CONSEQUENCES OF JOB MISMATCH:

EMPIRICAL EVIDENCE FROM SOUTH KOREAN LABOR MARKET

By

CHOI, Dain

THESIS

Submitted to

KDI School of Public Policy and Management

In Partial Fulfillment of the Requirements

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Committee in charge:

Professor Sung Joon Paik, Supervisor _____

Professor Seul Ki CHOI _____

Professor Hee Seung Yang _____

Approval as of December, 2017

Consequences of Job Mismatch:

Empirical Evidence from the South Korean Labor Market

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KDI School of Public Policy and Management

Abstract

This study explores the effects of education-job mismatch, skill-job mismatch, and major-job mismatch on job satisfaction as well as on turnover intention. Moreover, special attention is paid to differences in the labor effects of job mismatches among junior college graduates, university graduates, and postgraduates who are currently enrolled, completed, or graduated from a master's or Ph.D. programs.

The data used is based on 2014 Graduates' Occupational Mobility Survey (2014GOMS1). Furthermore, the samples are restricted to following categories: employees aged 25-34, graduates from tertiary education, and wage workers currently employed.

Major findings from the empirical results are as follows; 1) under-education and skill deficit have significantly positive impacts on job satisfaction but do not have any significant influences on turnover intention; 2) over-education and skill surplus have significantly negative effects on job satisfaction and positive effects on turnover intention; 3) employees who experience job mismatches with respect to the field of education are less likely to be satisfied with their jobs and do not have significant relationship with turnover intention.

Furthermore, although the labor market effects of job mismatches do not vary much according to educational levels; there are two different outcomes. These are 4) under-education does not have significant impact on job satisfaction in the case of postgraduates; and 5) with respect to turnover intention, it has been found that postgraduates from master's or doctorate programs tend to be more influenced by skill-job mismatch, while university graduates tend to be more affected by education-job mismatch.

Likewise, the degree of influence of education, skill, and major mismatches on job satisfaction and turnover intention is different. Therefore, public policy formulations would need to consider not only education-job mismatch, but also skill-job and major-job mismatches, when dealing with the issue of job mismatches. Consequently, it would be proposed that Korean education and labor policy measures that aim to close the huge mismatch gap between their tertiary education outcomes and industry needs should consider these three distinct types of job mismatches simultaneously in order to align both fields better.

I. Introduction

Since 1990, South Korea (hereafter 'Korea') has been experiencing economic depression and labor market crisis. In particular, the Korean economy struggled from serious economic recessions after the Asian Financial Crisis (IMF crisis) in 1997 and the Global Financial Crisis in 2008. Due to slow growth and mounting uncertainties, Korean companies were reluctant to hire new employees thereby driving up the number of unemployed youth. The youth unemployment rate in Korea constantly increased from 8.8% to 10.56% since 2012 (World Bank, 2016). What is more problematic is that access to decent jobs seems highly demanding for many young people due to the structural problems in the labor market. Although the expansion of higher education generated many highly educated youths, the Korean economy has failed to create quality jobs that could absorb such highly-skilled workers (National Economic Advisory Council, 2006).

Surprisingly, however, economic crises did not have greater impact on the social demand for higher education than expected. Rather, the demand for university even increased during the IMF crisis, seeing that the number of applicants rose during that period. For instance, the number of applicants for 2-year junior college slightly decreased from 1,524,488 in 1997 to 1,471,641 in 1999, while same figure for 4-year university increased from 1,283,071 in 1997 to 1,620,615 in 1999 (Yu, 2001). In addition, after the adoption of a new regulation regarding the establishment of new universities in 1995, the number of students of Korean universities and junior colleges have been on the rise which has caused an excess supply in the job market. According to an OECD report (2011), tertiary graduation accounted for 63% of the education level of the 25-34-year cohort which was the highest proportion among OECD countries.

Although more than half of Koreans completed higher education, large companies that demand such highly educated workers and provide ample salary offer only 10 percent of the total jobs in Korea (Christian & Kang, 2012). Hence, the structural education-job mismatch in

the Korean labor market has been regarded as a serious matter of concern in Korea (Park, 1982).

Job mismatch could be grouped into three different categories: education-job mismatch, skill-job mismatch, and major-job mismatch (Nho & Lim, 2009). According to an ILO report (2013), an education-job mismatch refers to the situation where workers have more(less) years of education than their job requires. Skill-job mismatch means that demand(supply) for a certain type or level of skill exceeds the supply(demand) of people with that skill (ILO, 2013). Lastly, a major-job mismatch occurs when the major of college graduates and field of work are not coherent.

Among them, there has been much research done on education-job mismatch. The reason for this is that over-education has become a critical issue, with approximately 24% of employees considered to be overeducated in the Korean labor market (Chae et al., 2005). On this, numerous studies scrutinized the determinants and labor outcomes of over-education (Alba-Ramirez, 1993; Kim, 2005; Park, 2005; Shin & Son, 2008). However, compared to studies on education mismatch, very little research has been carried out on the labor impacts of skill mismatch and major mismatch (Cha & Chu, 2010). This is because many researchers believed that education mismatch could encompass both concepts of skill and major mismatch (Alba-Ramiresz,1993). Yet, recent studies on job mismatch have started to deal with education mismatch, skill mismatch, and major mismatch separately. This is based on the notion that the mismatch between a worker's years of schooling and the minimum years of education required for the job would not fully explain the effects of skill and major mismatch. Since this paper covers education, skill, and major mismatches individually, it serves as a comprehensive study regarding the issue of job mismatches.

Moreover, this paper explores the labor effects of education, skill, and major mismatch depending on the level of education: 2 or 3-year junior college graduates, 4-year university graduates, and university plus postgraduates who graduated from 4-year university and are

currently enrolled, completed, or graduated from a master's or PhD program. In Korea, junior colleges and universities are the two main types of institutions for higher education but the Korean system of tertiary education is highly stratified (Shavit, 2007). While junior colleges have strived to provide differentiated education service from universities such as vocational training programs, associate degrees awarded by junior colleges to their graduates are apt to acquire lower labor market values than that of bachelor's degrees awarded by 4-year universities. This is because admission to the lower-tier junior colleges requires much lower exam scores on the national entrance examinations than admission to 4-year universities. Furthermore, there exists a severe hierarchical stratification within 4-year universities based on prestige, test scores required for admission, and ultimately the social privileges of the graduates. Therefore, junior colleges and universities of lower prestige are included in the second-tier education system and graduates from these institutions have difficulty in achieving quality employment, and ultimately securing socioeconomic advancement. In this context, studying the influences of education, skill and major mismatch by junior colleges, universities, and master's and doctorate programs would enable us to find out whether education levels are important factors for the analysis of job mismatches.

This paper aims to investigate the consequences of education, skill, and major mismatch in the Korean labor market by analyzing the most recent 2014 Graduate Occupation Mobility Survey 1 (2014GOMS1) data. In addition, this paper appends data for three consecutive years from the 2012GOMS1 to 2014GOMS1 in order to confirm the robustness of this study. In this paper, we mainly focus on both job satisfaction and turnover intention as labor outcomes and would like to address the following research questions:

i) to what extent and in what ways does the education-job mismatch influence employee's job satisfaction and turnover intention in Korea?

ii) to what extent and in what ways does the skill-job mismatch influence employee's job

satisfaction and turnover intention in Korea?

iii) to what extent and in what ways does the major-job mismatch influence employee's job satisfaction and turnover intention in Korea?

iv) to what extent could labor effects of the education-job mismatch be accounted for by skill-job mismatch and major-job mismatch?

v) do the labor effects of education-job, skill-job, major-job mismatches vary according to educational level?

The findings of this research would be of interest to various educational stakeholders as well as human resource managers in diverse industries. Additionally, this study may be of use to policy makers who play a pivotal role in formulating policy measures that could close the huge mismatch between tertiary education and industry in Korea.

II. Literature Review

1. Definition of job mismatch

After the research conducted by Duncan and Huffman in 1981, many researchers have become interested in the problems and consequences of job mismatch and developed three distinct concepts: education mismatch, skill mismatch and major mismatch.

First of all, education mismatch is defined as a mismatch between worker's educational attainment and the level that is typically required to perform adequately (McGuinness, 2006). Over-education occurs when a worker's years of schooling is greater than the minimum number of years required for the job (Biner et al., 2012). Under-education refers to the situation where a worker's years of schooling is less than the minimum number of years required for the job (Biner et al., 2012). Lastly, if a worker's years of schooling is equal to the minimum number of years required for the job, it is regarded as an 'education-job match' (Biner et al., 2012).

Secondly, skills show the development of human capital. To perform one's duty at a workplace, not only cognitive skills, such as literacy or numeracy skills, but also non-cognitive skills such as physical or soft skills are needed. According to the OECD report (2014), these skills should be utilized effectively in the labor market in order to positively affect individuals' success in workplaces, participation in society, and economic development. However, in reality, skills that are required for the job sometimes do not match with the skills that the employee possesses. For example, a skill surplus occurs when the skill levels possessed by workers are higher than the skill levels actually needed for the job. On the other hand, a skill deficit happens when workers possess a lower level of skills than what is required for the job (Quintini, 2011).

Lastly, a major mismatch is about the relationship between the learning contents from schools or vocational education institutions and the job contents at workplaces. Robst (2006) utilizes the university major as the proxy variable for major mismatch and he classifies it into three parts based on the relevance between the major and the job activity: 'very closely related', 'somewhat closely related', and 'not closely related'. However, this paper divides the relationship into two parts: 'major-job match' which integrates 'very closely related' and 'somewhat closely related' and 'major-job mismatch' which comprises 'not closely related'.

2. Measurement of job mismatch

There are three possible ways to measure job mismatch: direct and objective measurement, self-reported measurement, and empirical measurement (Hartog, 2000). First, some researchers systematically measure the level of work required for a certain job based on the job description of the standard occupational dictionary (Rumberger, 1987). While this measurement is highly reliable, it is very arduous to update it constantly (Rumberger, 1987). Some studies on job mismatch utilize such objective measurements (Kim & Lee, 2000).

Second, self-reports are used to measure job mismatches (Duncan& Hoffman, 1981). Information on self-reported job mismatches is obtained by asking workers to what extent their

educational attainment, skills, and college major correspond to their tasks performed at work. Self-report measures have the advantage of being easily implementable in a survey, and thus up-to-date information could be obtained easily. On the other hand, self-reports have disadvantages; they are prone to biases and respondents might have the tendency to overstate the requirements in their workplace and upgrade their position at work (Hartog, 2000)

Lastly, the use of an empirical study is another possible way to measure education and skill mismatch. For example, researchers could assign workers into two groups of 'over-education' and 'under-education' by comparing a worker's education level and the average level of entire workers. In the case where a worker has more years of schooling than the average years of all workers, he/she could be labeled 'over-education'. This empirical method has an advantage of making symmetrical distributions of over-education (or skill surplus) and under-education (or skill deficit) because worker's education and skill levels are determined relatively depending on those of entire workers (Groot, 1996). However, this method is impossible to apply to the research on major mismatch.

3. Effects of job mismatch in labor market

The literatures on labor market mismatch are quite extensive. Early studies on labor market mismatch tended to focus on the wage effects of mismatches since rates of return to investment in education was a special concern around the world. In this regard, they found that education and skill mismatch, especially over-education, negatively influences wage. (Duncan & Hoffman, 1981; Hartog & Oosterbeek, 1988; Sicherman, 1991; Hersch, 1991; Cohn & Khan, 1995; Van Smoorenburg & Van der Velden, 2000; Allen & Van der Velden, 2001; Lim, Nho, & Jung, 2010). As education-job mismatch emerged as one of serious problems across the world, there has been growing interest in effects of education, skill, and major mismatches on various labor outcomes such as job satisfaction (Tsang & Levin, 1985; Hersch, 1991; Allen & Van der Velden, 2001), on-the-job search (Allen & Van der Velden, 2001), turnover (Topel,1986;

Hersch, 1991), and occupational choice (Viscusi, 1979). Among these various labor outcomes, this paper is designed to investigate the effects of mismatches on job satisfaction and turnover intention.

1) Effects on job satisfaction

First, the early studies have highlighted that mismatched workers are not only more likely to endure wage penalties but also tend to have lower job satisfaction (Tsang & Levin ,1985; Park, 2004; Cha & Chu, 2010). For instance, Tsang and Levin (1984) finds that over-education is negatively and significantly related to job satisfaction which, in turn, is positively and significantly related to firm output. To be specific, a l-year increase in over-education is associated with a 3.30% drop in the average level of job satisfaction, and a 1% increase in job satisfaction was associated with a 2.53% increase in firm output. Park (2004) also notes that overeducated employees are less likely to be satisfied with their jobs compared to the employees working in a job for which their own level is required. However, Allen and Van der Velden (2001) argues that over-education has a negative effect on worker's job satisfaction but the effect is not statistically significant.

Furthermore, according to a previous analysis on the effect of under-education (Allen & Van der Velden, 2001), employees whose level of education is lower than the required level of education are more likely to be dissatisfied with their job than those who are educationally matched. But given that there is no big difference between less educated workers and educationally matched workers in terms of job satisfaction, under-education does not have stronger impact on job satisfaction than over-education does.

When it comes to skill mismatches, numerous studies find that skill mismatches have stronger influence on job satisfaction rather than education mismatches (Allen & Van der Velden, 2001; Cha & Chu, 2010). Both studies agree that skill surplus has negative effect on job satisfaction, even after controlling for education and major mismatches. In this sense, skill

surplus has relatively greater impact on job satisfaction. However, effect of skill deficit on job satisfaction is controversial because there have been many contradictory findings. For instance, Allen and Van der Velden (2001) claims that skill deficit has a significant negative impact on job satisfaction when education and job mismatches are controlled. By contrast, a recent paper studying the effect of skill deficit in the Korean labor market states that the direction of the correlation coefficient has been changed across models and such effects are not statistically significant (Cha & Chu, 2010).

Although very few researches concerning major mismatch have been conducted, a recent article published in Korea suggests that major mismatch has a substantially negative impact on job satisfaction when adding all types of mismatches in the regression (Cha & Chu, 2010). Yet, since there is scant literature available on this topic, further research is needed to confirm the labor effects of major mismatch.

2) Effects on turnover intention

Several studies have shown that over-education causes high labor turnover (Topel, 1986; Hersch, 1991; Park, 2004). For example, according to Park (2004), 90% of employees who answer that their educational level is higher than required level do not tend to consider their current job as their permanent job and they strive to look for other jobs that match their own educational level. In contrast, there is another study that contradicts these findings; over-education and under-education have no significant effect on turnover intention (Uh, 1995). Thus, further study is needed to examine the effect of over-education on turnover intention.

Besides, advanced studies have emphasized that not only over-education but also skill surplus has a significant positive impact on turnover intention (Park, 2005; Cha & Chu, 2010). More interestingly, a recent article shows that the effect of skill surplus on turnover intention is relatively stronger than that of over-education when controlling all types of mismatches (Cha & Chu, 2010). This result implies that individuals working in an environment that demands

lower skill levels than their own are more likely to seek for other jobs because feelings over

having a skill surplus could work as an incentive to find a job that would be make use of their

skills more. On the other hand, a skill deficit had no significant effect on turnover intention

(Cha & Chu, 2010)

Likewise, although there were ample studies done with respect to over-education and

skill surplus, there has not much research investigating how under-education, skill deficit, and

major mismatches may affect turnover intention. Accordingly, further studies on these issues

are needed.

4. Conceptual framework

As noted before, relatively fewer studies on the effects of under-education, skill deficit,

and major mismatch have been conducted as compared to the effects of over-education and

skill surplus. Hence, in order to carry out a comprehensive and thorough study concerning job

mismatches, this paper aims to identify how under-education, over-education, skill deficit, skill

surplus, and major mismatch may influence job satisfaction and turnover intention, as indicated

in Figure 1.

Figure 1. Conceptual framework
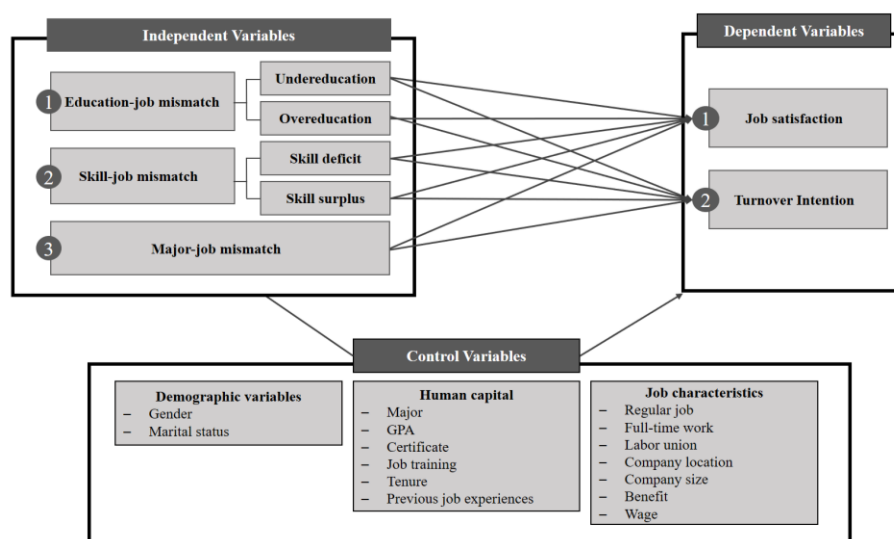
Firstly, self-reported job mismatches are considered as independent variables in this study. Under-education is the case where an employee works in an environment that demands ability of a higher educational level than the worker's current one. On the other hand, over-education indicates working in a job that requires skills of a lower educational level than one's existing ones to adequately perform their tasks. When it comes to skill mismatches, skill deficit is a case where the subject's skill level is lower than the required level of the job and skill surplus is a case where the job level is lower than the subject's skill level. In addition, major mismatch is measured by respondent's judgement and it means that a respondent's undergraduate major is not relevant to the field of his/her current job.

Second, outcome variables are job satisfaction and turnover intention. Job satisfaction is defined as the degree to which employees feel personally fulfilled and content in their job roles. Job satisfaction in this article is a relatively unique concept because it only focuses on job satisfaction resulting from their tasks at work, but does not include employees' overall job satisfaction and satisfaction resulting from their workplace or organization. In addition, turnover intention indicates whether employees have plans to leave their current jobs.

Lastly, as for the controlled variables, this paper tries to control for all relevant factors that contribute to job satisfaction and/or turnover intention so as to eliminate the conflicting variables and omitted variable bias. On the basis of previous studies, demographic variables, human capital, and job characteristics are controlled in the regression model (Duncan & Hoffman, 1981; Allen & Van der Velden, 2001; Noh & Lim, 2009; Lim, Noh, & Jung, 2010; Cha & Chu, 2010; Paolo & Mañé, 2016). To be specific, this research controls gender and marital status as demographic variables, and undergraduate majors, GPA in university, certificate, job training, tenure, and previous job experiences as human capital. When it comes to job-relevant variables, regular job, full-time work, labor union status, company location,

company size and employee benefits are controlled for the analyses. In addition, since wages are well-known determinants of both job satisfaction and turnover intention, wages are controlled in all regression models. Moreover, job satisfaction is controlled for the analysis on turnover intention, since job satisfaction is well-known factors that are inversely associated with turnover intention for workers (Medina, 2012).

Furthermore, this conceptual framework was also applied to analysis on the labor effects of education, skill, and major mismatches according to educational levels: junior college graduates, university graduates, and postgraduates.

III. Research Method

1. Data

This paper uses recently available data from the 2014 Graduates' Occupational Mobility Survey (GOMS) which has been carried out annually since 2006. GOMS consists of a survey targeting graduates from higher education institutions including two or three-year junior colleges and four-year universities. Respondents of the 2014 GOMS graduated from university (or junior college) in August in 2013 or in February in 2014. Since GOMS provides useful information on the outcomes of education and training programs in the labor market, it provides valuable data for studies on labor outcomes of graduates. More importantly, GOMS has collected self-reported data regarding education-job mismatch, skill-job mismatch and major-job mismatch separately. However, as GOMS changed from panel data to cross-sectional data beginning from 2012 GOMS, it might not be able to provide definite information about cause-and-effect relationship.

In order to focus on job mismatch and its labor consequences on youth, the sample has been confined to youth aged 25-34 who are currently working and are wage workers. Following this purpose of the research, the sample size is 5,051 people.

2. Research model & methodology

In order to analyze the impacts of educational mismatches, skill mismatches and major mismatches on job satisfaction and turnover intention, this paper utilizes the similarly designed models which include not only indicators of attained level of education but also a set of control variables including demographic variables, human capital and job characteristics.

Firstly, the first model includes educational mismatch. Under-education and over-education are sets of dummies representing educational mismatches. The reference category for both variables is education-job match, which means subject's educational level is

considered appropriate for one's current job. Furthermore, the dummies indicating educational levels are as follows: 2 or 3-year junior college, university plus postgraduate studies, and 4-year university as the reference category.

$$Y_i = \beta_0 + \beta_1 underedu_i + \beta_2 overedu_i + \beta_3 E_i + X'_i\beta + \varepsilon_i \qquad (1)$$

- Y_i = Set of Outcomes (i.e. job satisfaction, turnover intention)
- $Underedu_i$ = when job level is higher than subject's own educational level
- $Overedu_i$ = when job level is lower than subject's own educational level
- E_i = A set of dummies specifying the attained educational level
  (i.e. junior college graduates, university graduates, university plus postgraduates)
- X'_i = The set of control variables
- ε_i = The error term that is assumed to be normally distributed

Model 2 aims to study effect of skill mismatches on labor market outcomes. Like Model 1, a set of dummies indicating the acquired educational level and a set of control variables are included in the regression model. The key difference of Model 2 with Model 1 is that *skill deficit* and *skill surplus* are added instead of *under-education* and *over-education*.

$$Y_i = \beta_0 + \beta_4 deficit_i + \beta_5 surplus_i + \beta_6 E_i + X'_i\beta + \varepsilon_i \qquad (2)$$

- Y_i = Set of Outcomes (i.e. job satisfaction, turnover intention)
- $deficit_i$ = when job level is higher than subject's own skill level
- $surplus_i$ = when job level is lower than subject's own skill level
- E_i = A set of dummies specifying the attained educational level
- X'_i = The set of control variables
- ε_i = The error term that is assumed to be normally distributed

In Model 3, dummy variable *major_mismatch* is included so as to examine the impacts of major mismatch, along with the effects of educational level and other variables controlled. In this case, the reference category is major-job match where respondent's undergraduate major and one's career field are considered to align.

$$Y_i = \beta_0 + \beta_7 major\_mismatch_i + \beta_8 E_i + X'_i\beta + \varepsilon_i \qquad (3)$$

- Y_i = Set of Outcomes (i.e. job satisfaction, turnover intention)
- $major\_mismatch_i$ = when subject's undergraduate major does not align with the field of job
- E_i = A set of dummies specifying the attained educational level
- X'_i = The set of control variables
- ε_i = The error term that is assumed to be normally distributed

Model 4 is designed to ascertain how much skill mismatches and/or major mismatch account for the effects of educational mismatches. Model 4 incorporates three types of job mismatches in the regression. By doing so, we could find not only estimate the net effect of each kinds of mismatches after controlling for the effect of the other but also find out what kind of mismatch has stronger overall effect on the labor outcome.

$$Y_i = \gamma_0 + \gamma_1 underedu_i + \gamma_2 overedu_i + \gamma_3 deficit_i + \gamma_4 surplus_i +$$

$$\gamma_5 major\_mismatch_i + \gamma_6 E_i + X'_i\gamma + \varepsilon_i \qquad (4)$$

- Y_i = Set of Outcomes (i.e. job satisfaction, turnover intention)
- $Underedu_i$ = when job level is higher than subject's own educational level
- $Overedu_i$ = when job level is lower than subject's own educational level
- $deficit_i$ = when job level is higher than subject's own skill level
- $surplus_i$ = when job level is lower than subject's own skill level
- $major\_mismatch_i$ = when subject's undergraduate major is not considered appropriate for the field of job
- E_i = A set of dummies specifying the attained educational level
- X'_i = The set of control variables
- ε_i = The error term that is assumed to be normally distributed

To prove the labor impacts of education, skill, and major mismatches depending on educational level, this paper makes three sub-groups (2 or 3-year junior college graduates, 4-year university graduates, and postgraduates) and utilize the same models. But one thing to keep in mind is that the set of dummies specifying the acquired educational level should be removed from the model because this analyzes the labor effects within subgroups that share the same level of education.

In each model, different research methods are utilized depending on the types of dependent variables. For example, when dealing with job satisfaction as the dependent variable, ordered probit regression is employed since job satisfaction is a categorical (or ordinal) variable. In addition, when the effect on turnover intention is examined which is a dummy variable, probit regression is used.

Table 1. Research methodology

Model	Key regressor	Dependent variable	Methodology
Model 1	Education mismatch (Undereducation, Overeducation)	Job satisfaction	Ordered probit regression
		Turnover intention	Probit regression
Model 2	Skill mismatch (Skill deficit, Skill surplus)	Job satisfaction	Ordered probit regression
		Turnover intention	Probit regression
Model 3	Major mismatch (Mismatch=1, Match=0)	Job satisfaction	Ordered probit regression
		Turnover intention	Probit regression
Model 4	Education mismatch Skill mismatch Major mismatch	Job satisfaction	Ordered probit regression
		Turnover intention	Probit regression

3. Descriptive statistics of variables

Table 2. Summary statistics of variable

Variable	Definition/ Measurement	N	Mean	Std. Dev.	Min	Max
Job satisfaction	How much are you satisfied with your job? (5 point scale) 1: Very Dissatisfied 5: Very Satisfied	5,051	3.639477	0.8008026	1	5
Turnover intention	Are you preparing for turnover? 1: Yes 0: No	5,051	0.1595724	0.3662452	0	1
Under-education	Compared to the education level that your job requires, your education level is higher or lower? (My education level is…) 1: much lower, lower 0: proper, higher, much higher	5,051	0.1700653	0.3757274	0	1
Over-education	Compared to the education level that your job requires, your education level is higher or lower? (My education level is…) 1: much higher, higher 0: proper, lower, much lower	5,051	0.1680855	0.3739792	0	1
Skill deficit	Compared to the skill level that your job requires, your skill level is higher or lower? (My skill level is…) 1: much lower, lower 0: proper, higher, much higher	5,051	0.1728371	0.3781438	0	1
Skill surplus	Compared to the skill level that your job requires, your skill level is higher or lower? (My skill level is…) 1: much higher, higher 0: proper, lower, much lower	5,051	0.1579885	0.3647663	0	1
Major mismatch	Do you think your major is matched with your job? 1: not matched, not matched at all 0: very well matched, matched, so-so	5,051	0.2253019	0.4178224	0	1
2 or 3-year vocational college	What is the highest level of education you have received? 1: 2 or 3-year vocational college graduates 0: Others	5,051	0.1298753	0.3361994	0	1
4-year university	What is the highest level of education you have received? 1: 4-year university graduates 0: Others	5,051	0.8004356	0.3997125	0	1
University+ postgraduate study	What is the highest level of education you have received? 1: Master/Ph.D (including enrollment, completion, graduation) 0: Others	5,051	0.0696892	0.2546477	0	1

Variable	Definition/ Measurement	N	Mean	Std. Dev.	Min	Max
Gender	What is your gender? 1: Male 0: Female	5,051	0.7406454	0.4383239	0	1
Marital status	Are you single or are you married? 1: Single 0: Married	5,051	0.9441695	0.2296169	0	1
Humanities	What is your undergraduate major? 1: Humanities 0: Others	5,051	0.1065136	0.3085243	0	1
Social Science	1: Social science 0: Others	5,051	0.2019402	0.4014876	0	1
Education	1: Education 0: Others	5,051	0.0599881	0.2374883	0	1
Engineering	1: Engineering 0: Others	5,051	0.3595328	0.479911	0	1
Science	1: Science 0: Others	5,051	0.1354187	0.3422042	0	1
Medical	1: Medical 0: Others	5,051	0.0538507	0.2257452	0	1
Art, music and physical education	1: Art, music and physical education 0: Others	5,051	0.0827559	0.2755402	0	1
GPA(University)	What is your GPA in university? (Perfect score: 4.5)	5,051	3.644946	0.3980738	0	4.5
Certificate	Do you have certificate relevant to your job? 1: Yes　　　　0: No	5,051	0.6113641	0.4874886	0	1
Job training	Have you participated in job training? 1: Yes　　　　0: No	5,051	0.1568006	0.3636487	0	1
Tenure	How long have you been at your current job? (unit: year)	5,051	1.526216	1.21617	0.08	15.25
Previous job experience	Do you have work experiences before working in your current job? 1: Yes　　　　0: No	5,051	0.2122352	0.408931	0	1
Regular job	Are you a regular worker? 1: Regular worker 0: Non-regular worker	5,051	0.8146902	0.3885872	0	1
Full-time work	Do you have a full-time job? 1: Full-time worker 0: Part-time worker	5,051	0.9518907	0.2140183	0	1
Labor union	Does your company have an organized labor union? 1: Yes　　　　0: No	5,051	0.2922194	0.4548276	0	1
Company location	Where is your company located? 1: Metropolitan area (Seoul, Gyeonggi-do, Incheon) 0: Others	5,051	0.5521679	0.4973203	0	1
Company size	How large is your company? 1: Large company 0: Small/Medium company	5,051	0.4470402	0.4972366	0	1
Benefit	How many employee benefits does your company offer? 1: More than 3 benefits (out of 5 benefits) 0: Less than 2 benefits	5,051	0.8095427	0.3927007	0	1
Wage	What is your annual wage? (Natural log of the nominal wage)	5,051	7.821062	0.443238	4.78	9.20

Table 2 presents the definition and measurement of variables as well as basic statistics such as means and standard deviations. All the data above are derived from the self-reported questionnaires.

In this article, dependent variables are job satisfaction and turnover intention. Job satisfaction is the satisfaction of one's work at a company and it is drawn from the 5-point Likert scale questionnaire: 1= very dissatisfied, 2= dissatisfied, 3=neither dissatisfied nor satisfied 4=satisfied 5=very satisfied. In addition, turnover intention, which is identified as the intention to prepare for a change in jobs, involves job seeking activities such as job searching, applying for other jobs, registering for tests for employment, and the visit to an employment agency. Respondents who were asked "are you preparing for turnover?" might answer "yes" for various reasons such as starting up a business, studying abroad, and developing a passion for another job.

The independent variables of interest are education mismatches, skill mismatches, and major mismatch. *Education mismatches* could be originally captured from the questionnaire "Compared to the level of education you have actually attained, which level of education is required for your current job, lower or higher?" On a scale of five, the survey respondents were asked the extent to which their educational level matches with the level required for the job, with 1=much lower educational level is required for the job and 5= much higher educational level is required for the job.

In order to carry out the correlation and regression analyses, this paper recoded educational mismatch to two dummy variables: *over-education* and *under-education*. To be specific, respondents who answered that their current job requires much lower (1) or lower (2) level of education are categorized into *over-education* and those who answered that their current job requires much higher (5) or higher (4) level of education are assigned *under-*

education. *Education match* which comprises respondents who responded that their education level matches with the required level for the job (3) is used as a reference category.

Skill mismatch is also converted in a similar manner to education mismatch. The data of *Skill mismatch* was obtained from the questionnaire "Compared to the skill level you have actually possessed, which level of skill is required for your current job, lower or higher?" In this sense, those who responded that their job requires much lower (1) or lower (2) skill level are categorized under *skill surplus*, and respondents who considered their job requires much higher (5) or higher (4) skill level are assigned *skill deficit*. *Skill match* which comprises respondents who responded that their skill level matches with the required level for the job (3) is used as a reference category.

The data of *Major mismatch* was collected from the questionnaire "Do you think your field of job matches with your college major?" Major mismatch was measured on a five-point scale, from 1=not matched at all to 5=perfectly matched. In contrast to education and skill mismatches, major mismatch is recoded to one dummy variable. Respondents who answered 1=not matched at all or 2=not matched are recoded as 1 and those who answered the survey with option 3=neither matched nor mismatched to 5=perfectly matched, are recoded as 0.

In order to investigate whether labor outcomes of job mismatch vary according to educational level, 5,051 sample respondents are sorted into three groups: 2 or 3-year junior college graduates, 4-year university graduates, and university plus postgraduates. In particular, university plus postgraduates represent those who graduated from 4-year university and are currently enrolled, completed, or graduated from a master's or doctorate program. According to the 2014GOMS survey conducted in 2015, there were 656 junior college graduates, 4,043 university graduates, and 352 graduate students who were currently engaging in a master's program or a combined master's and doctorate program. Among 352 graduate students, 287 students were currently enrolled in a master's program. 7 students completed the coursework

of their master's program and 23 students graduated from their master's program. Moreover, 35 students were enrolled in a combined master's and doctorate program.

As for controlled variables, this paper tries to control all relevant factors that contribute to job satisfaction and/or turnover intention in order to clarify and assess the relationship between job mismatches and job satisfaction as well as job mismatches and turnover intention. This study controls gender and marital status as demographic variables, and undergraduate majors, GPA in university, certificate, job training, tenure, and previous job experiences as human capital. As for the job-relevant variables, regular job, full-time work, labor union status, company location, company size and employee benefits are controlled for the analyses. Particularly, *Wage* is the natural log of annual wage which is calculated from the average monthly income multiplied by 12 and then taken the natural logarithm. *Benefit* was obtained from the results of the survey question "does your company offer the five employee benefits: retirement pension, paid vacation, overtime pay, special bonus, and weekly paid holiday." In this regard, respondents who answered that more than three employee benefits out of five are offered by a company were recoded as 1, and those who responded that fewer than two benefits are offered, were recoded to 0. The detailed measurement of other control variables is indicated in Table 2.

IV. Results

1. Status of education, skill, and major mismatch depending on educational level

Table 3 illustrates the cross-tabulation of two different categorical variables: education-job mismatch, skill-job mismatch, major-job mismatch, and educational level. In Table 3, more than 65% of respondents in 2014GOMS data answered that their educational level, skill level, and field of education were appropriate for their current job. In addition, the proportion of over-education and under-education were quite similar. This was quite different from findings in the literature (Noh & Lim, 2009; Cha & Chu, 2010) because previous articles argued that the number of overeducated (or over-skilled) workers were much larger than that of less-educated (or less-skilled) workers.

When we look at the cross-tabulation of educational level and education-job mismatch, junior college graduates were more likely to regard themselves as the less educated workers followed by postgraduates and university graduates. Notably, 4-year university were much more likely to work in jobs that matched with their educational level. With regard to postgraduates, the proportions of over-education for postgraduates who completed coursework and graduated from master's program were 28.57% and 39.13% respectively, which were approximately twice as large as the proportion of junior college and university graduates who were considered as overeducated. This implies that highly educated people are more likely to experience over-education as Park (2005) claimed.

With regards to skill-job mismatch, university graduates had the highest probability of getting a job that matched with their skill level. At this point, we could observe that university graduates were more likely to experience education-job match as well as skill-job match than junior college graduates or postgraduates. On the other hand, postgraduates were more likely to work in jobs that did not match with their skill levels, as shown from the higher proportions of skill deficit and skill surplus in that group as compared to other educational groups.

One interesting point is that more than 82% of postgraduates were much more likely to find jobs that were relevant to their majors compared to junior college graduates and university graduates. This finding suggested that people who pursued a master's or Ph. D programs tended to find or get jobs that were related to their majors.

Table 3. Status of education, skill, and major mismatch depending on educational level

Educational level		Education-job mismatch			Skill-job mismatch			Major-job mismatch		Total
		Under	Match	Over	Deficit	Match	Surplus	Match	Mis-match	
		Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	
2 or 3-year junior-college graduates		129 (19.66)	417 (63.57)	110 (16.77)	118 (17.99)	430 (65.55)	108 (16.46)	509 (77.59)	147 (22.41)	656 (100)
4-year univ graduates		662 (16.3)	2,698 (66.7)	683 (16.89)	687 (16.99)	2,727 (67.45)	629 (15.56)	3,113 (77.00)	930 (23.00)	4,043 (100)
Univ+ post-grad-duates	MS (E)	54 (18.82)	191 (66.55)	42 (14.63)	55 (19.16)	181 (63.07)	51 (17.77)	236 (82.23)	51 (17.77)	287 (100)
	MS (C)	0 (0.00)	5 (71.43)	2 (28.57)	1 (14.29)	5 (71.43)	1 (14.29)	6 (85.71)	1 (14.29)	7 (100)
	MS (G)	0 (0.00)	14 (60.87)	9 (39.13)	0 (0.00)	16 (69.57)	7 (30.43)	19 (82.61)	4 (17.39)	23 (100)
	MS/ Phd (E)	14 (40.0)	18 (51.43)	3 (8.57)	12 (34.29)	21 (60.00)	2 (5.71)	30 (85.71)	5 (14.29)	35 (100)
	Total	68 (19.32)	228 (64.77)	56 (15.91)	68 (19.32)	223 (63.35)	61 (17.33)	291 (82.67)	61 (17.33)	352 (100)
Total		859 (17.01)	3,343 (66.18)	849 (16.81)	873 (17.28)	3,380 (66.92)	798 (15.80)	3,913 (77.47)	1,138 (22.53)	5,051 (100)

*Abbreviation: M=Match, Univ=University, E=Enrollment, C=Completion, G=Graduation
MS=Master program, MS/Phd= The combined master's and doctorate program

Besides this, Table 4 makes use of the Pearson Chi-square for relationship between job mismatches and educational level. A Pearson Chi-square statistical test was employed to determine if there was an association between job mismatches and educational level. In addition, the Cramer's V coefficient was used to compare multiple x^2 statistics to determine the strength of the relationship.

As a result, not only education-job mismatch but also skill-job mismatch was significantly associated with educational level, although the relationship between major-mismatch and educational level was not significant. Given the *Cramer's V,* the strongest relationship was between education-job mismatch and educational level, followed by skill-job mismatch.

Table 4. Pearson Chi-square for relationship between educational level and education-job mismatch, skill-job mismatch, major-job mismatch

Variables	Education-job mismatch	Skill-job mismatch	Major-job mismatch
Educational level			
x^2	31.9909***	18.5454**	6.2
sig.	0.000	0.046	0.284
N	5,051	5,051	5,051
Cramer's V	0.0563	0.0428	0.0351

2. Labor effects of education mismatch

As Model 1 was designed to include only education-job mismatch in the regression model, we could observe the labor effects of education mismatch in this section. As shown in Table 5, two types of education mismatch, under-education and over-education, had various effects on different labor outcomes. Compared to the workers who responded that their educational levels matched the level that their jobs require, undereducated workers were more likely to have higher job satisfaction. While under-education negatively impacted turnover intention, the effect was not statistically significant. In contrast to undereducated workers, overeducated workers were more likely to have lower job satisfaction and higher turnover intention and these effects were statistically significant at 1% level. Undereducated people might be satisfied with their jobs because they regarded their jobs as the best one they could have. On the other hand, overeducated workers might not be satisfied with their jobs since they might think they could get more attractive and promising jobs with their higher degrees than their current jobs if they wanted. This might also explain why overeducated workers had higher turnover intention.

Level of education significantly influenced turnover intention while it did not have statistically significant effect on job satisfaction. Specifically, compared to 4-year university graduates, 2 or 3-year junior college graduates were more likely to have higher turnover intention. This might be attributed to huge wage gaps between two educational groups. According to the data, the average monthly salary of university graduates was ₩2,362,508, while that of junior college graduates was ₩2,113,216. In addition, the recent article pointed out the wage gap between junior college graduates and university graduates has widened, especially in the case of high quality jobs (Oh & Chae, 2014).

Besides, graduate students in master's programs were less likely to look for other jobs compared to university graduates. Considering that attaining a master's degree is a way of

becoming an expert in a specific field, graduates from these programs might get a job where they could demonstrate maximum advantage of their specialties. In this sense, their turnover intention could be lowered.

As for control variables, major, gender, full-time work, company size, benefit, and wage had statistically significant impacts on job satisfaction. For example, employees majoring in education tended to have higher job satisfaction than those majoring in humanities. On the other hand, medical students had lower job satisfaction than those who study humanities. In addition, male workers tended to have higher job satisfaction than female workers and full-time workers were found to have lower levels of job satisfaction than part-time workers. This could be affected by high-paying freelancers who work in part-time jobs. Moreover, workers were more likely to be satisfied with their jobs when they not only received higher wage and numerous benefits but also worked in large companies.

Furthermore, wage, job satisfaction, regular job, and GPA had negative effects on turnover intention. On the other hand, job training and tenures had a positive influence on the worker's decision whether to move to another job. Employees who worked in metropolitan areas were more likely to find other jobs than those who worked in non-metropolitan areas.

Table 5. Labor effects of education mismatch

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Education-job mismatch ***(Reference: education match)***		
Under-education	0.209*** (0.047)	-0.032 (0.065)
Over-education	-0.904*** (0.045)	0.280*** (0.059)
Level of education ***(Reference: 4-year university)***		
2 or 3-year vocational college	-0.024 (0.047)	0.126* (0.068)
University+ postgraduate study	0.110 (0.073)	-0.350*** (0.111)
Demographic variables Gender	0.100** (0.040)	-0.099* (0.053)
Marital status	-0.025 (0.069)	-0.006 (0.100)
Human capital ***Major*** ***(Reference: humanities)*** Social science	-0.017 (0.060)	0.100 (0.082)
Education	0.406*** (0.090)	-0.144 (0.121)
Engineering	-0.070 (0.057)	0.099 (0.079)
Science	0.075 (0.064)	-0.013 (0.091)
Medical	-0.149* (0.086)	0.071 (0.118)
Art, music and physical education	-0.003 (0.074)	0.047 (0.100)
GPA(University)	0.031 (0.041)	-0.103* (0.057)
Certificate	-0.019 (0.032)	0.073 (0.048)
Job training	0.010 (0.044)	0.104* (0.060)
Tenure	0.013 (0.014)	0.044** (0.019)
Previous job experience	-0.015 (0.042)	0.078 (0.056)
Job characteristics Regular job	0.019 (0.050)	-0.378*** (0.065)
Full-time work	-0.233*** (0.086)	0.032 (0.106)

Labor union	-0.007 (0.037)	-0.028 (0.054)
Company location	-0.011 (0.031)	0.129*** (0.046)
Company size	0.063* (0.033)	-0.043 (0.050)
Benefit	0.291*** (0.046)	-0.015 (0.063)
Wage	0.093* (0.049)	-0.372*** (0.064)
Job satisfaction level **(Reference: very unsatisfied)** Unsatisfied		-0.191 (0.181)
So-so		-0.524*** (0.170)
Satisfied		-0.858*** (0.171)
Very Satisfied		-0.845*** (0.184)
Constant		3.002*** (0.536)
N	5051	5051
pseudo R^2	0.061	0.093

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3. Labor effects of skill mismatch

      Similar to education mismatch, skill mismatch had statistically significant effect on job satisfaction and turnover intention. Employees who worked in a job that demanded higher level of skills than their own skill level were more likely to have higher job satisfaction, while those who responded that their skill level was higher than their job requirement were less likely to be satisfied with their jobs. Additionally, skill surplus was associated with higher turnover intention. It is interesting to note that the labor effects of skill deficit were similar to those of under-education. Moreover, the effects of skill surplus on job satisfaction and turnover intention were similar to those of over-education. From this result, we could suggest that employees who feel that their skills and education levels are lower than the requested level of the job are more likely to be satisfied with their jobs because they consider their current work as their best option. By contrast, when employees feel that their level of skill and education is too high for their work and therefore cannot fully utilize their skills at work, they are less likely to be satisfied with their jobs and have stronger turnover intention.

Table 6. Labor effects of skill mismatch

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Skill-job mismatch ***(Reference: skill match)***		
Skill deficit	0.175*** (0.046)	-0.010 (0.064)
Skill surplus	-0.898*** (0.047)	0.254*** (0.061)
Level of education ***(Reference: 4-year university)***		
2 or 3-year vocational college	-0.010 (0.047)	0.122* (0.068)
University+ postgraduate study	0.150** (0.074)	-0.369*** (0.111)
Demographic variables Gender	0.102** (0.040)	-0.098* (0.053)
Marital status	-0.030 (0.070)	-0.006 (0.100)
Human capital ***Major*** ***(Reference: humanities)*** Social science	0.029 (0.060)	0.085 (0.082)
Education	0.472*** (0.090)	-0.164 (0.121)
Engineering	-0.036 (0.057)	0.086 (0.079)
Science	0.138** (0.064)	-0.036 (0.091)
Medical	-0.087 (0.085)	0.044 (0.118)
Art, music and physical education	0.052 (0.074)	0.030 (0.100)
GPA(University)	0.034 (0.041)	-0.104* (0.057)
Certificate	-0.016 (0.032)	0.074 (0.048)
Job training	0.020 (0.045)	0.104* (0.060)
Tenure	0.009 (0.014)	0.045** (0.019)
Previous job experience	-0.014 (0.042)	0.080 (0.056)
Job characteristics Regular job	0.033 (0.050)	-0.385*** (0.065)
Full-time work	-0.313*** (0.085)	0.053 (0.106)

Labor union	-0.024	-0.022
	(0.037)	(0.054)
Company location	-0.014	0.129***
	(0.032)	(0.046)
Company size	0.063*	-0.041
	(0.034)	(0.050)
Benefit	0.288***	-0.015
	(0.045)	(0.063)
Wage	0.120**	-0.381***
	(0.049)	(0.064)
Job satisfaction level		
(Reference: very unsatisfied)		
Unsatisfied		-0.187
		(0.183)
So-so		-0.530***
		(0.172)
Satisfied		-0.872***
		(0.173)
Very Satisfied		-0.867***
		(0.185)
Constant		3.087***
		(0.536)
N	5051	5051
pseudo R^2	0.057	0.092

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4. Labor effects of major mismatch

Major-job mismatch had direct negative impact on job satisfaction meaning that workers who responded that their undergraduate majors matched with their jobs were more likely to have higher job satisfaction. However, there is no statistically significant relationship between major-job mismatch and turnover intention.

Table 7. Labor effects of major mismatch

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Major-job mismatch *(Reference: major match)*		
Major mismatch	-0.616*** (0.040)	0.083 (0.054)
Level of education *(Reference: 4-year university)*		
2 or 3-year vocational college	-0.009 (0.048)	0.121* (0.068)
University+ postgraduate study	0.146* (0.074)	-0.374*** (0.112)
Demographic variables Gender	0.118*** (0.039)	-0.101* (0.053)
Marital status	-0.035 (0.069)	-0.003 (0.100)
Human capital *Major* *(Reference: humanities)*		
Social science	-0.068 (0.060)	0.103 (0.082)
Education	0.338*** (0.089)	-0.154 (0.121)
Engineering	-0.116** (0.057)	0.092 (0.080)
Science	0.036 (0.064)	-0.016 (0.091)
Medical	-0.240*** (0.085)	0.059 (0.119)
Art, music and physical education	-0.065 (0.073)	0.045 (0.101)
GPA(University)	0.013 (0.040)	-0.102* (0.057)
Certificate	-0.011 (0.032)	0.070 (0.048)
Job training	0.016 (0.044)	0.109* (0.060)

Tenure	0.015	0.045**
	(0.015)	(0.019)
Previous job experience	-0.023	0.089
	(0.042)	(0.056)
Job characteristics		
Regular job	0.059	-0.396***
	(0.049)	(0.065)
Full-time work	-0.188**	0.006
	(0.087)	(0.104)
Labor union	-0.022	-0.025
	(0.037)	(0.054)
Company location	-0.035	0.138***
	(0.031)	(0.046)
Company size	0.066**	-0.042
	(0.033)	(0.050)
Benefit	0.330***	-0.021
	(0.046)	(0.063)
Wage	0.120**	-0.380***
	(0.048)	(0.064)
Job satisfaction level ***(Reference: very unsatisfied)***		
Unsatisfied		-0.214
		(0.183)
So-so		-0.596***
		(0.172)
Satisfied		-0.966***
		(0.172)
Very Satisfied		-0.972***
		(0.185)
Constant		3.220***
		(0.537)
N	5051	5,051
pseudo R^2	0.040	0.088

Standard errors in parentheses $^*\ p < 0.1$, $^{**}\ p < 0.05$, $^{***}\ p < 0.01$

5. Labor effects of education, skill, and major mismatch

Table 7 shows the result of Model 4 which explains the labor effects of education, skill and major mismatches by adding all types of mismatches in the regression Model. In this section, we discuss the net effect of each kind of mismatch and attempt to figure out what kind of mismatch has stronger impact on job satisfaction and turnover intention.

Overall, the model fit of Model 4 was greatly improved compared to other models. While the sign and significance of labor effects of education-job mismatch was held constant after skill mismatches, major mismatch, and other control variables were controlled, the magnitude of the effects of education-job mismatch decreased. However, compared to Model 1 (Table 5), the magnitude of effects of under-education on job satisfaction was decreased by 31% ((0.143-0.209)/0.209*100). This implies that 31% of the effect of under-education on job satisfaction could be explained by the effect of skill and major mismatches. In addition, the magnitude of effect of over-education on job satisfaction was increased by 45% ((-0.495-(-0.904)/0.904*100) and size of impact of over-education on turnover intention was decreased by 24% ((0.211-0.280)/0.280*100). This result showed that 45% of impact of over-education on job satisfaction could be explained by the effect of skill and major mismatches on job satisfaction and 24% of influence of over-education on turnover intention could be explained by that of skill and major mismatches. In sum, skill and major mismatches accounted for a small proportion of the labor effects of educational mismatches.

Even when controlling for all types of job mismatches, we could observe not only a significant positive effect of under-education and skill deficit on job satisfaction, but also a significant negative impact of over-education, skill surplus, and major mismatch on job satisfaction. Based on the significance and magnitudes as indicated in Table 8, education-job mismatch had a stronger impact on job satisfaction than skill and job mismatch. It is interesting

to note that the size of the impact of over-education was stronger than that of job characteristics which were directly related to job satisfaction.

Lastly, when we discuss effects of job mismatches on turnover intention, we could observe that there was a significant positive effect of over-education but the magnitude of the effect was slightly decreased by 24.6% ((0.211-0.280)/0.280*100) when other types of mismatches were controlled. With respect to major-job mismatch, major mismatch did not significantly influence turnover intention. In addition, skill surplus appeared to have no effect on turnover intention at all when controlling for education and major mismatch, whereas skill surplus had a positive impact on turnover intention as shown in Model 2 (Table 6). To sum up, we could conclude that the effect of educational mismatches with regards to turnover intention, especially over-education, was much stronger than that of skill and major mismatches.

Table 8. Labor effects of education, skill, and major mismatch

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Education-job mismatch		
(Reference: education match)		
Under-education	0.143***	-0.039
	(0.054)	(0.082)
Over-education	-0.495***	0.211**
	(0.064)	(0.085)
Skill-job mismatch		
(Reference: skill match)		
Skill deficit	0.105*	0.015
	(0.054)	(0.080)
Skill surplus	-0.414***	0.093
	(0.065)	(0.087)
Major-job mismatch		
(Reference: major match)		
Major mismatch	-0.433***	0.025
	(0.041)	(0.056)
Level of education		
(Reference: 4-year university)		
2 or 3-year vocational college	-0.008	0.125*
	(0.048)	(0.068)
University+ postgraduate study	0.091	-0.351***
	(0.074)	(0.111)
Demographic variables		
Gender	0.096**	-0.098*
	(0.040)	(0.053)
Marital status	-0.026	-0.006
	(0.070)	(0.100)
Human capital		
Major		
(Reference: humanities)		
Social science	-0.054	0.100
	(0.060)	(0.082)
Education	0.313***	-0.140
	(0.091)	(0.122)
Engineering	-0.153***	0.103
	(0.057)	(0.080)
Science	0.023	-0.014
	(0.065)	(0.092)
Medical	-0.268***	0.075
	(0.087)	(0.119)
Art, music and physical education	-0.077	0.050
	(0.074)	(0.101)
GPA(University)	-0.003	-0.102*
	(0.041)	(0.057)
Certificate	-0.016	0.074
	(0.032)	(0.048)
Job training	0.029	0.103*
	(0.044)	(0.060)
Tenure	0.013	0.044**

	(0.014)	(0.019)
Previous job experience	0.014	0.075
	(0.042)	(0.056)
Job characteristics		
Regular job	-0.007	-0.376***
	(0.050)	(0.066)
Full-time work	-0.324***	0.046
	(0.087)	(0.107)
Labor union	-0.020	-0.026
	(0.037)	(0.054)
Company location	-0.017	0.128***
	(0.032)	(0.046)
Company size	0.063*	-0.042
	(0.033)	(0.050)
Benefit	0.284***	-0.014
	(0.046)	(0.063)
Wage	0.106**	-0.375***
	(0.050)	(0.064)
Job satisfaction level		
(Reference: very unsatisfied)		
Unsatisfied		-0.184
		(0.182)
So-so		-0.507***
		(0.171)
Satisfied		-0.836***
		(0.173)
Very Satisfied		-0.823***
		(0.185)
Constant		2.968***
		(0.538)
N	5051	5051
pseudo R^2	0.075	0.093

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Labor effects of education, skill, and major mismatch depending on level of education

1) 2 or 3-year junior college graduates

(1) Job satisfaction

Table 9 presents the results of the analysis on job satisfaction among 2 or 3-year junior college graduates. Compared to the Model 2 and Model 3, Model 1 showed a better model fit, which accounted for 0.083. This implies that educational mismatch strongly influences job satisfaction level than does skill mismatch and major mismatch.

In Model 4 where all types of job mismatches were added in the regression model, over-education had significant negative impact on job satisfaction and the effect of under-education was not statistically significant. While under-education had a positive impact on job satisfaction in our previous result, there were no big difference between less-educated employees and matched employees with regard to the level of job satisfaction if they were junior college graduates.

Furthermore, the labor effects of skill-job mismatches and major mismatch in the case of junior college graduates did not give contradictory results; the skill deficit had a significantly positive impact on job satisfaction; skill surplus and major mismatch both had significantly negative influence on job satisfaction.

Table 9. Effects on job satisfaction (2 or 3-year junior college graduates)

Job Satisfaction	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	-0.127 (0.137)	-0.145 (0.136)	-0.076 (0.133)	-0.123 (0.137)
Marital status	-0.033 (0.191)	-0.023 (0.206)	-0.068 (0.201)	-0.020 (0.204)
Human capital				
Major				
(Reference: humanities)				
Social science	-0.276 (0.254)	-0.198 (0.253)	-0.200 (0.258)	-0.285 (0.250)
Education	-0.989** (0.436)	-0.917** (0.436)	-0.859** (0.424)	-1.084** (0.439)
Engineering	-0.227 (0.240)	-0.217 (0.234)	-0.239 (0.242)	-0.306 (0.233)
Science	-0.087 (0.271)	0.061 (0.264)	-0.061 (0.275)	-0.064 (0.263)
Medical	-0.632** (0.262)	-0.529** (0.254)	-0.554** (0.263)	-0.715*** (0.255)
Art, music and physical education	-0.005 (0.275)	0.074 (0.268)	0.043 (0.273)	-0.051 (0.266)
GPA(University)	0.173* (0.103)	0.139 (0.102)	0.102 (0.102)	0.140 (0.101)
Certificate	-0.065 (0.093)	-0.074 (0.093)	-0.074 (0.092)	-0.085 (0.094)
Job training	0.024 (0.129)	0.032 (0.130)	-0.017 (0.130)	0.031 (0.129)
Tenure	0.033 (0.034)	0.034 (0.034)	0.050 (0.034)	0.033 (0.034)
Previous job experience	-0.018 (0.112)	-0.028 (0.113)	-0.025 (0.112)	0.030 (0.115)
Job characteristics				
Regular job	-0.082 (0.149)	-0.039 (0.147)	0.018 (0.147)	-0.131 (0.152)
Full-time work	-0.230 (0.285)	-0.321 (0.262)	-0.172 (0.271)	-0.308 (0.278)
Labor union	0.038 (0.120)	0.022 (0.121)	0.062 (0.120)	0.044 (0.121)
Company location	-0.027 (0.089)	-0.003 (0.089)	-0.020 (0.090)	-0.020 (0.090)
Company size	0.057 (0.097)	0.052 (0.097)	0.069 (0.097)	0.051 (0.098)
Benefit	0.468*** (0.115)	0.476*** (0.117)	0.437*** (0.112)	0.458*** (0.117)
Wage	0.134	0.202	0.166	0.172

	(0.151)	(0.153)	(0.152)	(0.153)
Education-job mismatch ***(Reference: education match)***				
Under-education	0.185			-0.000
	(0.132)			(0.154)
Over-education	-1.001***			-0.648***
	(0.122)			(0.178)
Skill-job mismatch ***(Reference: skill match)***				
Skill deficit		0.254*		0.294*
		(0.142)		(0.169)
Skill surplus		-0.946***		-0.425**
		(0.121)		(0.177)
Major-job mismatch ***(Reference: major match)***				
Major mismatch			-0.502***	-0.328***
			(0.115)	(0.122)
N	656	656	656	656
pseudo *R²*	0.083	0.080	0.048	0.097

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(2) Turnover intention

Table 10 describes the results of the effects on turnover intention among 2 or 3-year junior college graduates. In comparison to Model 1 and Model 3, Model 2 shows a better model fit which accounts for 0.072. This implies that skill mismatch has a stronger impact on turnover intention than education and major mismatch in the case of junior college graduates.

In Model 1, we could observe that undereducated workers who graduated from junior colleges were more likely to have turnover intentions than educationally matched workers. On the other hand, over-education did not give any significant impact on turnover impact, which means higher level of education is not a critical determinant of having turnover intention.

Model 2 shows the effect of skill mismatches on turnover intention in the case of junior college graduates. While skill deficit had a significantly positive association with turnover intention, skill surplus had no impact on turnover intention.

As shown in the Model 3, major-job mismatch did not influence employee's turnover intention if they are graduated from 2 or 3-year junior colleges.

When we control other mismatches in a regression model (Model 4), effects of under-education and skill deficits on turnover intention were not statistically significant at all while job characteristics such as benefit and wage had statistically significant effect on turnover intention. Based on the result, we could find that education, skill, and major mismatches do not have strong impact on turnover intention for junior college graduates. For them, job characteristics including benefits and wage are more directly influence turnover intention.

Table 10. Effects on turnover intention (2 or 3-year junior college graduates)

Turnover Intention	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	0.166 (0.186)	0.152 (0.186)	0.141 (0.184)	0.145 (0.186)
Marital status	0.022 (0.239)	-0.007 (0.239)	0.015 (0.242)	-0.007 (0.239)
Human capital				
Major				
(Reference: humanities)				
Social science	-0.301 (0.297)	-0.315 (0.298)	-0.312 (0.292)	-0.297 (0.299)
Education	-0.401 (0.674)	-0.414 (0.673)	-0.470 (0.667)	-0.364 (0.675)
Engineering	-0.472* (0.268)	-0.476* (0.270)	-0.434 (0.268)	-0.449* (0.272)
Science	-0.796** (0.329)	-0.807** (0.327)	-0.773** (0.328)	-0.783** (0.327)
Medical	-0.333 (0.305)	-0.373 (0.303)	-0.342 (0.300)	-0.313 (0.309)
Art, music and physical education	-0.386 (0.320)	-0.389 (0.323)	-0.388 (0.318)	-0.358 (0.324)
GPA(University)	0.126 (0.146)	0.120 (0.146)	0.145 (0.144)	0.126 (0.145)
Certificate	0.064 (0.126)	0.068 (0.126)	0.055 (0.126)	0.077 (0.126)
Job training	-0.187 (0.189)	-0.189 (0.192)	-0.189 (0.189)	-0.191 (0.192)
Tenure	-0.026 (0.042)	-0.027 (0.043)	-0.025 (0.041)	-0.028 (0.042)
Previous job experience	0.005 (0.151)	0.001 (0.151)	0.005 (0.150)	-0.023 (0.152)
Job characteristics				
Regular job	-0.226 (0.182)	-0.258 (0.184)	-0.215 (0.183)	-0.229 (0.184)
Full-time work	-0.441 (0.271)	-0.424 (0.273)	-0.443* (0.267)	-0.425 (0.273)
Labor union	-0.057 (0.163)	-0.059 (0.164)	-0.056 (0.163)	-0.065 (0.164)
Company location	0.102 (0.122)	0.105 (0.122)	0.116 (0.122)	0.110 (0.122)
Company size	0.054 (0.134)	0.055 (0.134)	0.043 (0.133)	0.055 (0.134)
Benefit	0.306* (0.162)	0.300* (0.161)	0.325** (0.161)	0.308* (0.162)
Wage	-0.376* (0.271)	-0.378* (0.271)	-0.361* (0.267)	-0.376* (0.273)

	(0.199)	(0.201)	(0.199)	(0.200)
Job satisfaction level **_(Reference: very unsatisfied)_**				
Unsatisfied	-0.841	-0.830	-0.803	-0.769
	(0.652)	(0.653)	(0.673)	(0.661)
So-so	-0.708	-0.687	-0.736	-0.607
	(0.631)	(0.631)	(0.652)	(0.640)
Satisfied	-1.050[*]	-1.031	-1.076	-0.936
	(0.636)	(0.636)	(0.658)	(0.647)
Very Satisfied	-0.957	-0.988	-0.955	-0.878
	(0.661)	(0.661)	(0.682)	(0.673)
Education-job mismatch **_(Reference: education match)_**				
Under-education	0.257[*]			0.053
	(0.154)			(0.204)
Over-education	0.263			0.123
	(0.164)			(0.225)
Skill-job mismatch **_(Reference: skill match)_**				
Skill deficit		0.337[**]		0.286
		(0.157)		(0.208)
Skill surplus		0.263		0.154
		(0.166)		(0.230)
Major-job mismatch **_(Reference: major match)_**				
Major mismatch			0.199	0.142
			(0.142)	(0.148)
Constant	2.945[*]	3.021[*]	2.822[*]	2.804[*]
	(1.673)	(1.676)	(1.669)	(1.675)
N	656	656	656	656
pseudo R^2	0.070	0.072	0.066	0.074

Standard errors in parentheses [*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$

2) 4-year university graduates

(1) Job satisfaction

In this section, we analyzed the effects of job mismatches on job satisfaction in the case of 4-year university graduates. When we referred to fit of the model, job satisfaction level was strongly influenced by education-job mismatches compared to skill-job mismatch and major-job mismatch to university graduates.

In Model 1, for those who graduated from universities, undereducated workers were more likely to be satisfied with their jobs and overeducated workers were less likely to be satisfied with their jobs. Both effects were statistically significant.

Model 2 shows the effect of skill mismatches on job satisfaction level of employees who graduated from 4-year universities. Both skill deficit and skill surplus had statistically significant impacts on job satisfaction; university graduates whose skill level was not higher than the desired level by the job were more likely to be satisfied with their jobs. On the other hand, university graduates who regarded themselves as over-skilled workers tended to have lower job satisfaction.

As shown in the Model 3, major-job mismatch influenced the level of employee's job satisfaction if they were graduated from universities. In Model 4, effects of skill deficits on job satisfaction were not statistically significant at all, as other types of job mismatches were controlled.

Table 11. Effects on job satisfaction (4-year university graduates)

Job Satisfaction	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	0.109** (0.043)	0.114*** (0.043)	0.122*** (0.043)	0.103** (0.043)
Marital status	-0.013 (0.076)	-0.014 (0.076)	-0.021 (0.075)	-0.014 (0.076)
Human capital				
Major				
(Reference: humanities)				
Social science	0.019 (0.064)	0.063 (0.064)	-0.040 (0.064)	-0.025 (0.064)
Education	0.449*** (0.097)	0.505*** (0.097)	0.375*** (0.096)	0.347*** (0.097)
Engineering	-0.060 (0.062)	-0.023 (0.062)	-0.101 (0.062)	-0.144** (0.063)
Science	0.089 (0.070)	0.144** (0.070)	0.052 (0.070)	0.027 (0.071)
Medical	0.019 (0.106)	0.070 (0.105)	-0.101 (0.104)	-0.111 (0.108)
Art, music and physical education	-0.013 (0.082)	0.047 (0.082)	-0.068 (0.081)	-0.096 (0.082)
GPA(University)	-0.005 (0.047)	0.003 (0.047)	-0.015 (0.046)	-0.041 (0.048)
Certificate	-0.009 (0.036)	-0.004 (0.036)	0.007 (0.036)	-0.005 (0.036)
Job training	0.019 (0.049)	0.029 (0.049)	0.032 (0.048)	0.041 (0.049)
Tenure	0.005 (0.016)	-0.003 (0.016)	0.002 (0.016)	0.005 (0.016)
Previous job experience	-0.022 (0.047)	-0.021 (0.047)	-0.033 (0.046)	0.001 (0.047)
Job characteristics				
Regular job	-0.001 (0.058)	0.015 (0.058)	0.035 (0.057)	-0.032 (0.058)
Full-time work	-0.051 (0.102)	-0.147 (0.103)	-0.028 (0.105)	-0.135 (0.104)
Labor union	-0.012 (0.040)	-0.026 (0.040)	-0.033 (0.040)	-0.030 (0.040)
Company location	-0.014 (0.035)	-0.018 (0.035)	-0.044 (0.035)	-0.020 (0.036)
Company size	0.067* (0.038)	0.060 (0.038)	0.058 (0.038)	0.069* (0.038)
Benefit	0.258*** (0.053)	0.253*** (0.052)	0.318*** (0.053)	0.247*** (0.053)
Wage	0.047	0.087	0.112*	0.059

	(0.058)	(0.058)	(0.057)	(0.059)
Education-job mismatch *(Reference: education match)*				
Under-education	0.227***			0.176***
	(0.052)			(0.060)
Over-education	-0.886***			-0.472***
	(0.051)			(0.072)
Skill-job mismatch *(Reference: skill match)*				
Skill deficit		0.164***		0.080
		(0.051)		(0.060)
Skill surplus		-0.892***		-0.423***
		(0.053)		(0.075)
Major-job mismatch *(Reference: major match)*				
Major mismatch			-0.620***	-0.450***
			(0.044)	(0.045)
N	4043	4043	4043	4043
pseudo R^2	0.059	0.055	0.040	0.075

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(2) Turnover intention

In this section, we analyzed the effects on turnover intention among 4-year university graduates. Surprisingly, the model fit of Model 1 and Model 4 were similar, even though Model 4 included not only education-job mismatch but also skill and major mismatches. This implies that education-job mismatch has a relatively strong influence on employee's turnover intention.

In Model 1, over-education showed a positive influence on worker's turnover intention and the effect was statistically significant. In addition, effect of skill surplus was statistically positive as described in Model 2. However, when education-job mismatch and major-job mismatch were controlled at once (Model 4), such effects were gone. We could conclude that education mismatch has far more impact on employee's turnover intention among 4-year university graduates.

Table 12. Effects on turnover intention (4-year university graduates)

Turnover Intention	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	-0.091 (0.059)	-0.093 (0.059)	-0.093 (0.059)	-0.091 (0.059)
Marital status	-0.020 (0.115)	-0.022 (0.115)	-0.018 (0.115)	-0.021 (0.115)
Human capital *Major* *(Reference: humanities)*				
Social science	0.170* (0.091)	0.158* (0.090)	0.169* (0.090)	0.170* (0.091)
Education	-0.023 (0.132)	-0.044 (0.131)	-0.037 (0.132)	-0.024 (0.133)
Engineering	0.182** (0.090)	0.168* (0.090)	0.163* (0.090)	0.183** (0.091)
Science	0.098 (0.102)	0.078 (0.102)	0.084 (0.103)	0.097 (0.103)
Medical	0.160 (0.144)	0.139 (0.144)	0.147 (0.145)	0.161 (0.146)
Art, music and physical education	0.012 (0.114)	-0.011 (0.114)	-0.006 (0.116)	0.011 (0.115)
GPA(University)	-0.088 (0.065)	-0.089 (0.065)	-0.092 (0.065)	-0.086 (0.066)
Certificate	0.041 (0.055)	0.040 (0.054)	0.037 (0.055)	0.041 (0.055)
Job training	0.151** (0.067)	0.150** (0.067)	0.153** (0.067)	0.150** (0.067)
Tenure	0.074*** (0.024)	0.076*** (0.024)	0.076*** (0.024)	0.074*** (0.024)
Previous job experience	0.116* (0.063)	0.118* (0.063)	0.126** (0.063)	0.115* (0.063)
Job characteristics				
Regular job	-0.404*** (0.073)	-0.412*** (0.073)	-0.422*** (0.073)	-0.403*** (0.074)
Full-time work	0.177 (0.138)	0.198 (0.138)	0.163 (0.136)	0.182 (0.139)
Labor union	-0.032 (0.061)	-0.028 (0.061)	-0.030 (0.061)	-0.032 (0.061)
Company location	0.184*** (0.053)	0.186*** (0.053)	0.192*** (0.053)	0.184*** (0.053)
Company size	0.003 (0.057)	0.007 (0.057)	0.011 (0.057)	0.003 (0.057)
Benefit	-0.120* (0.072)	-0.121* (0.072)	-0.135* (0.072)	-0.119* (0.072)
Wage	-0.540*** 	-0.556*** 	-0.563*** 	-0.541***

	(0.081)	(0.082)	(0.081)	(0.081)
Job satisfaction level *(Reference: very unsatisfied)*				
Unsatisfied	-0.195	-0.200	-0.225	-0.194
	(0.200)	(0.201)	(0.200)	(0.200)
So-so	-0.598***	-0.616***	-0.674***	-0.595***
	(0.188)	(0.190)	(0.187)	(0.189)
Satisfied	-0.947***	-0.977***	-1.063***	-0.943***
	(0.189)	(0.191)	(0.188)	(0.191)
Very Satisfied	-0.950***	-0.985***	-1.083***	-0.943***
	(0.203)	(0.205)	(0.203)	(0.205)
Education-job mismatch *(Reference: education match)*				
Under-education	-0.096			-0.067
	(0.078)			(0.097)
Over-education	0.250***			0.229**
	(0.067)			(0.096)
Skill-job mismatch *(Reference: skill match)*				
Skill deficit		-0.086		-0.045
		(0.075)		(0.094)
Skill surplus		0.201***		0.028
		(0.070)		(0.098)
Major-job mismatch *(Reference: major match)*				
Major mismatch			0.053	0.004
			(0.062)	(0.064)
Constant	4.163***	4.325***	4.518***	4.159***
	(0.650)	(0.649)	(0.648)	(0.652)
N	4043	4043	4043	4043
pseudo R^2	0.117	0.115	0.112	0.117

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3) University plus postgraduates (Master/ Ph.D)

(1) Job satisfaction

Here, the effects on job satisfaction among the master's and Ph.D. students are discussed. Model 1 has a better model fit when we compare it with Model 2 and Model 3. This suggests that education-job mismatch has relatively stronger impacts on employee's job satisfaction compared to skill-job and major-job mismatches.

In Model 1, when we included only educational mismatches in the regression model, over-education had significant negative impact on job satisfaction while under-education had no significant impact. As for the skill-job mismatches, Model 2 showed that skill surplus has negative relationship with employee's job satisfaction and the effect is statistically significant at 1% level. However, the effect of skill deficit had no impact on job satisfaction among postgraduate students. In addition, major mismatch had a statistically negative association with job satisfaction as shown in the Model 3.

When we incorporated education, skill, and major mismatches in the regression estimation, we could find that over-education and major mismatch maintained the sign of the effects on job satisfaction. Under-education and skill deficit also did not affect the level of job satisfaction as shown in the Model 1 and Model 2. However, with regard to skill surplus, it had negative effect on job satisfaction but the effect is statistically significant at 10%.

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Table 13. Effects on job satisfaction (university plus postgraduates)

Job Satisfaction	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	0.183 (0.165)	0.142 (0.163)	0.163 (0.161)	0.165 (0.163)
Marital status	-0.315 (0.418)	-0.524 (0.440)	-0.349 (0.439)	-0.501 (0.451)
Human capital ***Major*** ***(Reference: humanities)***				
Social science	-0.324 (0.303)	-0.279 (0.300)	-0.343 (0.293)	-0.292 (0.294)
Education	0.417 (0.291)	0.571** (0.291)	0.264 (0.261)	0.383 (0.290)
Engineering	0.038 (0.201)	0.100 (0.199)	-0.100 (0.194)	-0.028 (0.201)
Science	0.168 (0.228)	0.252 (0.220)	0.064 (0.221)	0.151 (0.228)
Medical	-0.429 (0.333)	-0.325 (0.331)	-0.579* (0.345)	-0.536 (0.341)
Art, music and physical education	0.112 (0.263)	0.155 (0.269)	-0.138 (0.267)	0.054 (0.260)
GPA(University)	0.215 (0.162)	0.210 (0.162)	0.138 (0.162)	0.197 (0.163)
Certificate	-0.102 (0.131)	-0.092 (0.129)	-0.074 (0.128)	-0.077 (0.131)
Job training	-0.004 (0.209)	-0.014 (0.208)	-0.075 (0.212)	-0.035 (0.212)
Tenure	-0.040 (0.049)	-0.046 (0.050)	-0.063 (0.055)	-0.050 (0.050)
Previous job experience	-0.126 (0.205)	-0.150 (0.208)	-0.127 (0.207)	-0.128 (0.208)
Job characteristics				
Regular job	0.288* (0.152)	0.265* (0.153)	0.356** (0.143)	0.326** (0.148)
Full-time work	-0.856*** (0.199)	-0.913*** (0.188)	-0.754*** (0.189)	-0.960*** (0.195)
Labor union	-0.015 (0.152)	-0.057 (0.153)	-0.021 (0.152)	-0.038 (0.148)
Company location	0.107 (0.121)	0.070 (0.120)	0.077 (0.122)	0.102 (0.123)
Company size	0.288* (0.155)	0.322** (0.154)	0.256* (0.152)	0.293* (0.157)
Benefit	0.376** (0.149)	0.363** (0.150)	0.370** (0.149)	0.392** (0.153)

Wage	0.264**	0.248**	0.145	0.245**
	(0.121)	(0.120)	(0.118)	(0.121)
Education-job mismatch				
(Reference: education match)				
Under-education	0.096			0.003
	(0.184)			(0.200)
Over-education	-1.198***			-0.695***
	(0.151)			(0.236)
Skill-job mismatch				
(Reference: skill match)				
Skill deficit		0.148		0.131
		(0.179)		(0.192)
Skill surplus		-1.084***		-0.388*
		(0.154)		(0.225)
Major-job mismatch				
(Reference: major match)				
Major mismatch			-0.912***	-0.510***
			(0.165)	(0.179)
N	352	352	352	352
pseudo R^2	0.097	0.090	0.072	0.111

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

(2) Turnover intention

In this section, we analyzed the impacts of job mismatches on turnover intention among master's and Ph. D students. Surprisingly, as in the case of junior college graduates, the model fit of Model 2 has the largest number, followed by Model 1 and Model 3. In addition, according to Model 1, both under-education and over-education had no significant effects on employee's turnover intention. This implies that the postgraduates are not strongly influenced by education-job mismatches in terms of turnover intention.

In addition, we could observe that skill surplus had a statistically significant influence on turnover intention in a positive way, while skill deficit and major mismatch had no significant impact on turnover intention as presented in Model 2 and Model 3.

In Model 4, there was a statistically significant effect of skill surplus on turnover intention while other types of job mismatches did not have any significant impacts. From these findings we could infer that skill mismatches, especially skill surplus, strongly influence employee's turnover intention rather than education and major mismatches. At this point, we could suggest that postgraduates tend to leave their current jobs when they think their work does not match with their skill levels, since majority of postgraduates usually aim to advance their technical skills in specific areas and hope to fully utilize the skills developed during their master's or doctorate programs.

Table 14. Effects on turnover intention (university plus postgraduates)

Turnover Intention	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	-0.564**	-0.552**	-0.530**	-0.549**
	(0.220)	(0.220)	(0.222)	(0.221)
Marital status	-0.073	0.113	-0.100	0.116
	(0.506)	(0.500)	(0.495)	(0.487)
Human capital				
Major				
(Reference: humanities)				
Social science	-0.456	-0.470	-0.453	-0.508
	(0.411)	(0.419)	(0.402)	(0.415)
Education	-0.883	-0.925	-0.921	-0.993*
	(0.575)	(0.577)	(0.578)	(0.591)
Engineering	0.031	0.013	0.036	-0.048
	(0.289)	(0.289)	(0.292)	(0.297)
Science	-0.445	-0.499	-0.425	-0.565*
	(0.316)	(0.318)	(0.322)	(0.327)
Medical	-0.324	-0.331	-0.370	-0.428
	(0.443)	(0.444)	(0.445)	(0.450)
Art, music and physical education	0.280	0.219	0.320	0.187
	(0.384)	(0.389)	(0.380)	(0.397)
GPA(University)	-0.337	-0.365	-0.299	-0.367
	(0.216)	(0.222)	(0.217)	(0.223)
Certificate	0.248	0.237	0.245	0.248
	(0.185)	(0.186)	(0.184)	(0.187)
Job training	-0.017	-0.036	0.025	-0.059
	(0.271)	(0.273)	(0.271)	(0.273)
Tenure	-0.004	-0.004	0.000	-0.002
	(0.069)	(0.069)	(0.069)	(0.069)
Previous job experience	-0.436	-0.423	-0.406	-0.407
	(0.286)	(0.296)	(0.277)	(0.294)
Job characteristics				
Regular job	-0.334	-0.324	-0.355	-0.307
	(0.231)	(0.231)	(0.227)	(0.234)
Full-time work	-0.026	0.072	-0.078	0.045
	(0.267)	(0.282)	(0.268)	(0.284)
Labor union	-0.052	-0.020	-0.041	-0.023
	(0.215)	(0.216)	(0.214)	(0.218)
Company location	-0.333*	-0.345*	-0.309*	-0.336*
	(0.182)	(0.181)	(0.181)	(0.182)
Company size	-0.233	-0.277	-0.230	-0.280
	(0.209)	(0.215)	(0.208)	(0.215)
Benefit	0.091	0.078	0.105	0.092
	(0.204)	(0.206)	(0.204)	(0.209)
Wage	0.055	0.039	0.092	0.049

	(0.165)	(0.165)	(0.160)	(0.167)
Job satisfaction level *(Reference: very unsatisfied)*				
Unsatisfied	0.520	0.575	0.461	0.643
	(0.657)	(0.688)	(0.631)	(0.688)
So-so	-0.074	-0.019	-0.199	0.004
	(0.626)	(0.656)	(0.598)	(0.659)
Satisfied	-0.286	-0.193	-0.462	-0.188
	(0.635)	(0.664)	(0.603)	(0.671)
Very Satisfied	-0.494	-0.359	-0.692	-0.384
	(0.671)	(0.702)	(0.645)	(0.706)
Education-job mismatch *(Reference: education match)*				
Under-education	0.130			0.207
	(0.231)			(0.235)
Over-education	0.340			-0.128
	(0.247)			(0.383)
Skill-job mismatch *(Reference: skill match)*				
Skill deficit		0.125		-0.009
		(0.233)		(0.238)
Skill surplus		0.571**		0.728*
		(0.243)		(0.377)
Major-job mismatch *(Reference: major match)*				
Major mismatch			0.033	-0.160
			(0.247)	(0.267)
Constant	0.896	0.767	0.734	0.743
	(1.790)	(1.794)	(1.778)	(1.801)
N	352	352	352	352
pseudo R^2	0.129	0.141	0.122	0.144

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

V. Robustness Check

This section is to check for the robustness of the sign, size, and statistical significance of the estimated regression. The cross-sectional study utilizing the Graduate Occupational Mobility Survey (GOMS) done in 2015 has the advantage of capturing the relationship between job mismatches and labor outcomes in 2015. However, it might cause problems due to small sample size. In particular, the sample size of *university plus postgraduates* is only 352 and most of them are not yet graduated from master's or Ph. D programs. In order to tackle such problems, this paper increases sample sizes by pooling GOMS data for three consecutive years, ranging from 2012GOMS1 to 2014GOMS1 for robustness check. In doing so, the pooled data allows us to analyze the labor impacts of job mismatches within sub-groups that would be too small, such as *university plus postgraduates*. This paper re-estimates all models by using such pooled cross-sectional time series data and adding time dummy variables to the models. This section demonstrates whether the results are drawn in a robust manner by comparing the results from one cross-sectional data and pooled cross-sectional data. All the results of this robustness check are placed in the Appendix.

Overall, robustness check confirms that the results are robust because similar results with regards to the sign and size of the estimated coefficients compared to previous results were obtained. On the other hand, some labor effects of job mismatches become statistically significant due to the larger sample size; 1) while the relationship between major-job mismatch and educational level was not statistically significant in our previous results, the two show statistically significant relationship in the robustness check (Appendix 2); 2) major-job mismatch has a substantially positive effect on turnover intention and the effect is statistically significant at 5% level (Appendix 5); 3) the effect of under-education on job satisfaction among junior college graduates becomes significantly positive (Appendix 7-(1)); 4) the influence of skill deficit on job satisfaction becomes statistically positive (Appendix 7-(3)); 5) skill deficit

has significant positive impact on employee's job satisfaction (Appendix 7-(5)); 6) the effect of skill deficit becomes statistically significant at 10% (Appendix 7-(6)).

Such different results might be obtained due to larger sample size and a unique feature of 2014GOMS data. To be specific, larger sample size raises the probability of obtaining statistical significance. In addition, compared to previous survey years (2013GOMS and 201GOMS), a larger number of respondents in 2014GOMS data tend to answer to the question in a positive way; more respondents answered that their educational level, skill level, and college major were well-matched with their job.

VI. Discussion & Conclusions

To analyze labor outcomes of job mismatches, the paper drew on data from GOMS surveyed in 2015 which is the most recent data. Following the previous literatures on job mismatch, we have distinguished three types of job mismatches which are measured by self-report measurement: education-job mismatch, skill-job mismatch, and major-job mismatch. Among education-job mismatch, under-education indicates working in a job that requires a higher level of education than one's own and over-education refers to working in a job that requires a lower level of education than one's own. In addition, skill deficit represents individuals working in jobs for which a higher skill level than their own is required and skill surplus indicates individuals working in jobs for which a lower skill level than their own is required. Lastly, major mismatch means that one's acquired field of education does not match with field of education required for the job.

Overall, the main purpose of this study was to investigate the effects of education, skill, and major mismatches on labor outcomes including job satisfaction and turnover intention. The results of the robustness check confirmed that the sign and significance of correlation coefficients were aligned with previous results. In this regard, our main findings are as follows:

Firstly, under-education and skill deficit have significantly positive effects on job satisfaction. Due to the ambiguous results for under-educated/under-skilled workers, it is more difficult to understand the situation of under-education and skill deficit than the situation of over-education and skill surplus. However, the rationale behind the significantly positive effects of undereducation and skill deficit could be found in recent studies that have argued under-education and skill deficits are not always bad. One possible explanation is that working in a job that requires higher education level is relevant to higher earnings as compared to occupations that do not require such levels of higher education. This in turn leads to higher job satisfaction for the under-educated workers (Canal Domínguez & Rodríguez Gutiérrez, 2013).

Another possible explanation that is relevant is the opportunity for skill development caused by job training and learning opportunities. Some studies have suggested that under-educated employees are more likely to participate in training (Buchel & Mertens, 2004) or have more learning opportunities (Korepi & Tahlin, 2009) given to them. Moreover, working in an environment which demands some more (but not too much more) skills positively affects the number of spontaneous learning opportunities and less-skilled workers are more often engaged in informal learning-on-the-job-activities such as instruction by supervisors and coworkers (Van der Velden & Verhaest, 2017). They also highlighted that at the start of their jobs, workers who were lesser-skilled showed the largest increase in skill development as time went on. For these reasons, undereducated and unskilled workers tend to have higher job satisfaction due to relatively higher salary raises and rapid increase in skill development resulting from training.

Second, this study found that over-education and skill surplus have had significantly negative impact on job satisfaction and a positive impact on turnover intention, which supports the results obtained in previous studies - that over-educated/over-skilled workers have a lower rate of job satisfaction (Tsang & Levin, 1985; Hersch, 1991; Hartog, 2000; Allen & Van der Velden, 2001; Park, 2004; Cha & Chu, 2010), as well as a higher turnover intention (Topel, 1986; Hersch, 1991; Park, 2004; Park, 2005; Cha & Chu, 2010; Van der Velden & Verhaest, 2017). As suggested in previous research, since these workers tend to see less opportunities to deploy the skills that they have developed, they are less satisfied with their jobs and wish to find another occupation where they are able to fully utilize their skills. As a result, the first and the second findings prove the validity of research questions 1 and 2.

Third, with regard to research question 3, this paper has found that employees who experience job mismatches with respect to their original major in university are less likely to be satisfied with their jobs. As Wolbers claimed (2003), whether having a major-mismatch is in itself a negative circumstance has become a controversial issue in terms of study on major

mismatch. Some studies stated that major-job mismatch should not be considered as negative because it could reflect the flexibility of that field of education in switching to alternative jobs. On the other hand, other studies have argued that major-job mismatch leads to negative consequences because it is the result of discrepancies between the acquired and required occupation-specific skills. At this point, the empirical result in this study implies that the latter interpretation is dominant by showing that employees who work in a field that does not match with their college majors tended to have a lower rate of job satisfaction.

Next, when it comes to research question 4, the effect of skill-job mismatch and major-job mismatch could explain quite a sizable portion of the effect of under-education and over-education on job satisfaction, which turned up at 31% and 45% respectively. On the other hand, only 24.6% of the influence of over-education on turnover intention could be explained by that of skill and major mismatches. In this sense, a relatively higher proportion of the effects of education-job mismatch on job satisfaction is accounted for by that of skill-job and major-job mismatches.

Following that, the labor effects of job mismatches according to the educational levels: were analyzed – according to junior college graduates, university graduates, and postgraduates - as indicated in research question 5. While no big difference existed in terms of effects of major mismatch, two different outcomes were found regarding the effects of education and skill mismatch; 1) under-education does not have a statistically significant influence on job satisfaction in the case of postgraduates; while it has a significantly positive impact in the case of junior college graduates and university graduates; and 2) over-education causes a higher rate turnover intention in the case of 4-year university graduates, while a skill-job mismatch has a higher influence on turnover intention in the case of postgraduates from master's or doctorate programs.

To explain further, undereducation does not have a statistically significant impact on job satisfaction on workers who are postgraduates because the wage gap between under-educated and educationally well-matched workers is not huge at ₩1,250,882 and ₩1,348,772 respectively. In particular, given the higher proportion of postgraduates who are enrolled in master's or combined master's and doctorate programs, they tend to work in a small range of occupations which mainly utilize professional or technical skills learnt from the educational programs (i.e. research assistants at university or at research institutes). Such a narrow choice of occupational options result in under-educated workers from those fields to feel indifferent from educationally-matched workers.

Furthermore, with respect to turnover intention, postgraduates tend to be influenced by skill surplus whereas university graduates tend to be affected by overeducation. Postgraduates who pursue a master's or doctorate degree aim to develop skills in a specific field and they tend to find jobs that fully utilize their skills that they have learnt through master's or doctorate programs (Paolo & Mañé, 2016). As a result, postgraduate students are more sensitive to skill-job mismatches than other sub groups and postgraduates wish to seek for another occupation where they make full use of their professional and technical skills. On the other hand, 4-year university graduates are more likely to work in jobs which require skills that could be developed and learned from training. Therefore, it could be said that 4-year university graduates would not be affected much in the case of a poor mismatch between their existing and required skill levels compared to postgraduates. In contrast to skill mismatches, university graduates are more likely to avoid the workplace where majority of workers have a lower educational level than what they themselves have attained (i.e. junior college graduates, high school graduates) due to the lower wages (Cha & Chu, 2010).

To sum up, the key contributions of this research to conducting a comprehensive and extensive study on the effects of job mismatches in Korean labor market are as follows: first,

this paper investigated the effects of job mismatches by dividing the information into three categories separately: education-job mismatch, skill-job mismatch, and major-job mismatch. Second, this study aimed to explore not only the effects of overeducation and skill surplus but also that of undereducation, skill deficit, and major mismatch which have not been thoroughly carried out for years. Finally, this article extended the research and tried to find the different outcomes of job mismatches by educational level: junior college graduates, university graduates, and university plus postgraduates.

VII. Limitations and Future Research

Nevertheless, this paper has areas to be improved in terms of its small sample size of postgraduates and subjective measurement. In this study, the sample size of postgraduates is relatively small, which is about one half of junior college graduates and one eleventh of university graduates. Furthermore, majority of the postgraduates sampled are current enrolled students and only a few are postgraduates who have completed their coursework or already graduated from master's or doctorate programs. Due to the many findings that argue highly educated people are more likely to suffer from over-education and skill surplus, studies on impacts of job mismatches among Ph.D. students have recently also been carried out (Shin, Kim, & Lim, 2010; Canal Domínguez & Rodríguez Gutiérrez, 2013; Paolo & Mañé, 2016). In contrast, little research regarding the issue of job mismatches among master's graduates has been conducted. In fact, as the number of master's graduates has rapidly increased by 42% from 47,226 in 2000 to 81,460 in 2016 (KESS, 2000; KESS, 2016), this has raised concerns about the possible negative outcomes of their misplacement in the Korean labor market. In this light, further study is necessary to analyze the effects of job mismatch with special focus on master's graduates. In order to conduct a thorough and extensive analysis on the labor outcomes

of job mismatches in the case of master's graduates, a larger number of respondents who completed the master's coursework and/or who graduated from master' programs are necessary.

Furthermore, the results could be distorted due to the self-report measurement of education, skill, and major mismatches which are heavily dependent on subjective judgement. As Hartog addresses (2000), in the case where mismatches are measured by self-report measurement, respondents might answer that their education or skill levels are higher than the level required for the job when they are dissatisfied with their job. In addition, employees are more likely to overestimate their own education or skill levels (Noh & Lim, 2009). In this light, objective measurement of job mismatches would be needed for further research on effects of mismatches.

VIII. Policy Implications

These research findings could draw practical implications for human resource managers in various types of industries, schools, and government specialized in the field of education and labor. First of all, considering that the labor outcomes of undereducation/skill deficit and overeducation/skill surplus are different, different incentives and strategies should be employed for under-educated/under-skilled workers as well as over-educated/over-skilled workers. For instance, under-educated people should be provided with more learning opportunities that would enable them to develop the additional skills required for the jobs, which would result in higher job satisfaction. On the other hand, for the over-educated and over-skilled workers, human resource managers, for example, should put concerted efforts to minimize the low rate of productivity caused by their extra educational qualifications and skill surplus by providing more opportunities such as department rotations that would enable workers to find a position that is appropriate for their educational and skill levels.

Besides this, the school should also play a key role in teaching the technical skills that are required for jobs in order to reduce the skill gap between tertiary education and industry. Moreover, the school should offer various internship opportunities to students in order to help them find the field of work that they are interested in, and get a hands-on experience.

Lastly, considering that overeducation, skill surplus, and major mismatch have negative impacts on labor outcomes in Korea, strengthening industry-academic cooperation in order to close the huge mismatch between tertiary education and industry should be prioritized. To this end, the Korean government has endeavored to strengthen the linkages between education and work through financial and institutional support so far. Furthermore, policy makers should also play a crucial role in helping to creating the supply of and demand for quality jobs which would enable the proportion of over-educated and over-skilled workers to fully utilize their professional skills and increase their competitiveness.

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Appendix

1. Status of education, skill and major mismatch depending on educational level (Pooled data from 2012GOMS1 to 2014GOMS1)

Educational level		Education-job mismatch			Skill-job mismatch			Major-job mismatch		Total
		Under	Match	Over	Deficit	Match	Surplus	Match	Mis-match	
		Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	Freq (%)	
2 or 3-year junior-college graduates		298 (18.05)	1,044 (63.23)	309 (18.72)	292 (17.69)	1,062 (64.32)	297 (17.99)	1,237 (74.92)	414 (25.08)	1,651 (100)
4-year univ graduates		1,550 (16.09)	6,312 (65.52)	1,771 (18.38)	1,667 (17.31)	6,361 (66.03)	1,605 (16.66)	7,351 (76.31)	2,282 (23.69)	9,633 (100)
Univ+ post-grad-duates	MS (E)	124 (20.70)	385 (64.27)	90 (15.03)	`107 (17.86)	391 (65.28)	101 (16.86)	510 (85.14)	89 (14.86)	599 (100)
	MS (C)	1 (10.00)	6 (60.00)	3 (30.00)	2 (20.00)	7 (70.00)	1 (10.00)	9 (90.00)	1 (10.00)	10 (100)
	MS (G)	4 (7.41)	35 (64.81)	15 (27.78)	3 (5.56)	39 (72.22)	12 (22.22)	46 (85.19)	8 (14.81)	54 (100)
	MS/Phd (E)	25 (36.23)	39 (56.52)	5 (7.25)	25 (36.23)	39 (56.52)	5 (7.25)	62 (89.86)	7 (10.14)	69 (100)
	Total	154 (21.04)	465 (63.52)	113 (15.44)	137 (18.72)	476 (65.03)	119 (16.26)	627 (85.66)	105 (14.34)	732 (100)
Total		2,002 (16.66)	7,821 (65.09)	2,193 (18.25)	2,096 (17.44)	7,899 (65.74)	2,021 (16.82)	9,215 (76.69)	2,801 (23.31)	12,016 (100)

*Abbreviation: M=Match, Univ=University, E=Enrollment, C=Completion, G=Graduation
MS=Master program, MS/Phd= The combined master's and doctorate program

2. Pearson Chi-Square for relationship between educational level and education-job mismatch, skill-job mismatch, major-job mismatch

Variables	Education-job mismatch	Skill-job mismatch	Major-job mismatch
Educational level			
x^2	42.3237***	26.9715***	37.4515***
sig.	0.000	0.003	0.000
N	12,016	12,016	12,016
Cramer's V	0.0420	0.0335	0.0558

3. Labor effects of education mismatch (Pooled data from 2012GOMS1 to 2014GOMS1)

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Education-job mismatch ***(Reference: education match)***		
Under-education	0.279*** (0.034)	0.002 (0.046)
Over-education	-0.923*** (0.031)	0.250*** (0.042)
Level of education ***(Reference: 4-year university)***		
2 or 3-year vocational college	-0.041 (0.034)	0.057 (0.048)
University+ postgraduate study	0.165*** (0.053)	-0.332*** (0.081)
Demographic variables Gender	0.125*** (0.027)	-0.104*** (0.038)
Marital status	-0.079* (0.048)	-0.039 (0.072)
Human capital ***Major*** ***(Reference: humanities)*** Social science	-0.074* (0.042)	0.009 (0.057)
Education	0.359*** (0.061)	-0.309*** (0.086)
Engineering	-0.088** (0.040)	0.014 (0.055)
Science	-0.024 (0.046)	-0.065 (0.064)
Medical	-0.187*** (0.060)	-0.110 (0.086)
Art, music and physical education	-0.102** (0.051)	-0.055 (0.069)
GPA(University)	0.034 (0.030)	-0.206*** (0.041)
Certificate	0.009 (0.023)	0.128*** (0.034)
Job training	0.048 (0.033)	0.100** (0.044)
Tenure	0.007 (0.009)	0.025* (0.014)
Previous job experience	0.009 (0.030)	0.134*** (0.040)
Job characteristics Regular job	-0.006 (0.035)	-0.395*** (0.046)
Full-time work	-0.253*** (0.059)	-0.074 (0.074)

Labor union	0.028 (0.026)	0.022 (0.038)
Company location	0.012 (0.022)	0.215*** (0.033)
Company size	0.046* (0.024)	-0.027 (0.036)
Benefit	0.249*** (0.031)	-0.015 (0.044)
Wage	0.082** (0.036)	-0.300*** (0.046)
Job satisfaction level **(Reference: very unsatisfied)** Unsatisfied		-0.130 (0.148)
So-so		-0.472*** (0.142)
Satisfied		-0.793*** (0.142)
Very Satisfied		-0.810*** (0.150)
Year	-0.028 (0.022)	0.033 (0.032)
Constant		-63.544 (64.322)
N	10008	10008
pseudo R^2	0.066	0.096

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

4. Labor effects of skill mismatch (Pooled data from 2012GOMS1 to 2014GOMS1)

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Skill-job mismatch ***(Reference: skill match)***		
Skill deficit	0.238*** (0.034)	0.040 (0.045)
Skill surplus	-0.919*** (0.032)	0.222*** (0.043)
Level of education ***(Reference: 4-year university)***		
2 or 3-year vocational college	-0.032 (0.034)	0.056 (0.048)
University+ postgraduate study	0.197*** (0.053)	-0.344*** (0.081)
Demographic variables Gender	0.139*** (0.027)	-0.107*** (0.038)
Marital status	-0.090* (0.048)	-0.038 (0.072)
Human capital ***Major*** ***(Reference: humanities)*** Social science	-0.023 (0.042)	-0.004 (0.057)
Education	0.404*** (0.060)	-0.321*** (0.086)
Engineering	-0.056 (0.040)	-0.000 (0.055)
Science	0.035 (0.046)	-0.083 (0.064)
Medical	-0.148** (0.060)	-0.126 (0.086)
Art, music and physical education	-0.032 (0.051)	-0.074 (0.069)
GPA(University)	0.041 (0.030)	-0.208*** (0.041)
Certificate	0.014 (0.023)	0.126*** (0.034)
Job training	0.053 (0.033)	0.100** (0.044)
Tenure	0.004 (0.009)	0.026* (0.014)
Previous job experience	0.008 (0.030)	0.136*** (0.040)
Job characteristics Regular job	0.006 (0.035)	-0.401*** (0.046)
Full-time work	-0.289*** (0.058)	-0.067 (0.074)

Labor union	0.026 (0.026)	0.023 (0.038)
Company location	0.012 (0.022)	0.214*** (0.033)
Company size	0.047* (0.024)	-0.026 (0.036)
Benefit	0.237*** (0.031)	-0.011 (0.044)
Wage	0.091** (0.035)	-0.304*** (0.046)
Job satisfaction level (Reference: very unsatisfied) Unsatisfied		-0.136 (0.149)
So-so		-0.483*** (0.143)
Satisfied		-0.814*** (0.143)
Very Satisfied		-0.843*** (0.151)
Year	-0.021 (0.022)	0.031 (0.032)
Constant		-59.825 (64.275)
N	10008	10008
pseudo R^2	0.062	0.095

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5. Labor effects of major mismatch (Pooled data from 2012GOMS1 to 2014GOMS1)

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Major-job mismatch ***(Reference: major match)*** Major mismatch	-0.587*** (0.029)	0.091** (0.039)
Level of education ***(Reference: 4-year university)*** 2 or 3-year vocational college	-0.027 (0.034)	0.054 (0.048)
University+ postgraduate study	0.195*** (0.054)	-0.347*** (0.082)
Demographic variables Gender	0.158*** (0.027)	-0.108*** (0.038)
Marital status	-0.098** (0.047)	-0.034 (0.072)
Human capital ***Major*** ***(Reference: humanities)*** Social science	-0.095** (0.042)	0.011 (0.057)
Education	0.316*** (0.059)	-0.313*** (0.086)
Engineering	-0.105*** (0.040)	0.010 (0.055)
Science	-0.019 (0.046)	-0.070 (0.064)
Medical	-0.259*** (0.059)	-0.110 (0.087)
Art, music and physical education	-0.125** (0.050)	-0.059 (0.070)
GPA(University)	0.024 (0.029)	-0.205*** (0.041)
Certificate	0.017 (0.023)	0.122*** (0.034)
Job training	0.052 (0.033)	0.103** (0.044)
Tenure	0.010 (0.010)	0.025* (0.014)
Previous job experience	0.002 (0.030)	0.140*** (0.040)
Job characteristics Regular job	0.038 (0.035)	-0.408*** (0.046)
Full-time work	-0.231*** (0.058)	-0.084 (0.074)
Labor union	0.017 (0.026)	0.022 (0.038)

Company location	0.001 (0.022)	0.220*** (0.033)
Company size	0.052** (0.024)	-0.026 (0.036)
Benefit	0.273*** (0.031)	-0.017 (0.044)
Wage	0.116*** (0.035)	-0.311*** (0.046)
Job satisfaction level (*Reference: very unsatisfied*) Unsatisfied		-0.146 (0.149)
So-so		-0.533*** (0.142)
Satisfied		-0.885*** (0.143)
Very Satisfied		-0.918*** (0.151)
Year	-0.018 (0.022)	0.030 (0.032)
Constant		-58.076 (64.190)
N	10008	10008
pseudo R^2	0.037	0.092

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6. Labor effects of education, skill, and major mismatch

(Pooled data from 2012GOMS1 to 2014GOMS1)

Dependent variable	Model 1 Job satisfaction	Model 2 Turnover intention
Education-job mismatch *(Reference: education match)*		
Under-education	0.190*** (0.041)	-0.037 (0.059)
Over-education	-0.518*** (0.044)	0.195*** (0.059)
Skill-job mismatch *(Reference: skill match)*		
Skill deficit	0.130*** (0.040)	0.064 (0.058)
Skill surplus	-0.424*** (0.045)	0.070 (0.061)
Major-job mismatch *(Reference: major match)*		
Major mismatch	-0.370*** (0.030)	0.034 (0.040)
Level of education *(Reference: 4-year university)*		
2 or 3-year vocational college	-0.019 (0.034)	0.054 (0.048)
University+ postgraduate study	0.133** (0.053)	-0.326*** (0.081)
Demographic variables Gender	0.129*** (0.027)	-0.103*** (0.038)
Marital status	-0.087* (0.048)	-0.040 (0.072)
Human capital **Major** *(Reference: humanities)* Social science	-0.089** (0.042)	0.011 (0.057)
Education	0.292*** (0.060)	-0.300*** (0.086)
Engineering	-0.154*** (0.040)	0.017 (0.056)
Science	-0.060 (0.046)	-0.062 (0.064)
Medical	-0.288*** (0.061)	-0.099 (0.087)
Art, music and physical education	-0.143*** (0.051)	-0.051 (0.070)
GPA(University)	0.009 (0.030)	-0.205*** (0.041)
Certificate	0.008 (0.023)	0.128*** (0.034)
Job training	0.057*	0.101**

	(0.033)	(0.044)
Tenure	0.004	0.025[*]
	(0.010)	(0.014)
Previous job experience	0.033	0.133[***]
	(0.030)	(0.040)
Job characteristics		
Regular job	-0.027	-0.394[***]
	(0.035)	(0.046)
Full-time work	-0.294[***]	-0.065
	(0.059)	(0.074)
Labor union	0.022	0.022
	(0.026)	(0.038)
Company location	0.008	0.215[***]
	(0.023)	(0.033)
Company size	0.053[**]	-0.027
	(0.024)	(0.036)
Benefit	0.238[***]	-0.013
	(0.031)	(0.044)
Wage	0.081[**]	-0.300[***]
	(0.036)	(0.046)
Job satisfaction level		
(Reference: very unsatisfied)		
Unsatisfied		-0.133
		(0.148)
So-so		-0.461[***]
		(0.142)
Satisfied		-0.778[***]
		(0.143)
Very Satisfied		-0.799[***]
		(0.151)
Constant		2.847[***]
		(0.388)
N	10008	10008
pseudo R^2	0.079	0.096

Standard errors in parentheses [*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$

7. Labor effects of job mismatch depending on level of education

(Pooled data from 2012GOMS1 to 2014GOMS1)

1) Effects on job satisfaction (2 or 3-year junior college graduates)

Job Satisfaction	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	0.069 (0.097)	0.106 (0.098)	0.130 (0.093)	0.099 (0.098)
Marital status	-0.217* (0.118)	-0.229* (0.122)	-0.269** (0.118)	-0.220* (0.122)
Human capital				
Major				
(**Reference: humanities**)				
Social science	-0.234 (0.169)	-0.190 (0.172)	-0.223 (0.171)	-0.258 (0.170)
Education	-0.533** (0.260)	-0.501** (0.250)	-0.571** (0.259)	-0.591** (0.251)
Engineering	-0.228 (0.156)	-0.233 (0.157)	-0.271* (0.157)	-0.329** (0.156)
Science	-0.238 (0.182)	-0.107 (0.179)	-0.229 (0.182)	-0.251 (0.181)
Medical	-0.476*** (0.174)	-0.417** (0.174)	-0.505*** (0.173)	-0.583*** (0.173)
Art, music and physical education	-0.225 (0.184)	-0.138 (0.184)	-0.198 (0.182)	-0.282 (0.183)
GPA(University)	0.101 (0.072)	0.092 (0.071)	0.030 (0.071)	0.069 (0.071)
Certificate	0.099 (0.064)	0.089 (0.064)	0.073 (0.062)	0.082 (0.064)
Job training	0.054 (0.094)	0.071 (0.093)	0.085 (0.095)	0.065 (0.095)
Tenure	0.001 (0.020)	0.003 (0.020)	0.014 (0.021)	-0.000 (0.021)
Previous job experience	-0.007 (0.078)	0.005 (0.079)	0.011 (0.078)	0.052 (0.079)
Job characteristics				
Regular job	0.084 (0.100)	0.140 (0.099)	0.155 (0.100)	0.031 (0.102)
Full-time work	-0.336** (0.170)	-0.409** (0.160)	-0.344** (0.166)	-0.384** (0.167)
Labor union	0.050 (0.080)	0.034 (0.080)	0.064 (0.078)	0.053 (0.080)
Company location	0.084 (0.061)	0.100 (0.061)	0.087 (0.060)	0.090 (0.061)
Company size	0.143** (0.068)	0.143** (0.068)	0.149** (0.068)	0.158** (0.069)

Benefit	0.174**	0.196***	0.224***	0.171**
	(0.074)	(0.074)	(0.072)	(0.075)
Wage	0.025	0.050	0.076	0.044
	(0.099)	(0.100)	(0.103)	(0.099)
Education-job mismatch (Reference: education match)				
Under-education	0.475***			0.320***
	(0.094)			(0.122)
Over-education	-0.958***			-0.495***
	(0.084)			(0.131)
Skill-job mismatch (Reference: skill match)				
Skill deficit		0.438***		0.253**
		(0.097)		(0.124)
Skill surplus		-0.961***		-0.455***
		(0.082)		(0.128)
Major-job mismatch (Reference: major match)				
Major mismatch			-0.663***	-0.437***
			(0.076)	(0.082)
year	-0.013	0.004	0.001	-0.023
	(0.059)	(0.059)	(0.059)	(0.060)
N	1385	1385	1385	1385
pseudo R^2	0.083	0.081	0.048	0.101

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2) Effects on turnover intention (2 or 3-year junior college graduates)

Turnover Intention	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	0.147 (0.139)	0.128 (0.139)	0.131 (0.138)	0.128 (0.139)
Marital status	0.051 (0.181)	0.041 (0.181)	0.061 (0.181)	0.043 (0.181)
Human capital ***Major*** ***(Reference: humanities)***				
Social science	-0.091 (0.218)	-0.107 (0.220)	-0.100 (0.219)	-0.089 (0.221)
Education	-0.009 (0.408)	-0.020 (0.410)	-0.033 (0.404)	0.011 (0.409)
Engineering	-0.011 (0.198)	-0.024 (0.200)	0.018 (0.200)	0.009 (0.202)
Science	-0.211 (0.244)	-0.253 (0.243)	-0.203 (0.245)	-0.217 (0.245)
Medical	-0.118 (0.222)	-0.147 (0.224)	-0.101 (0.224)	-0.090 (0.226)
Art, music and physical education	-0.116 (0.228)	-0.136 (0.230)	-0.110 (0.229)	-0.097 (0.232)
GPA(University)	-0.102 (0.098)	-0.098 (0.098)	-0.082 (0.098)	-0.089 (0.098)
Certificate	0.094 (0.089)	0.098 (0.089)	0.097 (0.089)	0.103 (0.089)
Job training	-0.018 (0.131)	-0.033 (0.132)	-0.018 (0.132)	-0.030 (0.133)
Tenure	-0.026 (0.029)	-0.029 (0.029)	-0.026 (0.028)	-0.027 (0.029)
Previous job experience	0.146 (0.101)	0.140 (0.101)	0.137 (0.101)	0.124 (0.102)
Job characteristics				
Regular job	-0.216[*] (0.120)	-0.225[*] (0.120)	-0.213[*] (0.121)	-0.199 (0.122)
Full-time work	-0.151 (0.196)	-0.136 (0.197)	-0.156 (0.195)	-0.134 (0.197)
Labor union	0.031 (0.110)	0.043 (0.110)	0.024 (0.110)	0.037 (0.111)
Company location	0.263[***] (0.086)	0.257[***] (0.086)	0.269[***] (0.086)	0.262[***] (0.086)
Company size	0.063 (0.097)	0.064 (0.097)	0.061 (0.097)	0.060 (0.097)
Benefit	0.030 (0.106)	0.026 (0.106)	0.029 (0.106)	0.031 (0.107)

Wage	-0.350***	-0.349***	-0.360***	-0.354***
	(0.127)	(0.128)	(0.127)	(0.128)
Job satisfaction level				
(Reference: very unsatisfied)				
Unsatisfied	-0.060	-0.059	-0.019	-0.013
	(0.358)	(0.356)	(0.365)	(0.360)
So-so	-0.308	-0.286	-0.315	-0.225
	(0.341)	(0.338)	(0.347)	(0.342)
Satisfied	-0.613*	-0.594*	-0.616*	-0.510
	(0.344)	(0.341)	(0.352)	(0.348)
Very Satisfied	-0.441	-0.439	-0.426	-0.349
	(0.366)	(0.362)	(0.371)	(0.369)
Education-job mismatch				
(Reference: education match)				
Under-education	0.120			-0.019
	(0.116)			(0.167)
Over-education	0.251**			0.078
	(0.112)			(0.162)
Skill-job mismatch				
(Reference: skill match)				
Skill deficit		0.192*		0.192
		(0.115)		(0.167)
Skill surplus		0.294***		0.196
		(0.112)		(0.162)
Major-job mismatch				
(Reference: major match)				
Major mismatch			0.218**	0.154
			(0.098)	(0.105)
Year	0.209**	0.212**	0.217***	0.219***
	(0.083)	(0.084)	(0.083)	(0.084)
Constant	-419.424**	-423.810**	-435.157***	-439.551***
	(168.111)	(168.246)	(167.911)	(168.697)
N	1385	1385	1385	1385
pseudo R^2	0.080	0.082	0.080	0.084

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

3) Effects on job satisfaction (4-year university graduates)

Job Satisfaction	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	0.130***	0.141***	0.156***	0.134***
	(0.030)	(0.030)	(0.030)	(0.030)
Marital status	-0.048	-0.053	-0.061	-0.055
	(0.054)	(0.053)	(0.053)	(0.054)
Human capital				
Major				
(Reference: humanities)				
Social science	-0.054	-0.003	-0.086*	-0.071
	(0.045)	(0.045)	(0.045)	(0.045)
Education	0.401***	0.440***	0.352***	0.330***
	(0.066)	(0.065)	(0.065)	(0.066)
Engineering	-0.081*	-0.043	-0.102**	-0.144***
	(0.044)	(0.044)	(0.044)	(0.044)
Science	-0.005	0.044	-0.014	-0.044
	(0.050)	(0.050)	(0.050)	(0.051)
Medical	-0.089	-0.062	-0.188***	-0.195***
	(0.072)	(0.074)	(0.072)	(0.074)
Art, music and physical education	-0.104*	-0.034	-0.134**	-0.150***
	(0.056)	(0.056)	(0.055)	(0.056)
GPA(University)	0.013	0.026	0.015	-0.010
	(0.034)	(0.034)	(0.034)	(0.034)
Certificate	-0.001	0.008	0.013	-0.000
	(0.026)	(0.026)	(0.026)	(0.026)
Job training	0.062*	0.066*	0.067*	0.073**
	(0.036)	(0.036)	(0.036)	(0.036)
Tenure	0.006	-0.001	0.004	0.003
	(0.011)	(0.011)	(0.011)	(0.011)
Previous job experience	0.002	-0.000	-0.007	0.021
	(0.034)	(0.034)	(0.034)	(0.034)
Job characteristics				
Regular job	-0.038	-0.029	0.003	-0.061
	(0.040)	(0.040)	(0.040)	(0.041)
Full-time work	-0.142**	-0.176**	-0.134*	-0.169**
	(0.072)	(0.072)	(0.072)	(0.072)
Labor union	0.017	0.021	0.007	0.009
	(0.029)	(0.029)	(0.029)	(0.029)
Company location	0.001	0.002	-0.012	-0.002
	(0.025)	(0.025)	(0.025)	(0.025)
Company size	0.038	0.034	0.031	0.046*
	(0.028)	(0.027)	(0.027)	(0.028)
Benefit	0.246***	0.225***	0.273***	0.230***
	(0.036)	(0.036)	(0.036)	(0.036)

Wage	0.056	0.073[*]	0.121[***]	0.051
	(0.042)	(0.042)	(0.041)	(0.043)
Education-job mismatch				
(Reference: education match)				
Under-education	0.258[***]			0.192[***]
	(0.038)			(0.045)
Over-education	-0.919[***]			-0.521[***]
	(0.035)			(0.048)
Skill-job mismatch				
(Reference: skill match)				
Skill deficit		0.200[***]		0.093[**]
		(0.037)		(0.044)
Skill surplus		-0.920[***]		-0.431[***]
		(0.037)		(0.050)
Major-job mismatch				
(Reference: major match)				
Major mismatch			-0.566[***]	-0.360[***]
			(0.032)	(0.033)
Year	-0.021	-0.015	-0.012	-0.020
	(0.025)	(0.025)	(0.025)	(0.025)
N	7988	7988	7988	7988
pseudo R^2	0.064	0.059	0.036	0.076

Standard errors in parentheses [*] $p < 0.1$, [**] $p < 0.05$, [***] $p < 0.01$

4) Effects on turnover intention (4-year university graduates)

Turnover Intention	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	-0.104**	-0.107**	-0.107**	-0.105**
	(0.042)	(0.042)	(0.042)	(0.042)
Marital status	-0.092	-0.091	-0.089	-0.092
	(0.081)	(0.081)	(0.081)	(0.081)
Human capital				
Major				
(Reference: humanities)				
Social science	0.050	0.038	0.051	0.052
	(0.062)	(0.062)	(0.062)	(0.062)
Education	-0.263***	-0.275***	-0.268***	-0.260***
	(0.093)	(0.093)	(0.093)	(0.093)
Engineering	0.037	0.022	0.026	0.038
	(0.061)	(0.061)	(0.062)	(0.062)
Science	-0.021	-0.036	-0.029	-0.020
	(0.071)	(0.070)	(0.071)	(0.071)
Medical	-0.044	-0.056	-0.045	-0.041
	(0.105)	(0.105)	(0.106)	(0.106)
Art, music and physical education	-0.079	-0.100	-0.090	-0.077
	(0.078)	(0.079)	(0.079)	(0.079)
GPA(University)	-0.197***	-0.201***	-0.202***	-0.196***
	(0.047)	(0.047)	(0.047)	(0.047)
Certificate	0.112***	0.109***	0.106***	0.112***
	(0.039)	(0.039)	(0.039)	(0.039)
Job training	0.114**	0.115**	0.116**	0.114**
	(0.049)	(0.049)	(0.049)	(0.049)
Tenure	0.053***	0.055***	0.054***	0.054***
	(0.017)	(0.017)	(0.017)	(0.017)
Previous job experience	0.130***	0.133***	0.136***	0.129***
	(0.045)	(0.045)	(0.045)	(0.046)
Job characteristics				
Regular job	-0.418***	-0.423***	-0.429***	-0.418***
	(0.052)	(0.052)	(0.052)	(0.052)
Full-time work	-0.046	-0.041	-0.051	-0.045
	(0.094)	(0.093)	(0.093)	(0.094)
Labor union	0.016	0.015	0.014	0.016
	(0.043)	(0.043)	(0.043)	(0.043)
Company location	0.248***	0.248***	0.253***	0.249***
	(0.038)	(0.038)	(0.038)	(0.038)
Company size	0.005	0.008	0.010	0.005
	(0.041)	(0.041)	(0.041)	(0.041)
Benefit	-0.043	-0.038	-0.046	-0.042
	(0.051)	(0.051)	(0.051)	(0.051)

Wage	-0.448***	-0.457***	-0.468***	-0.448***
	(0.057)	(0.057)	(0.056)	(0.057)
Job satisfaction level *(Reference: very unsatisfied)*				
Unsatisfied	-0.210	-0.219	-0.232	-0.209
	(0.171)	(0.172)	(0.171)	(0.171)
So-so	-0.596***	-0.618***	-0.662***	-0.591***
	(0.164)	(0.165)	(0.164)	(0.164)
Satisfied	-0.926***	-0.963***	-1.028***	-0.921***
	(0.165)	(0.165)	(0.164)	(0.165)
Very Satisfied	-0.946***	-0.993***	-1.067***	-0.942***
	(0.174)	(0.175)	(0.173)	(0.175)
Education-job mismatch *(Reference: education match)*				
Under-education	-0.039			-0.055
	(0.054)			(0.068)
Over-education	0.232***			0.225***
	(0.048)			(0.065)
Skill-job mismatch *(Reference: skill match)*				
Skill deficit		-0.010		0.026
		(0.052)		(0.066)
Skill surplus		0.177***		0.008
		(0.050)		(0.068)
Major-job mismatch *(Reference: major match)*				
Major mismatch			0.061	0.010
			(0.044)	(0.045)
Year	0.001	-0.000	-0.001	0.001
	(0.036)	(0.036)	(0.036)	(0.036)
Constant	2.645	4.879	5.858	2.406
	(72.935)	(72.863)	(72.816)	(72.929)
N	7988	7988	7988	7988
pseudo R^2	0.114	0.112	0.110	0.114

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

5) Effects on job satisfaction (university plus postgraduates)

Job Satisfaction	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	0.051 (0.115)	0.065 (0.115)	0.109 (0.114)	0.057 (0.114)
Marital status	-0.053 (0.241)	-0.199 (0.258)	-0.053 (0.253)	-0.106 (0.253)
Human capital				
Major				
(**Reference: humanities**)				
Social science	-0.325[*] (0.197)	-0.223 (0.195)	-0.167 (0.195)	-0.263 (0.193)
Education	0.305 (0.204)	0.435[**] (0.202)	0.396[**] (0.187)	0.298 (0.202)
Engineering	-0.018 (0.155)	0.032 (0.154)	0.083 (0.154)	-0.033 (0.154)
Science	0.021 (0.164)	0.100 (0.162)	0.163 (0.163)	0.042 (0.163)
Medical	-0.456[*] (0.252)	-0.401 (0.256)	-0.464[*] (0.260)	-0.516[**] (0.262)
Art, music and physical education	-0.101 (0.175)	-0.033 (0.176)	-0.020 (0.182)	-0.048 (0.176)
GPA(University)	0.207[*] (0.120)	0.178 (0.120)	0.133 (0.121)	0.173 (0.120)
Certificate	-0.078 (0.093)	-0.077 (0.092)	-0.040 (0.092)	-0.064 (0.093)
Job training	-0.142 (0.165)	-0.176 (0.166)	-0.244 (0.165)	-0.159 (0.165)
Tenure	-0.007 (0.040)	-0.005 (0.042)	-0.008 (0.046)	-0.009 (0.043)
Previous job experience	0.037 (0.167)	0.006 (0.167)	0.046 (0.169)	0.056 (0.171)
Job characteristics				
Regular job	0.166 (0.112)	0.169 (0.113)	0.231[**] (0.108)	0.206[*] (0.110)
Full-time work	-0.498[***] (0.142)	-0.550[***] (0.139)	-0.483[***] (0.139)	-0.573[***] (0.142)
Labor union	0.121 (0.106)	0.082 (0.106)	0.074 (0.106)	0.097 (0.104)
Company location	0.027 (0.091)	-0.016 (0.092)	-0.031 (0.092)	-0.005 (0.093)
Company size	0.129 (0.106)	0.175 (0.107)	0.154 (0.106)	0.139 (0.108)
Benefit	0.307[***] (0.108)	0.322[***] (0.106)	0.299[***] (0.107)	0.325[***] (0.108)

Wage	0.209**	0.197**	0.141	0.195**
	(0.092)	(0.092)	(0.092)	(0.092)
Education-job mismatch				
(Reference: education match)				
Under-education	0.175			-0.018
	(0.131)			(0.147)
Over-education	-1.004***			-0.645***
	(0.119)			(0.169)
Skill-job mismatch				
(Reference: skill match)				
Skill deficit		0.284**		0.302**
		(0.130)		(0.146)
Skill surplus		-0.882***		-0.261
		(0.118)		(0.165)
Major-job mismatch				
(Reference: major match)				
Major mismatch			-0.744***	-0.437***
			(0.130)	(0.136)
Year	-0.168*	-0.159*	-0.142	-0.146
	(0.089)	(0.089)	(0.089)	(0.089)
N	635	635	635	635
pseudo R^2	0.080	0.076	0.057	0.092

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

6) Effects on turnover intention (university plus postgraduates)

Turnover Intention	Model 1 Education-job mismatch	Model 2 Skill-job mismatch	Model 3 Major-job mismatch	Model 4 All
Demographic variables				
Gender	-0.305* (0.164)	-0.285* (0.163)	-0.302* (0.163)	-0.288* (0.164)
Marital status	0.423 (0.422)	0.546 (0.425)	0.429 (0.421)	0.618 (0.410)
Human capital *Major* *(Reference: humanities)*				
Social science	-0.600** (0.297)	-0.590* (0.305)	-0.601** (0.296)	-0.633** (0.308)
Education	-0.958*** (0.357)	-0.945*** (0.359)	-0.961*** (0.354)	-1.010*** (0.368)
Engineering	-0.118 (0.207)	-0.110 (0.208)	-0.092 (0.204)	-0.144 (0.210)
Science	-0.409* (0.226)	-0.397* (0.224)	-0.390* (0.224)	-0.440* (0.229)
Medical	-0.826** (0.353)	-0.853** (0.355)	-0.780** (0.346)	-0.888** (0.354)
Art, music and physical education	-0.019 (0.264)	-0.034 (0.265)	-0.020 (0.262)	-0.056 (0.268)
GPA(University)	-0.314* (0.169)	-0.359** (0.172)	-0.306* (0.169)	-0.348** (0.174)
Certificate	0.248* (0.135)	0.257* (0.135)	0.239* (0.134)	0.260* (0.135)
Job training	0.105 (0.203)	0.110 (0.206)	0.123 (0.202)	0.128 (0.206)
Tenure	-0.009 (0.055)	-0.010 (0.055)	-0.009 (0.055)	-0.012 (0.056)
Previous job experience	0.269 (0.189)	0.291 (0.193)	0.276 (0.189)	0.312 (0.193)
Job characteristics				
Regular job	-0.203 (0.175)	-0.182 (0.176)	-0.228 (0.172)	-0.180 (0.175)
Full-time work	-0.111 (0.195)	-0.062 (0.197)	-0.094 (0.193)	-0.053 (0.198)
Labor union	0.048 (0.162)	0.040 (0.161)	0.060 (0.161)	0.052 (0.162)
Company location	-0.236* (0.136)	-0.251* (0.134)	-0.230* (0.136)	-0.239* (0.135)
Company size	-0.108 (0.146)	-0.129 (0.147)	-0.116 (0.146)	-0.152 (0.145)
Benefit	-0.057 (0.150)	-0.068 (0.150)	-0.066 (0.149)	-0.075 (0.152)

Wage	0.286**	0.281**	0.288**	0.294**
	(0.129)	(0.130)	(0.127)	(0.131)
Job satisfaction level				
(Reference: very unsatisfied)				
Unsatisfied	0.383	0.459	0.326	0.478
	(0.600)	(0.625)	(0.601)	(0.619)
So-so	-0.106	0.014	-0.176	0.001
	(0.580)	(0.603)	(0.578)	(0.597)
Satisfied	-0.315	-0.166	-0.392	-0.201
	(0.583)	(0.606)	(0.579)	(0.602)
Very Satisfied	-0.848	-0.705	-0.891	-0.751
	(0.611)	(0.633)	(0.609)	(0.629)
Education-job mismatch				
(Reference: education match)				
Under-education	0.163			0.005
	(0.172)			(0.189)
Over-education	0.126			-0.400
	(0.183)			(0.305)
Skill-job mismatch				
(Reference: skill match)				
Skill deficit		0.325*		0.325*
		(0.171)		(0.188)
Skill surplus		0.416**		0.702**
		(0.178)		(0.296)
Major-job mismatch				
(Reference: major match)				
Major mismatch			0.098	0.001
			(0.186)	(0.195)
Year	0.089	0.072	0.079	0.069
	(0.133)	(0.134)	(0.133)	(0.136)
Constant	-181.411	-147.670	-160.231	-141.343
	(268.517)	(270.746)	(268.357)	(274.728)
N	635	635	635	635
pseudo R^2	0.108	0.119	0.106	0.123

Standard errors in parentheses * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$