated/over-skilled). Therefore, one would overestimate the returns to over-qualification when not controlling for unobserved individual heterogeneity, if there is a negative correlation between the probability of being over-qualified and unobserved (lower) ability. Using data from the Household Income and Labour Dynamics in Australia (HILDA) survey over the period 2001–2007, Mavromaras et al. (2013) also found that the estimated wage effects of over-qualification become smaller compared to the pooled OLS estimation when controlling for unobserved heterogeneity because unobserved individual heterogeneity and the probability of being over-qualified are negatively correlated.

We noted that the following two possible elements are integrated into this analysis that expands existing literature. First, this paper is a competent study of over-skilling, which has not been sufficiently analyzed previously in many countries due in part to the lack of data. Indeed, the information on skill mismatch has only recently become available in a limited range of datasets such as the British Household Panel Survey (BHPS) and Household Income and Labour Dynamics in Australia (HILDA). Mavromaras et al. (2010) claimed that over-skilling is a more appropriate measure of a qualification-job mismatch than over-education because skills (and abilities) are generally considered as the fundamental source of mismatch between the worker and the job. It suggests that over-skilling is a better measure than over-education because the former is less likely to be contaminated by unobserved individual heterogeneity than the latter. To a degree, therefore, the estimates of over-skilling presented in this paper seem less likely to be affected by the problem of unobserved individual productivity differences.

Second, using the longitudinal nature of the YP survey, this paper employs a panel FE estimation to examine whether the conventional OLS estimation results are affected by biases from unobserved individual-specific characteristics when estimating the wage effects of over-skilling. As noted, some previous studies in the literature have been constrained by the absence of panel data that would provide controls for unmeasured individual heterogeneity that might otherwise bias results (e.g., Di Pietro & Urwin, 2006). The current analysis shows that a panel FE estimation produces consistent results with findings that have been reported elsewhere, namely, reduced coefficients in the wage equations compared to pooled OLS, which is consistent with the presence of unobserved individual heterogeneity. This result indicates that the omission of unobserved individual factors may overestimate the wage penalty associated with over-skilling without controlling unobserved individual heterogeneity. In this paper, we conclude that it is necessary to use panel estimation techniques if one is to draw the correct inference on the possible causal effect of over-skilling on labor market outcomes, particularly for young college graduates.

Neither of these two elements discussed above is completely original and can be found in a number of papers (e.g., Mavromaras et al., 2013), though still relatively irregularly. Nevertheless, when coupled with a third distinguishing feature of the current study, focusing on young college graduates, this analysis does have some claim to originality, particularly in Korea, and so adds to the literature. Indeed, there are few papers on over-skilling compared to over-education (McGuinness, Pouliakas, & Redmond, 2018). Moreover, most prior research dealing with skill mismatch generally focuses on the whole labor force (McGuinness, 2006). Further, to our knowledge, no study exists that examines the wage effects of over-skilling by applying a panel approach published in a journal to date in Korea. The Korean labor market is a very important one as it has been reaching very high graduate education levels and what happens in it is

pertinent to many advanced industrialized economies, hence, empirical results of the type attempted in this paper can be of great interest for broader applied labor market policy and can be of significance in the relevant literature.

Methods

Data Source

The data used in this study is drawn from the YP survey. The YP is a longitudinal survey conducted annually from 2001 on a nationally representative sample of 5,956 young Korean men and women who were 15-29 years old when first surveyed in 2001 (YP 2001). These individuals were interviewed annually through 2006 with a total of six surveys collected over the period. To compensate for the aging issue of initial panel sample, the second version of YP was newly conducted from 2007 on a sample of 10,206 that represents Korean youth from 15 to 29 years old when they were first interviewed in 2007 (YP 2007). For this empirical analysis, the YP 2007 cohort is used by adding a new set of more recent and representative statistics of current youth. More specifically, the data for the current paper comes from the first nine waves (2007–2015) of the YP 2007 cohort. As noted, the YP 2007 is a nationally representative panel dataset of the Korean youth population that has been collected

Table 1

Definition of Variables

Variables	Definitions
Panel *A*: Dependent Variable	
LNHWAGE	Log hourly wages
Panel *B*: Skills-Job Mismatch	
OVER_SKILL	Dummy variable: 1 if the worker feels that his/her level of skills required by his/her current job is (1) *Very low* or (2) *Low*, compared to his/her skills level
WELL-MATCHED	Dummy variable: 1 if the worker feels that his/her level of skills required by his/her current job is (3) *Appropriate*, compared to his/her skills level <Reference group>
Panel *C*: Socio-Demographic Characteristics	
FEMALE	Dummy variable: 1 if female
AGE	Workers age (expressed in years)
AGESQ	The square of *AGE*/100
SINGLE	Dummy variable: 1 if single (never married) <Reference group>
MARRIED	Dummy variable: 1 if married
CAPITAL	Dummy variable: 1 if the worker lives in the capital area (i.e., Seoul, Incheon, and Gyeonggi-do)
Panel *D*: Human Capital Characteristics	
COLLEGE	Dummy variable: 1 if 2-to-3-year college degree
UNIVERSITY	Dummy variable: 1 if 4-year college degree or above <Reference group>
TENURE	Workers job tenure in the current occupation (expressed in years)
TENURESQ	The square of *TENURE*/100
Panel *E*: Employment Characteristics	
UNION	Dummy variable: 1 if union member
PUBLIC	Dummy variable: 1 if employed in the public sector
SMALL	Dummy variable: 1 if a firm has less than 300 workers <Reference group>
MEDIUM	Dummy variable: 1 if a firm has 300 to 999 workers
LARGE	Dummy variable: 1 if a firm has more than 1,000 workers

annually since 2007. This ongoing cohort has been surveyed nine times to date. These follow-up studies aim to suggest and contribute to employment policy-making of the government and researches to solve youth unemployment by tracking and investigating school activities, socio-economic activities, and relevant personal information of the youth sample.

In this paper, we focused on young Korean college graduate workers. The sample used in the empirical analysis is restricted to a panel of full-time salaried workers holding at least a two-year college degree and who provide complete information on the variables of interest (wages, for example), so that self-employed and unpaid family-employed workers are excluded. The sample size we retained is approximately 2,400 observations per wave (male: 1,100, female: 1,300). The respondents in the sample were re-surveyed each year from 2007 through 2015, meaning that each respondent was interviewed a maximum of nine times over a period of nine years.

In regards to the Korean youth labor market, some aspects of the data are worth noting at this point. In Table 2, the average age of male (resp. female) workers is 29.5 (resp. 27.1) years, and the average of their logarithmic hourly wages is 9.630 (resp. 9.407). These results suggest that female workers, on average, enter the labor market earlier but their wages are less than of the male workers. This gender

Table 2

Summary Mean Statistics

Variables	Male	Female
Panel *A*: Dependent Variable		
LNHWAGE (Log hourly wages)	9.630(0.018)	9.407(0.016)
Panel *B*: Skills-Job Mismatch		
OVER_SKILL (Over-skilled only)	0.116(0.003)	0.137(0.003)
Panel *C*: Socio-Demographic Characteristics		
AGE (Workers Age)	29.470(0.032)	27.075(0.032)
AGESQ (The square of *AGE*/100)	8.788(0.019)	7.450(0.018)
MARRIED (Married)	0.263(0.004)	0.165(0.003)
CAPITAL (Living in the capital area)	0.532(0.005)	0.498(0.005)
Panel *D*: Human Capital Characteristics		
UNIVERISTY (4-year college degree or above)	0.641(0.005)	0.583(0.005)
TENURE (Workers Job tenure; years)	1.684(0.024)	1.419(0.021)
TENURESQ (The square of *TENURE*/100)	0.086(0.002)	0.073(0.002)
Panel *E*: : Employment Characteristics		
UNION (Union member)	0.89(0.003)	0.061(0.002)
PUBLIC (Public sector employment)	0.115(0.003)	0.166(0.003)
MEDIUM (Medium-sized firm)	0.117(0.003)	0.102(0.003)
LARGE (Large-sized firm)	0.300(0.005)	0.240(0.004)
Sample Size (Observations)	9,846	11,700

Note: The sample is full-time salaried graduate workers from the YP 2007 data (2007–2015).

Standard error in parentheses.

discrepancy may be expected because compulsory military service is legislated in Korea. The current conscription law applies only to males aged 18–35, and thus most Korean male workers complete about two years of mandatory military service before entering the labor market. However, firms generally acknowledge military service as job experience in determining initial wages. Consequently, male workers' entry-level wages are higher than those of female workers in general.

As regards the gender pay gap, Table 2 reveals that young Korean female college graduates have much lower wages than their male counterparts. The log of hourly wages is 9.630 for male workers and 9.407 for female workers, which yields a gender wage gap of approximately 22%. It suggests that the relative position of young female college workers may be inferior to that of male counterparts in the Korean workplace, at least in terms of wages. Indeed, according to the OECD (2017) report, *The Pursuit of Gender Equality: An Uphill Battle*, the gender pay gap in Korea is the highest among the member countries of the OECD at 37.2%, contributing to making working life for Korean women unappealing.

In terms of the distributions of skill mismatch, the majority of young college graduate workers are adequately skilled (approximately 84%). The probability of a worker being over-skilled depends on his or her gender. Female college graduates are more likely to be over-skilled than their male counterparts. Approximately 16% of female college graduate workers are estimated to be over-skilled, whereas 11% of males do. It is difficult to validate these data due to a lack of comparable information, but the prevalence of over-skilled college graduate workers in our sample appears lower than in other developed countries, such as the U.S., U.K., and Australia, where approximately 40–50% of the labor force is over-skilled. For instance, Mavromaras et al. (2010) found that over-skilled college graduate workers comprise 54.4% of the labor force in the U.K. and 43.4% of the labor force in Australia. However, our results indicate that at least one out of 10 college graduates are over-skilled in the Korean youth labor market. These findings reflect a considerable level of over-skilling in the Korean labor market. It suggests that the share of over-skilled workers among young Korean college graduates is non-negligible, although it appears that well-matched skilled workers are the majority in the Korean workplace. The phenomenon of highly educated workers accepting low-skilled jobs may cause troubles for jobseekers with relatively lower levels of skills.

The proportion of over-skilled college graduate workers also suggests that important gender effects exist as over-skilling is more frequent among women than among men. The result may be partly explained by a large share of women (approximately 39%) working temporary/daily jobs as this form of employment seems to be a factor of being over-skilled. The existence of such a pattern has significant implications in the Korean youth labor market because over-skilling may explain a substantial part of the gender wage gap.

Measurement Issues

In the existing literature, the concept of skill mismatch is usually measured as the difference between acquired and required skills in the workplace. Individuals are defined as being over-skilled if they claim that a lower level of skills is most appropriate for the current job of a given individual. Conversely, individuals are deemed to be under-skilled if the most appropriate level of skills is higher than the level of skills actually acquired by a given individual. In this paper, both concepts are measured subjectively through a single question below, unlike typical skill mismatch research and analysis whereby separate questions can be used to identify over-skilling and under-skilling (McGuinness et al., 2018).

In your view, what is the level of skills required by your current job, compared to your skills level?

(1) *Very low*
(2) *Low*
(3) *Appropriate*
(4) *High*
(5) *Very high*

There is a five-point scale with respondents answering that the skills needed to do the current job are (1) very low, (2) low, (3) appropriate, (4) high, and (5) very high than acquired. As the current study only focuses on individuals with a higher education degree, workers in our final sample would be either over-skilled or adequately-matched for their jobs. Therefore, individuals selecting (1) or (2) on the scale are classified as being over-skilled, while those selecting (3) on the scale are considered to be skill-matched (the reference group in regression analysis).

The self-assessment method for measuring skill mismatch is one of the key solutions in the literature, but it faces relevant criticism. The principal disadvantage of the subjective approach is that it is prone to subjective bias in the same way as over-education (for details on subjective bias arguments, see a recent paper by McGuinness et al., 2018). Self-report measures such as the Likert-type scales (i.e., a 5- or 7-point scale that offers a range of answer options from one extreme attitude to another, like "extremely likely" to "not at all likely"), however, have been widely used to measure skill mismatch in the literature, because these scales generally offer an efficient method of capturing a wide range of variance in self-reported attitudes and behaviors. Indeed, as pointed out by Mavromaras et al. (2010), skill mismatch has been argued to be a more accurate measure of a mismatch than educational mismatch on the ground that the inability of educational mismatch measures to account for unobserved ability leads to problems in interpreting empirical results. McGuinness and Sloane (2011) also claimed that skill mismatch may be a more comprehensive measure than educational mismatch for picking up variations in individual qualifications because skill mismatch requires the workers to compare all their skills and abilities, irrespective of whether they were learned in the classroom or work environment, with the actual skill requirements of their current job.

The existing literature also provides several findings concerning the reliability of the self-reported skill mismatch measure. For instance, Jones and Sloane (2010) argued that no clear evidence exists that workers consistently overestimate or underestimate their own skills or demand regarding the extent to which their present employment position requires the level of skills they possess. Di Pietro and Urwin (2006) also claimed that the self-reported subjective measures of educational mismatch and skill mismatch are reliable compared to the jobholder's judgment concerning the degree of utilization of workers' knowledge and skills (i.e., job analysis). Therefore, the individual's subjective assessment adopted in this analysis would be expected to provide important information on the study, even though it could also be generally the weakness of the study. In other words, self-reported measures are considered reliable and are viewed as capable of producing reliable results in relation to the issues examined in the current paper (Park & Shahiri, 2015).

Analysis

The Mincer-style human capital wage equation is a highly stylized model used in the existing literature on the effect of over-education on labor market outcomes. The present study also performs a Mincerian wage regression to examine the wage effects of over-skilling among young college graduate workers in the Korean labor market while controlling for various covariates, such as individual socio-demographic, human capital, and job characteristics. The wage equation estimated in the empirical analysis takes the following general form:

$$lnY_{it} = \alpha_0 + \beta_1 X_{it} + \beta_2 Z_{it} + \gamma OVER\_SKILL_{it} + \alpha_i + \mu_{it} \quad (1)$$

where *i* and *t* index individuals and time periods respectively. The dependent variable lnY_{it} is the log hourly wage of the individual worker *i*. X_{it} is a vector of individual socio-demographic and human capital factors such as gender, age, marital status, region, education, and job tenure. Z_{it} is a vector of job characteristics such as union membership, public sector employment, and firm size. $OVER\_SKILL_{it}$ equals an over-skilling dummy (well-matched being the reference category). β and γ are vectors of unknown parameters to be estimated. α_i represents unobserved and constant individual-specific (time-invariant) error component across respondents. μ_{it} is a conventional mean zero disturbance.

This extended specification of the Mincer wage equation with a single dummy for over-skilling is a special case of Verdugo and Verdugo (1989) which includes both dummies for over-education and under-education. According to Equation (1), over-skilled college graduate workers are compared to their adequately-matched counterparts with the same level of education. As noted, most studies in the over-education literature that adopt Equation (1) found that over-educated workers receive significant pay penalty ($\gamma<0$).

From the theoretical perspective, the current study attempts to test the assignment theory (Sattinger, 1993) in the context of the youth labor market. Assignment theory suggests that there is a relationship between a worker's skill profile and skill content of their job, stating that the job's skills requirements do matter in the wage determination process. The basic idea is that the actual level of productivity realized is also

determined by the mismatch between skills and job level, although higher-level skills raise productivity in general. In explaining the relationship between wages and labor market mismatch, the human capital theory (Becker, 1964) highlights the importance of individual characteristics, whereas job competition theory (Thurow, 1975) concentrated on job characteristics. The assignment theory approach emphasizes that both individual and job characteristics should be taken into account when explaining wage differentials between over-skilled and adequately-matched workers. Therefore, over-skilled college graduates should earn a different return on their skills as those who are adequately skilled: $\gamma \neq 0$.

According to the assignment theory, as wages are determined by the jobs skills requirements, the return to excess skills would tend to zero and, thus, over-skilled workers tend to receive a wage penalty as compared with their well-matched counterparts with the same educational level (i.e., the wage penalty): $\gamma < 0$. There exists a certain skill level required for a job irrespective of the attributes of individual workers who are employed in it, and individual workers are then assigned to these jobs based on their skills acquired. In such circumstances, working in a job below one's skill level (i.e.β, being over-skilled) may impose a limitation on the utilization of skills. The lower level of the job in effect imposes a ceiling on the worker's productivity, resulting in lower wages. In this case, jobs are the main factor limiting in over-skilled workers' productivity.

The assignment theory also predicts that the wage penalty for over-skilling is higher for female workers than for male workers. McGuiness and Bennett (2007) argued that the public sector, for instance, is known to be a sector in which a large portion of jobs imposes wage ceilings that are lower than workers' productivity. As women are relatively more likely to work in the public sector than men, women are generally more exposed to wage ceilings. In this empirical analysis, the sample is disaggregated by gender and models are estimated separately for men and women. If a different wage effect on the basis of gender exists, it may suggest the one reason for the gender wage gap in the Korean youth labor market.

As noted, to investigate the role of unobserved individual heterogeneity on the wage effects of over-skilling, this study employs two types of estimation methods in the empirical analysis: pooled OLS and panel FE estimations. Each type of estimation contains different information, and the comparisons are informative. Pooled regressions can be informative about the overall association between wages and over-skilling, whereas FE estimates provide for a measure of the possible causal effect of being over-skilled on wages. The analysis begins with a pooled OLS regression, which generates the simplest estimates as if it was derived from a simple cross-sectional dataset. Later, panel FE estimation is performed, exploiting the panel nature of the YP 2007 data, which controls for time-invariant unobserved individual heterogeneity such as a lower innate ability. For the current paper, the panel FE approach produces more precise and credible wage effects of over-skilling. As the information contained in the data is the same for both estimations, the major difference in the estimates is that the panel estimation controls for unobserved heterogeneity, but the pooled estimation does not.

Results

This section presents the estimation results of Equation (1). The specific estimates for the whole sample, and separately by gender, are presented in Table 3 and Table 4, respectively. For the whole sample, the analysis begins with the pooled OLS estimation based on the assumption that over-skilling and unobserved ability is not correlated and moves to panel estimations using the FE specification.

Estimation results are reported in Table 3. There are two columns for each estimation methods. The specific estimates based on OLS and panel FE regressions are reported corresponding in columns (1) and (2), respectively. Although coefficients estimates are presented based on a large number of control variables, the general results are consistent with conventional wage estimations. Regarding the wage effects of over-skilling in panel *A*, we find that over-skilling has a significant negative correlation with wages. In column (1), the pooled OLS estimate indicates a detrimental effect of over-skilling with a wage loss of 12.8%. In column (2), the analysis also finds that the FE estimate of over-skilling is much lower than the case of the pooled OLS model. The general over-skilling penalty falls from 12.8% to 6.6% between the pooled OLS and FE specifications. These findings suggest that over-skilling negatively affects wages in the Korean youth labor market.

Moreover, the wage penalty associated with youth over-skilling can be particularly explained by unobserved ability.

Turning to the coefficient estimates of individual socio-demographic, human capital, and employment characteristics in panels *B-D,* the results show that young female college graduates *(FEMALE*) are paid less than their male counterparts in the Korean workplace. There exist strong age effects (*AGE*) with positive and negative signs on the linear and quadratic terms (*AGESQ*). The marital status variable (*MARRIED*) is consistent with the findings of some existing studies: being married has positive returns for males, reflecting conventional household roles. As might be expected, living in a capital area (*CAPITAL*) has significant positive effects on wages, which suggests that capital areas continue to be characterized by higher cost of living, increased demand for labor, and expanded job opportunities—all of which contribute to increased wage rates. In terms of human capital endowments, a higher level of education (*UNIVERSITY*) is associated with higher wages, which indicates that wages increase with educational attainment (i.e., the wage premium). This finding is consistent with the typical predictions that people with higher levels of human capital accumulation are paid more than those with lower

Table 3

The Wage of Effects of Over-Skilling

Explanatory Variables	Pooled OLS (1)	Panel FE (2)
Panel *A*: Skills-Job Mismatch		
OVER_SKILL (Over-skilled only)	- 0.128(0.063)***	- 0.066(0.040)***
Panel *B*: Socio-Demographic Characteristics		
FEMALE (Female workers)	- 0.110(0.026)***	-
AGE (Workers Age; years)	0.160(0.012)*	0.126(0.059)**
AGESQ (The square of *AGE*/100)	- 0.218(0.143)	- 0.072(0.102)
MARRIED (Married with a spouse)	0.012(0.034)	0.082(0.050)*
CAPITAL (Living in the capital area)	0.278(0.024)***	0.187(0.109)*
Panel *C*: Human Capital Characteristics		
UNIVERSITY (4-year college degree or above)	0.245(0.026)***	0.363(0.252)
TENURE (Job tenure; years)	0.020(0.012)*	0.081(0.014)***
TENURESQ (The square of *TENURE*/100)	- 0.201(0.129)	- 0.607(0.148)***
Panel *D*: Employment Characteristics		
UNION (Union member)	0.060(0.047)	0.099(0.059)*
PUBLIC (Public sector employment)	- 0.029(0.036)	- 0.017(0.078)
MEDIUM (Medium-sized firm)	0.100(0.040)**	0.025(0.060)
LARGE (Large-sized firm)	0.180(0.029)***	0.047(0.053)
Constant	7.929(0.677)***	7.023(0.853)***
Sample Size (Observations)	21,546	

Legend: *** p<0.01, ** p<0.05, * p<0.1. Standard error in parentheses.

Notes: The sample is full-time salaried graduate workers from the YP 2007 data (2007-2015).

levels of human capital traits. Findings concerning employment characteristics are also as expected for the indicators for members of labor unions (*UNION*) and firm size (*MEDIUM*, *LARGE*) account for the wage premium.

A separate analysis is performed disaggregating the results based on gender. Table 4 provides results concerning the gender (i.e., male and female) dimension of the wage effects of over-skilling. Similar to the results in Table 3, the coefficients from both pooled OLS and FE estimations generate statistically significant coefficients of over-skilling for both genders. The results also show that the wage penalty is higher for females than for males with both gender-specific wage effects much lower under the FE framework that controls for unobserved individual heterogeneity.

Discussion

In relation to the estimated wage effects of being over-skilled, the major findings of this study are fairly similar to the stylized facts in existing literature. In Table 3, as in most earlier studies, the result gives support to the assignment theory hypothesis, demonstrating the existence of a significant wage penalty for being over-skilled: $\gamma < 0$. In column (1), wages are significantly lower for the over-skilled, with a coefficient of -0.128. This result suggests that over-skilled workers earn, on average, 12% less than their well-matched counterparts. Considering that the wage penalty to over-skilled individuals will only be one part of the loss generated by mismatch, the estimated wage penalties presented here could be thought of a fraction of the total productivity losses resulting from being over-skilled (Mavromaras et al., 2010). Indeed, being over-skilled also increase an individual probability of future unemployment (e.g., Mavromaras, Sloane, & Wei, 2015) and is associated with lower job satisfaction (e.g., Green & Zhu, 2010) and lower workplace harmony. Moreover, over-skilling may cause a waste of resources to the society at large in terms of state investment into education that does not bear its yields (McGuinness, 2006).

To investigate the extent to which the estimated over-skilling coefficients may be influenced by unobserved individual heterogeneity, a panel FE model is estimated exploiting the panel nature of the YP 2007 data. In column (2), the wage effects of being over-skilled are greatly reduced, when accounting for unobserved ability. The panel FE estimation produces much weaker estimates than the pooled OLS regression: the wage penalty to over-skilled workers in the current job was lower at an approximate 6.4% in the panel FE estimation. This result indicates that it is only well-matched workers with a college degree who change status to a job where they are over-skilled that suffer an approximate 6.4% wage penalty. It may suggest that the wage effects of being over-skilled observed in the pooled OLS model are upward biased (an overestimate) as a consequence of unobserved innate ability. This evidence may also emphasize the importance of controlling for unobserved ability when estimating the effect of labor market mismatch, suggesting that empirical evidence using cross-section data should be viewed with caution, particularly in the Korean setting.

Table 4 shows similar results to those presented

Table 4

The Wage Effects of Over-Skilling by Gender

Over-Skilling	Relative to Well-Matched	
	Males	**Female**
Pooled OLS	-0.106 (0.039)***	-0.177(0.075)***
Panel FE	-0.075 (0.045)*	-0.104 (0.054)*
Observations	9,846	11,700

Legend: *** p<0.01, ** p<0.05, * p<0.1. Standard error in parentheses.

in Table 3. The pooled OLS estimation generates highly significant coefficients for both genders. Not surprisingly, a strong negative association is found for those who are over-skilled. Most of the wage impact of being over-skilled is removed by controlling for unobserved individual-specific characteristics, suggesting that the results based on the pooled OLS estimation method may be upward biased due to the problem of unobserved ability. These results once again highlight the importance of panel estimation methods, to eliminate unobserved heterogeneity bias, when attempting to assess the impact of over-skilling on wages.

The main result in Table 4 is that the estimates of a wage penalty due to over-skilling in a panel FE model are less than approximately one-third the size estimated in the pooled OLS procedure. For men (resp. women), the wage penalty relating to over-skilling fell from 10.1% (resp. 16.2%) in the pooled OLS regression to 7.2% (resp. 9.9%) in the panel FE estimation, which indicates that well-matched men (resp. women) that switch to a job where they are over-skilled suffer a 7.2% (resp. 9.9%) wage penalty. The estimates of over-skilling obtained from the panel FE model appear less likely to be affected by a failure to control for unobserved ability. These findings suggest that unobserved individual-specific characteristics continue playing an important role in the way over-skilling effects are determined. Table 4 also points to significant gender differences in wage penalties for being over-skilled. Women have a relatively higher wage penalty than men. It suggests that female college graduate workers appear to suffer more than their male counterparts when switching from a well-matched job into an over-skilled job in the Korean youth labor market. This finding is also consistent with the prediction of the assignment theory as discussed in the previous section.

Conclusion

In this paper we empirically examined the wage effects of over-skilling among young Korean college graduates at an early stage of their career, using the latest panel data from the YP 2007 survey (2007–2015). To focus on over-skilling, this analysis makes a distinction between educational mismatch (the focus of current literature) and skill mismatch, which has been understudied due to lack of relevant data. In the empirical analysis, a worker is defined as over-skilled if the worker feels the level of skill required by the current job is low compared to his or her own skill level. The empirical strategy uses Mincer-type regressions with log hourly wages as the dependent variable and dummy for being over-skilled as the main regressor. Using a panel FE estimation method, this analysis attempts to control for unobserved individual-specific characteristics. The use of panel data analysis helps in dealing with the endogeneity problem caused by unobserved individual heterogeneity.

The major findings of this study confirm and support the results of existing studies as follows. Whatever the estimation method, the main conclusion gives support to previous studies in the literature: over-skilling leads to a wage penalty, suggesting that over-skilled workers tend to earn less than their well-matched counterparts. Comparing the magnitude of wage penalties estimated with panel FE estimation to those with the pooled OLS estimation, we found that the wage penalty for being over-skilled are greatly reduced when accounting for unobserved heterogeneity. The large reduction in wage effects indicates that the use of appropriate panel methodology considerably reduces the size of the relevant coefficients. When estimating the effects using the data disaggregated by gender, this study found that the wage penalty associated with over-skilling are stronger for women than for men. It may suggest that over-skilling in a particular case of women should be focused on policy concerns in the Korean youth labor market.

Over-skilling is more likely to happen among the young and those with higher levels of educational attainment in general. It suggests that policies to increase educational levels may not be sufficient to address the problem of over-skilling. Given the negative relationship between over-skilling and wages, it is possible that the wage penalty for over-skilled young workers will be higher for the population as a whole because the wage growth in matched workers will tend to outstrip that of their mismatched counterparts over the entire lifecycle. A more general policy implication of our results is that governments have a role to play in reducing transitions into over-skilling, which potentially has devastating impacts on future labor market outcomes and progression amongst young workers. A new channel through which well-designed framework policies that promote efficient reallocation may also boost labor productivity. Higher managerial

quality that imposes heavy or unpredictable costs on hiring and firing, slowing down the reallocation process and higher participation in lifelong learning, and training beyond formal education to address changing labor market needs due to technological advances are also associated with better matching of job skills.

Ethical clearance:

The study was approved by the institution.

Conflict of interest:

None.

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