勞 動 經 濟 論 集
第42卷 第2號, 2019. 6. pp.37～62

Academic Transfer, Self-Selection, and Returns to Education*

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We investigate the type of self-selection arising in college transfer in Korea, and then estimate the returns to additional college education gained through transfers from junior colleges to four-year colleges or universities. In this paper, we show that academic transfer is consistent with a positive selection hypothesis, in a sense that students with characteristics correlated positively to productivity are more likely to transfer to four-year colleges from junior colleges. These empirical results also meet an underlying dispersion condition. In addition, we find that the transferred would make a statistically significant return to additional college education.

Keywords: Junior college transfer, Selection, Propensity score matching

I. Introduction

Since 1996, owing to the Korean government's relaxation of the regulations regarding academic transfer admission, the number of transfer students in Korea has increased

논문 접수일 : 2019년 2월 12일, 논문 수정일 : 2019년 5월 28일, 논문 게재확정일 : 2019년 6월 13일

* This research was supported by the Daegu University Research Grant, 2015.

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dramatically. This relaxation enabled post-secondary schools to accept transfer applicants in place of their students on a leave of absence as well as those who had dropped out. It also increased the acceptance of transfer students from 2 to 5% of the total number enrolled in a second bachelor's degree course.[1]

The *Statistical Yearbook of Education*[2] published by the Korean Educational Development Institute presents that the ratio of transfer students to new entrants significantly increased until 1999, when it reached a ratio of 15.7%.[3] This increase in transfer students resulted in financial difficulties for some private universities or colleges. In particular, the second-year transfer system then available caused severe financial trouble for junior colleges because of the rapid student outflow to four-year colleges or universities. The transfer eligibility rules have been changed twice since 1999 to overcome this financial problem, at least partially. The Korean Ministry of Educational and Human Resources abolished the second-year transfer system and in 1999 restored the original system of allowing only many transfer applicants to be admitted as the number of dropouts. In addition, the Ministry abolished fall-semester transfers in 2006. However, none of these regulatory actions was the key to resolving the problems, although they did temporarily result in a sharp decrease in student transfers the next year, namely, in 2000 and 2007.

Given that the number of college transfers has been steady despite such tightening actions, it is useful to investigate the factors motivating college transfers, and then identify the type of self-selection being indirectly observed. Regarding the motivations for college transfer, Park, Kim, and Kim's (2008) survey shows that college students preparing for transfer consider the following factors as the primary causes: college reputation (43.4%), their aptitude (31.4%), and a favorably viewed major in the labor market (19.4%). In practice, most transfer students have a strong preference for colleges

1) In general, there are currently two types of academic transfer in Korea. One is the transfer from an associate degree to a bachelor's degree, and the other is the transfer from a bachelor's to second bachelor's degree. Naturally, the latter type is likely to have an advantage, because admissions to the latter are generally less competitive than to the former.

2) See the Korean Educational Development Institute (http://cesi.kedi.re.kr/) for details.

3) In fact, the number of transfer students was only about 5,000 during 1992-1994.

in metropolitan areas, and consequently, the competition for entrance to such colleges is significantly higher than for those in rural areas. These statistics imply that, at least in Korea, the college name written on a diploma is significant for determining its labor market returns. Ultimately, it can be said that the key motivation for such transfers is to increase wages in the labor market.

Despite the expectation that a transfer results in increased wage, only a fraction of junior college students seem to have decided to transfer to four-year institutions in Korea. In this context, it is important to examine whether the transfer students are randomly selected from the population of junior colleges. Regarding the type of selection from junior college students, Park, Kim, and Kim (2008) argue that the ratio of students aiming at college from academic high schools is high, relative to vocational high schools. The authors also address that students considering a transfer tend to feel less proud of their school and/or department than other students. On the basis of this result, they claim that an important factor motivating junior college students' transfers is the high intrinsic self-esteem and ambition for the future.

In the literature of college education, many studies have addressed estimating the economic returns to college education since the 1960's, arguing that college education plays a crucial role in the labor market. More recently, however, some studies stress the importance of college transfer, with a gradual increase in the fraction of transfer students in the United States. Using panel data techniques, Hilmer (2002) argues that the quality of the universities attended before transferring should have positive effects on future earnings, as well as the quality of the universities from which a student graduated. In Korea, there are a few studies that tackle junior college transfer. Among them, Lee (2010) argues that the transferred college graduates from junior colleges would earn less than the non-transferred college graduates. Choi (2016) points out that there exist no statistically significant effects of junior college transfer on full time jobs and wages, with the *Graduate Occupational Mobility Survey* (*GOMS*). Nonetheless, notice that little attention has been paid to considering the self-selection and causal effects of junior college transfer, compared to the possibility of the aforementioned non-random selection.

In this paper, we examine the selection problem and the causal effects of additional college education from college transfer, especially the one from junior colleges to four-year colleges or universities.[4] To do so, we consider incorporating the standard migration theory into an academic transfer model. Logically, junior college transfer seems like migration from underdeveloped regions to developed regions. Just as migration is primarily motivated by migrants' economic interests, those who seek upward academic transfer would decide to do so when they are convinced that it will increase their income.[5]

More specifically, according to the migration theories that are developed by Borjas (1987) and Chiquiar and Hanson (2005), we address the self-selection problem in a junior college transfer setting and then estimate the labor market returns to additional college education by the transfer. To this end, we analyze the type of selection characterizing junior college transfer by comparing the wage densities of non-transferred junior college graduates (the non-transferred), i.e., associate bachelor, with those of four-year college or university graduates who transferred from junior colleges (the transferred) by means of a counterfactual concept.

Specifically, in order to obtain a counterfactual wage distribution of the transferred, we match the wage distribution of the non-transferred to the transferred in terms of propensity score matching (PSM). We then regard the wage distributions for the matched non-transferred as the counterfactual wage distribution of the transferred.[6] This comparison between the actual wage distribution of the non-transferred and the counterfactual wage distribution of the transferred makes it possible to see from which

4) In Korea, junior college students are generally provided with two- or three-year courses of study and entitled to an associate degree with completion.

5) There may be various motivations for upward transfer: students' expectation of an increased skill price in terms of observable socioeconomic background; self-recognition of their ability to produce more; the desire to acquire better jobs, change majors, apply for graduate schools, or enter schools of good reputation; and some other unobserved characteristics.

6) Note that the counterfactual wage distribution of the transferred refers to the wage distribution of the non-transferred adjusted to the covariates of the transferred. Clearly, it is the wage distribution of the non-transferred junior college graduates matched to the transferred college graduates.

part of the overall wage distribution of junior college graduates the transferred are selected.

With such a counterfactual concept, we can also estimate the causal effects of additional college education from junior college transfer in terms of wage, i.e., starting salary in our case. In practice, it might be enough for estimating the causal effects to obtain a sample in which junior college students are randomly transferred to four-year colleges. However, the problem is that it is impossible to guarantee the randomness, and thus we should acquire the counterfactual wages of the transferred, comparing them with their actual wages. For the causal effects of transfer (treatment), we have three key estimands: average treatment effect on the treated (*ATT*), average treatment effect on the controls (*ATC*), and average treatment effects (*ATE*).

This paper is organized as follows: the next section shows data sources and gives descriptive statistics regarding junior college transfer. Section III presents the theoretical foundation of self-selection and preliminary results of estimating propensity scores. Section IV identifies the type of self-selection and the causal effects of transfer. Section V concludes.

Ⅱ. Data and Summary Statistics

1. Data

In order to investigate the type of selection arising amongst transfer students from junior colleges, we collected data from the *2005 Graduate Occupational Mobility Survey* (*GOMS*) conducted by the Korea Employment Information Service. The *GOMS* is the largest short-term panel survey of a representative sample of Korean college graduates. It is funded by the Employment Insurance Fund, sponsored by the Ministry of Labor, and officially approved by Statistics Korea. The *2005 GOMS* was launched in 2006 for a population of 502,764 college graduates, who graduated between August 2004 and February 2005, and was conducted annually until 2008. The first survey comprises 26,544 observations, covering approximately 5% of the target population. The dataset contains the graduates' demographic background, school life, job search, job training, preparation for jobs, and information on current and/or past jobs.[7)]

Among these variables, we focus on an experience(s) of college transfer to four-year colleges or universities from junior colleges and starting salaries after graduation, along with demographic background. Note that we do not include non-transferred graduates who had previously attended another school but entered their current school as a freshman by retaking the College Scholastic Ability Test, a college entrance exam in Korea. Students who transferred into junior colleges are excluded as well, as are those who transferred from four-year colleges. Given our focus on examining the type of selection in junior college transfer, the two types of observations can be considered irrelevant, and not of interest in our study. We also exclude any graduates not responding to the question as to whether current job is their first job after college graduation, along with those not responding with their prior school information. Furthermore, only the graduates who are fully employed in their first job are included in our analysis. The fully employed workers are defined as those who have, by law, an employment contract for one year or more. These exclusions result in eliminating more than 11,000 observations from the original sample. However, note that the main purpose of the *GOMS* is to survey overall employment after college rather than to estimate the effects of transfer.

In order to identify types of selection in transfer and measure transfer effects immediately after college graduation, we use monthly starting salaries from the *GOMS* as the variable of interest. To acquire the monthly starting salaries, the *GOMS* converts any daily, weekly, monthly or annual starting salaries before taxes to a monthly basis. In addition, even bonuses are included, e.g., for salaried employees. In fact, using

7) Heckman, Ichimura, and Todd (1997) argue that much of the bias may be eliminated by the matching methods using comparison groups in the same labor market and the same questionnaire. Fortunately, as will be described below, our dataset used to calculate the transfer effects would most likely meet these conditions.

starting salaries would be more acceptable than using the previous salaries of graduates, as they cannot often capture the effects of junior college transfer exactly, including the effects of experience after college graduation.

As demographic variables, we have age and gender of graduates, education of their father, and the number of family members. The regions and types of high school the graduates attended are also included; in this paper, the sites are divided into four regions: Seoul, the other metropolitan cities, Kyeonggi province, and the other provinces. High school location is used as a regional covariate because most of high school students would attend one of their hometown schools in Korea. Finally, high schools are classified into academic and vocational.

2. Summary statistics

As shown at the bottom of Table 1, there are 14,917 observations among which the non-transferred (*A*) and college graduates are 5,841 and 8,467 in the column of non-transfer, respectively. The transferred (*B*) in the column of transfer are only 609, which are 9.4% of those initially entering junior colleges, a transfer rate of B/(*A*+*B*). The female-transferred are 246 and male-transferred are 363 in the fifth column. The fraction of the transferred amongst males is high by 2.1%p in the eighth column, compared to females. The transfer rate of the junior college starters aged 28-29 is 41.8%, the highest in age groups. Those who are aged 30-31 follow, with a transfer rate of 33.3%.

For father's education and high school type involving transfer rates, the seventh column shows that there are 6,194 graduates whose fathers received a high school diploma, approximately 41.5% of the sample, and then middle school and college educated cases follow in turn. Overall, it can be observed that transfer rates are positively related to father's education. It is remarkable, as shown in the eighth column, that there exists a jump of more than 9%p in the transfer rates for graduates whose fathers received college degrees. Moreover, the transfer rate for those whose fathers have master's or doctorate degrees is 21.5%. This implies that junior college students

<Table 1> Transfer and non-transfer graduates by covariates

Variable	Non-transfer: Junior college graduates (A)		Non-transfer: College graduates		Transfer: College graduates (B)		Total	B/(A+B)
	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.	Freq.	Pct.
Gender	5,841	100.0	8,467	100.0	609	100.0	14,917	9.4
Men	3,113	53.3	4,859	57.4	363	59.6	8,335	10.4
Women	2,728	46.7	3,608	42.6	246	40.4	6,582	8.3
Age	5,841	100.0	8,467	100.0	609	100.0	14,917	9.4
20-21	209	3.6	0	0.0	0	0.0	209	0.0
22-23	1,702	29.1	349	4.1	3	0.5	2,054	0.2
24-25	1,788	30.6	2,945	34.8	85	14.0	4,818	4.5
26-27	1,072	18.4	3,015	35.6	132	21.7	4,219	11.0
28-29	247	4.2	1,928	22.8	177	29.0	2,352	41.8
30-31	146	2.5	136	1.6	73	12.0	355	33.3
32 or over	677	11.6	94	1.1	139	22.8	910	17.0
Father's education	5,841	100.0	8,467	100.0	609	100.0	14,917	9.4
No schoolings	115	2.0	58	0.7	6	1.0	179	5.0
Elementary sch.	1,137	19.5	881	10.4	130	21.3	2,148	10.3
Middle schools	1,395	23.9	1,219	14.4	130	21.3	2,744	8.5
High schools	2,521	43.2	3,446	40.7	227	37.3	6,194	8.3
Junior colleges	131	2.2	255	3.0	9	1.5	395	6.4
Colleges	458	7.8	1,944	23.0	84	13.8	2,486	15.5
Graduate schools	84	1.4	664	7.8	23	3.8	771	21.5
Location of HS	5,841	100.0	8,467	100.0	609	100.0	14,917	9.4
Seoul	1,298	22.2	2,190	25.9	123	20.2	3,611	8.7
Other big cities	1,692	29.0	2,537	29.9	199	32.7	4,428	10.5
Kyeonggi	976	16.7	1,056	12.5	55	9.0	2,087	5.3
Other provinces	1,875	32.1	2,684	31.7	232	38.1	4,791	11.0
Type of HS	5,841	100.0	8,467	100.0	609	100.0	14,917	9.4
Academic	2,971	50.9	8,056	95.2	447	73.4	11,474	13.1
Vocational	2,870	49.1	411	4.8	162	26.6	3,443	5.3

Source: *2005 Graduate Occupational Mobility Survey* (GOMS), Korea Employment Information Service with highly educated families are more likely to transfer to four-year colleges, compared to those with primary or secondary school educated families. Whether it is coercive or self-directed, those who attend junior colleges appear to consider college transfer more frequently when well-educated family members' advice on transfer is available.

Regarding high school (HS) type, college graduates from academic high schools in the non-transfer column of Table 1 are 8,056, with 95.2% of the subsample. In contrast, the number from vocational high schools is only 411 in the same case. The transfer rate for graduates from academic high schools is higher than for vocational graduates by 7.8%p, as in the eighth column. The high school (HS) locations, however, do not show striking features in relation to transfer rates. There is a noticeably low transfer rate in Kyeonggi province, though.

Ⅲ. Theoretical Background and PSM

1. Conceptual framework

To develop a junior college transfer model that addresses the self-selection problem, we follow Borjas' (1987) and Chiquiar and Hanson's (2005) approaches. While not identical, the basic model can be described by

$$\ln w_{cc}^{i} = \mu_{cc}^{i} + \epsilon_{c}^{i}, \tag{1}$$

$$\ln w_{cu}^{j} = \mu_{cu}^{j} + \gamma^{j} + \epsilon_{c}^{j}, \tag{2}$$

where ϵ_c^i and $\epsilon_c^j \sim N(0, \sigma_c^2)$.[8] Assume that the error terms are independent from

8) Note that the error terms ϵ_c^i and ϵ_c^j are assumed to be identically distributed because propensity score matching is based on the conditional independence assumption (CIA) as will be explained later. If their distributions were not identical, then the CIA would not be met. This

individuals i and j. Let w_{cc} and w_{cu} denote the wages of the non-transferred and the transferred, respectively, of all students who initially entered junior colleges. For simplicity, the superscripts for individuals i and j are suppressed. In addition, let μ_{cc} and μ_{cu} denote the observable socioeconomic variables that can affect wage levels for each group, i.e., base wages. To be specific, μ_{cu} is the base wage of the transferred, reflecting a counterfactual wage that they would expect to earn if they had graduated from junior colleges without upward academic transfer. Consequently, γ represents the wage premium obtained from additional college education through transferring to four-year colleges.

In making transfer decisions, junior college students are likely to transfer to four-year colleges or universities if they expect that a rise in their lifetime income is greater than its costs (strictly in present value) after graduation with the transfer. A decision rule of junior college transfer can be expressed as below:

$$\ln w_{cu} > \ln w_{cc} + TC,$$

where TC denotes transfer costs, including the opportunity costs of additional years at college as well as the costs of transfer preparation.[9)]

In this respect, Borjas (1987) argues that the negative-selection (positive-selection) hypothesis implies that when income dispersion in the country of origin is greater (smaller) than in the country of destination, the less (more) skilled are more likely to migrate from the country of origin. The underlying meaning of these hypotheses is that assuming higher income dispersion in the country of origin, with the same measured skills, low-income workers would have more incentive to migrate than high-income workers, as they can probably find opportunities to increase their income, owing to the

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implies that given the observable covariates, transfer decisions are non-random with regard to unobserved characteristics.

9) In practice, it is common in Korea that the students who intend to transfer to another college go to related private educational institutes because unlike the United States, the students generally take an entrance exam when hoping to transfer. Of course, TC also includes the time costs to prepare for it.

smaller income dispersion in the country of destination. In this case, the immigrants are “negatively selected” from the population of the original country. In addition to these two selection hypotheses, the author argues that low-income workers in the country of origin can become high-income workers in the country of destination, we call it “refugee sorting.” Historically, this would arise when there were structural shifts in income distribution, e.g., resulting from the confiscation of one’s property by a sudden political change in the country of origin.[10)]

Whether a selection type with junior college transfer is positive or negative could depend on the difference between within-group wage dispersions (e.g., σ_c^2 and σ_u^2) for individuals with comparable attributes. Note that σ_u^2 is the within-group wage dispersion of non-transferred college graduates. Recall that σ_c^2 is, by definition, the within-group wage dispersion of both the transferred and the non-transferred who initially attended junior colleges. For example, aside from the transfer effects, if $\sigma_c^2 < \sigma_u^2$, then junior college students with high productivity will have a greater incentive to transfer than otherwise. In practice, given that the transferred have the same productivity as the non-transferred college graduates at the mean of the wage distribution, highly productive junior college students would intend to transfer, as they could boost their income owing to the greater within-group wage differentials. On the contrary, if $\sigma_c^2 > \sigma_u^2$, less productive junior college students would have a greater incentive to transfer than those with high productivity. The former, in our case, can be termed positive selection, while the latter, negative selection. In relation to this, we investigate empirical results involving the difference between σ_c^2 and σ_u^2, and which type of selection of the transferred the results are consistent with, by comparing the *counterfactual* wage distribution of the transferred four-year college or university graduates (hereafter, TR) with the actual distribution of the non-transferred junior college graduates (hereafter, NTR).

10) Note that the “refugee sorting” case is not addressed with junior college transfer in this paper.

2. Propensity score matching (PSM)

For the type of selection involved in transfer, it can be considered the counterfactual wage distribution of the transferred by matching the NTR to the TR properly, in terms of observed covariates. In this regard, Rosenbaum and Rubin (1983) suggest that the balancing score, such as propensity score, is sufficient to remove bias from observed covariates through adjusting only for the difference in propensity score. One of the advantages of using propensity score matching (PSM) is the ability to avoid the curse of dimensionality when the treated units (i.e., the TR) are matched to the control units (i.e., the NTR) with many covariates. All the information about the characteristics of the treated and the control units can be incorporated by propensity score, a single index.

The propensity score can have various forms such as a probability, an odds ratio or other indices for participating in a program. Among them, given the covariates of the TR and NTR, the most popular method is to use logit or probit analysis to acquire the propensity scores. Note, however, that specifying empirical models for propensity scores is not the case where we find covariates determining transfer decisions. Rather, it is simply done to set up covariates to obtain propensity scores, so that we can match the treated and control units properly. In addition, there are no reasons to include too many covariates in the model because of the over-specification problem, resulting in higher standard errors in the estimated propensity scores.

With respect to the PSM, we have two important underlying assumptions met: the conditional independence assumption (CIA) and a sizable overlap condition.[11) Rosenbaum and Rubin (1983) show that just as matching is valid on the covariates, matching on the propensity score is also justified under the CIA. The authors argue that the treatment effect estimator adjusting for the propensity score can be efficient and consistent. On the other hand, the overlap condition states that there must be a substantial overlap in propensity score of the treated and the control units so that PSM

11) For details, see Rosenbaum and Rubin (1983), Heckman, Ichimura, Smith, and Todd (1996), Heckman, Ichimura, and Todd (1997).

may be valid.

With our dataset, we estimate propensity scores of transfer—predicted probabilities of transfer to four-year colleges—using logit regression analysis because it must be one of the most frequently used statistical procedures. To specify a logit model for transfer (T_i), we consider as covariates the graduates' age (Age_i), their gender ($Gender_i$), their father's education ($FEdu_i$), the number of family members ($NumFam_i$), and dummies of the region and type of high school they graduated from. In doing so, we exclude graduates aged 21 or under from the analysis because there are no transferred observations for the age group, as shown in Table 1. In fact, it would be too early for them to graduate from a four-year college following college transfer. This is because usually, though not necessarily, it would take at least two years to acquire the minimum qualifications to take the entrance exams for transfer, aside from the additional years spent in four-year colleges. In practice, the graduates are likely to be some time away from transfer decisions. Graduates aged 32 or over are also excluded from the analysis; it is likely that the experience effects of older graduates would already have been reflected in starting salaries after graduation, as mentioned before. Moreover, as will be shown later, it appears to be better balanced to focus on a cohort of graduates aged 22-31.

Equation (3) shows empirical results of the logit analysis, so that we can predict the probability of transfer. Note that a binary variable $T_i = 1(0)$ denotes the transfer (non-transfer) of a junior college student i to a four-year college or university. Age_i denotes the age of the junior college student and $Gender_i = 1(0)$ means that the student is male (female). As said before, $FEdu_i$ is the father's education level and $NumFam_i$ is the number of the family members. $OthCities_i$, $Kyeonggi_i$, and $OthProvinces_i$ are regional dummies for the graduated high schools, where the base region is Seoul. In addition, $VocSchool_i = 1(0)$ indicates a vocational (academic) high school. One of the estimation results in (3) is that the probability of transfer to four-year colleges would significantly increase with age and father's education level. In addition, junior college students from big cities and provinces are more inclined to transfer, and so are those who graduated from academic high schools. However, recall that this specification is not designed to determine transfer models (Khandker et al. 2010), but to simply obtain propensity scores indexed by multiple covariates for matching.

$$\begin{aligned}\hat{T}_i = &-20.41^{***} + .70^{***}Age_i - 1.18^{***}Gender_i + .25^{***}FEdu_i \\ &\;(.81) \qquad (.03) \qquad\qquad (.13) \qquad\qquad\quad (.05) \\ &- .04NumFam_i + .63^{***}OthCities_i - .31Kyeonggi_i \\ &\;\;(.04) \qquad\qquad (.15) \qquad\qquad\quad (.21) \\ &+ .58^{***}OthProvinces_i - 1.54^{***}VocSchool_i{}^{12)} \\ &\;(.16) \qquad\qquad\qquad (.13)\end{aligned} \tag{3}$$

To make matching estimators effective, the TR and the NTR matched need to be similar to each other in terms of observed covariates. To enhance the validity of matching estimators, only the TR and NTR within the region of common support are included in the analysis as well. Then balancing tests are conducted, specifically, to check if distributions of the covariates included in the model differ systematically between the two groups.

There are various matching methods based upon estimated propensity scores: for analysis, we adopt the single nearest-neighbor, caliper, kernel, and local linear matching methods. With this respect, the fundamental reason for using the propensity score matching is that the junior college wage distribution of the TR cannot be directly observed, although it could be if they were simply junior college graduates without upward academic transfer. To make it possible, though not perfect, it would be required to pick up an NTR(s) analogous to a given TR in terms of propensity score, from the subsample. In this case, the NTR matched are regarded as the counterfactual ones if the given TR had not transferred to a four-year college or university. Eventually, the counterfactual wage distribution of the TR corresponds to the actual wage distribution

12) For details, see the appendix. The figures in parentheses are corrected standard errors, and ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively.

for the matched NTR. Single nearest-neighbor matching, for instance, involves an NTR matched to its nearest neighbor in terms of the propensity score for transfer (for a short description of other matching methods, see notes in Table 3).

Ⅳ. Self-Selection and Causal Effects of Transfer

1. Existence of self-selection in transfer

Conceptually, removing the wage premium to college transfer, γ, from Equation (2) would give us the counterfactual wage distribution of the TR:

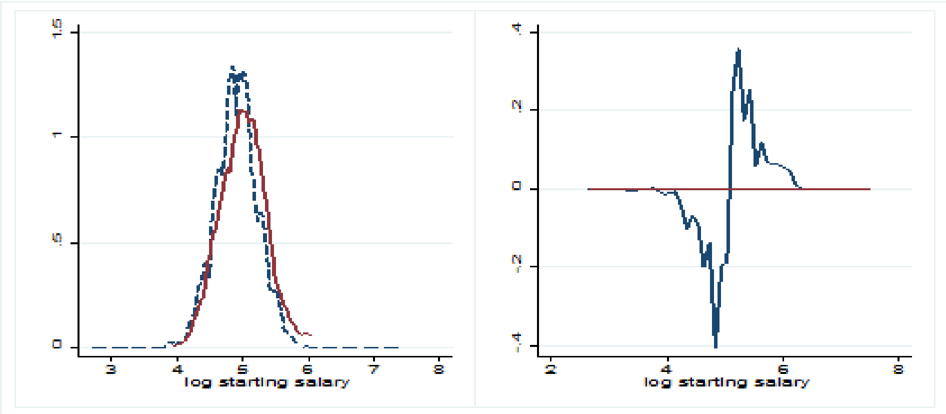
$$\ln w'_{cu} = \mu_{cu} + \epsilon_c. \quad (4)$$

In order to identify the type of selection in transfer, we compare the wage distributions in Equations (1) and (4). Notice that no differences between the two distributions would imply that the TRs are randomly selected from the population of junior college students, in terms of observed as well as unobserved characteristics.

Using the single nearest-neighbor matching, we can compare the counterfactual log starting salary density for the TR with the actual density for the NTR in Figure 1, where at a glance, the two distributions look similar to each other. Nonetheless, it is likely that the TRs are selected non-randomly from the population of junior college students, in relation to observable characteristics, with the difference between the two distributions in the figure. To be specific, as shown in Figure 1(b), the difference in log starting salary densities is negative in the lower tail and is positive in the upper tail, implying that there can be a positive selection occurring in transfer from junior colleges.

[Figure 1] Comparison of counterfactual for the transferred (TR) and actual for the non-transferred (NTR)

(a) (b)



Notes: In Figure 1(a), the solid line is the counterfactual density of log starting salaries for the transferred (TR) and the dashed line is the actual density for the non-transferred (NTR). This counterfactual density is the one for the non-transferred junior college graduates (NTR) matched to the transferred four-year college graduates (TR). Figure 1(b) shows the difference between the two densities in Figure 1(a).

In Table 2, summary statistics are provided for the log starting salary distributions. In the case of all corresponding to Figure 1, it shows that the mean of the counterfactual starting salaries of the transferred college graduates (TR) is statistically high by 0.1 log point, relative to the non-transferred junior college graduates (NTR). It is shown that the number of the non-transferred junior college graduates matched to the transferred college graduates is 470 when single nearest-neighbor matching is used.

For men and women, counterfactual means of log starting salaries result from using logit analysis for each group (see Table A1 in the appendix). The estimation results from logit analysis show that there are no remarkable differences between men and women in terms of a sign of estimated coefficients, even with some differences in the number of family members and Kyeonggi province. In Table 2, the counterfactual means for men and women are high by more than 0.1 log point, compared to the NTR.

Examining the estimated standard deviations of log starting salaries in Table 2, on the other hand, the within-group dispersions of starting salaries for four-year college graduates are statistically large for all the groups, relative to junior college graduates. Considering the relationship between the type of selection and the within-group wage dispersions addressed in the previous section, these results are consistent with the *positive* selection hypothesis in junior college transfer, as shown in Figure 1. It suggests that given the observable characteristics, junior college graduates who have relatively high productivity may be more likely to transfer to four-year colleges or universities.

<Table 2> Starting salary distributions for junior college transfer

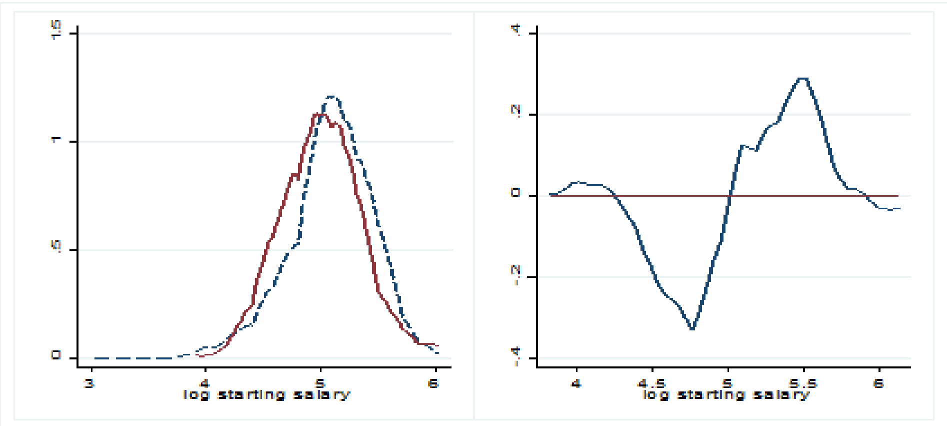
		All	Men	Women
Mean difference of log starting salaries				
Counterfactual for the transferred (TR)	Obs.	470	267	202
	Mean (A)	5.010	5.118	4.935
		(0.016)	(0.019)	(0.026)
Actual for the non-transferred (NTR)	Obs.	4,955	2,627	2,328
	Mean (B)	4.910	5.011	4.796
		(0.005)	(0.006)	(0.007)
Mean difference	$A - B$	0.100***	0.106***	0.139***
	t-stat.	[6.011]	[5.074]	[5.841]
Dispersion ratio of log starting salaries				
Actual for the four-year college	Obs.	8,373	4,778	3,595
	Std. dev. (C)	0.392	0.363	0.389
Actual for junior college (NTR)	Obs.	4,955	2,627	2,328
	Std. dev. (D)	0.342	0.327	0.321
Std. dev. ratio	C/D	1.145***	1.108***	1.209***
	F-stat.	[1.312]	[1.229]	[1.463]

Notes: The transferred (TR) denotes the transferred college graduates from junior colleges, while the non-transferred (NTR) denotes the non-transferred junior college graduates. Notice that (A) indicates a sample mean of counterfactual log starting salaries of the transferred college graduates. In fact, it is a sample mean of actual log starting salaries of the non-transferred junior college graduates (NTR) matched to the transferred four-year college graduates (TR). (B) is a sample mean of actual log starting salaries of the non-transferred junior college graduates (NTR). (C) and (D) are sample standard deviations of actual log starting salaries for the non-transferred four-year college and junior college graduates. The figures in parentheses are standard errors. ***, **, * denotes statistical significance at 1%, 5%, and 10% levels, respectively.

Source: *2005 Graduate Occupational Mobility Survey* (*GOMS*), Korea Employment Information Service

[Figure 2] Comparison of counterfactual and actual for the transferred (TR)

(a) (b)



Notes: Figure 2(a) shows the densities of the counterfactual (the solid line) and actual (the dashed line) log starting salaries for the transferred (TR). Figure 2(b) shows the difference between the two densities in Figure 2(a).

2. Causal effects of transfer

With data from the *2005 GOMS*, Figure 2 shows the counterfactual and actual distribution of log starting salaries for the TR, using single nearest-neighbor matching.[13] To be more specific, as described earlier, the counterfactual distribution is the one of log starting salaries that the non-transferred (NTR) matched to the transferred (TR) were paid after graduating from junior colleges. The actual distribution corresponds to the log starting salaries that the transferred were actually paid after graduating from four-year colleges or universities. In this figure, the average transfer effect can be observed as the mean difference between the two distributions. With regard to the

13) To evaluate the quality of the single nearest-neighbor matching, we conduct balancing tests. Overall, it appears that the matching method reduces the covariate imbalance considerably. The matched variables appear to be relatively well balanced for all and for male graduates, respectively. On the other hand, the observations on female graduates do not work as well in the balancing test, particularly because of an imbalance in age. For details, see Table A2 in the appendix.

<Table 3> Causal effects of additional college education from junior college transfer by matching methods

(a) All

Matching		NN(1)	Caliper	Kernel	LLM
ATT		0.083***	0.084***	0.047**	0.046**
		[2.75]	[2.79]	[2.35]	[2.30]
ATC		0.045	0.045	0.060*	0.047
		[0.83]	[0.85]	[1.83]	[1.28]
ATE		0.050	0.050	0.059*	0.047
		[1.28]	[1.20]	[1.84]	[1.29]
Comm. support	NTR	3,516	3,516	3,516	3,516
	TR	470	460	470	470
	Total	3,986	3,976	3,986	3,986

(b) Men

Matching		NN(1)	Caliper	Kernel	LLM
ATT		0.081**	0.087**	0.070***	0.068
		[2.08]	[2.43]	[2.79]	[1.52]
ATC		0.114**	0.115*	0.095**	0.065
		[2.08]	[1.92]	[2.04]	[1.52]
ATE		0.109**	0.111*	0.092**	0.065
		[2.26]	[1.96]	[2.47]	[1.28]
Comm. support	NTR	1,767	1,764	1,767	1,767
	TR	267	264	267	267
	Total	2,034	2,028	2,034	2,034

(c) Women

Matching		NN(1)	Caliper	Kernel	LLM
ATT		0.012	0.016	0.014	0.018
		[0.20]	[0.29]	[0.36]	[0.41]
ATC		0.121*	0.120*	0.019	0.027
		[1.69]	[1.77]	[0.36]	[0.54]
ATE		0.110*	0.110**	0.018	0.026
		[1.79]	[2.03]	[0.38]	[0.52]
Comm. support	NTR	1,855	1,842	1,855	1,855
	TR	202	193	202	202
	Total	2,057	2,035	2,057	2,057

Notes: The figures in brackets indicate z-statistics from bootstrapping. There are 50 bootstrap replications. The nearest-neighbor matching is one-to-one. In addition, the tolerance of caliper is 0.01 in terms of propensity score, and the kernel functions used in kernel and local linear matching are Epanechnikov and tricube. ***, **, and * indicate significance at 1%, 5%, and 10% levels, respectively. Notice that unlike the other matching methods used, a tolerance of 0.01 in caliper matching for all, men, and women would lead to 460, 264, and 193 observations, respectively, for the TR on the common support. It is confirmed that, for all graduates, for example, our single nearest-neighbor matching reduces the covariate imbalance considerably, leading to the absence of significant differences in the covariates between the TR and NTR units. For details, see Table 2A in the appendix.

densities, Figure 2(b) presents the actual minus counterfactual density of the transferred. The density difference is negative from the left tail to a salary slightly over 5.0, and positive above this point. It is clear that there exist returns to additional education through junior college transfer.

By comparing the counterfactual and actual starting salaries of the transferred (TR), it can be confirmed that there is a transfer effect of approximately 7.7% $(=\{\exp(5.084)/\exp(5.010)-1\}\times 100)$ in Table 2. Notice that the mean of the actual log starting salaries for the TR is 5.084 from the *2005 GOMS*, although it is not reported in Table 2. The transfer effect looks similar to the average transfer effect on the TR for all from single nearest-neighbor matching in Table 3.

To examine the causal effects of additional college education from junior college transfer, a non-parametrically average treatment effect on the treated (*ATT*) can be estimated, together with various matching methods and the acquired propensity scores ($\hat{T}_i$). In our case, the *ATT* from transfer is the mean difference between the log starting salaries of the transferred (TR) and the matched non-transferred, counterfactuals for *ATT*. Contrary to this, the *ATC* (average treatment effect on the control units) indicates the mean difference between the log starting salaries of the non-transferred (NTR) and the matched transferred, counterfactuals for *ATC*. Consequently, the *ATE* (average treatment effect) is a weighted average of the *ATT* and *ATC*.

Regarding causal effects, the treatment effect on the subpopulation of the treated units (*ATT*) is occasionally meaningful, relative to the whole population, i.e., the average treatment effect (*ATE*) (Imbens, 2003; Heckman et al., 1998). In this respect, when evaluating the importance of narrowly aimed programs, it may be irrelevant to consider even the potential treatment effects on the control units.

As shown in Table 3, the average transfer effects on the TR (*ATT*s) for all are estimated approximately 4-8% in terms of the monthly starting salary. It implies that the transferred college graduates would make statistically significant returns as much to additional college education. With this respect, given that we could not control for additional college education from junior college transfer, notice that the *ATT*s estimated are not purely causal effects of transfer itself, but the causal effects of additional schooling evoked from transfer. In this context, we admit that further studies are required, where the additional schooling is controlled for in estimating *ATT*s, so that the causal effects of transfer can be more precisely identified. For men, the estimated *ATT*s are statistically significant by about 7-8%, with the single nearest matching, caliper, and kernel matching. In contrast, there are no *ATT*s statistically significant for women, no returns to female junior college transfer. Furthermore, notice that, for all, most of the average transfer effects on the NTR (*ATC*) and on all junior college entrants (*ATE*) do not significantly differ from zero. For men and women, however, the estimated *ATC*s of 11-12% are statistically significant at a 10% level, only with the single nearest-neighbor and caliper matching.

Note that the *ATC* and the resulting *ATE* are noisy, relative to the *ATT* in Table 3. To give the reason, it is required to know that, in our case, only a small pool of the TR are matched to the NTR in estimating the *ATC*s, a weak common support problem in the place of junior college graduates. As a result, this can lead to insufficient information on the estimated *ATC*s, large standard errors, so that it might be difficult to evaluate the estimates of *ATC* and *ATE* correctly.

Ⅴ. Concluding Remarks

In this paper, we have attempted to answer the questions of which type of students transfer from junior colleges to four-year colleges or universities, and then to estimate the returns from additional college education gained through junior college transfer.

One of our main findings is that there appears to be positive selection in junior college transfer in Korea. This implies a non-random selection of students for the transfer, in terms of observable characteristics. In addition, the dispersion story also applies to this positive selection, as in Borjas (1987).

As shown before, on the other hand, it was tried to estimate causal effects of additional college education from junior college transfer through various matching methods in this study, so that propensity scores were calculated from observed covariates under the CIA. In doing so, however, notice that it can be a limitation because we cannot rule out, e.g., the existence of any omitted variable biases from the model, with the observed covariates. Moreover, given that the pseudo R^2s in the logit analyses are slightly more than 30%, we admit that it may be likely that junior college transfer is not well explained by the observed covariates used in this study (see Table A1 in the appendix).

Ideally, it may be more interesting to estimate how the causal effects of transfer are in other countries, compared to Korea, along with the types of selection. However, we seldom find any other studies addressing the transfer effects in the literature. Hence, we hope that much future research will be done on academic transfer in other countries, so that the transfer effects can be directly comparable with those from this study.

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Appendix

<Table A1> Estimation Results from Logit Analysis

Transfer	All	Men	Women
Age	0.699***	0.764***	0.693***
	(0.028)	(0.041)	(0.041)
Gender	-1.182***		
	(0.129)		
Father's education	0.253***	0.121**	0.422***
	(0.046)	(0.063)	(0.070)
Number of family members	-0.043	-0.092*	0.003
	(0.043)	(0.059)	(0.067)
Other big cities	0.633***	0.640***	0.474**
	(0.157)	(0.209)	(0.246)
Kyeonggi province	-0.310*	-0.839***	0.010
	(0.215)	(0.329)	(0.295)
Other provinces	0.578***	0.488**	0.581***
	(0.161)	(0.220)	(0.241)
Vocational high school	-1.535***	-1.232***	-2.045***
	(0.135)	(0.169)	(0.238)
Constant	-20.411***	-22.802***	-20.977***
	(0.807)	(1.220)	(1.194)
Pseudo R^2	0.307	0.312	0.328
Observations	5,425	2,895	2,530

Notes: The figures in parentheses are corrected standard errors, and ***, **, and * represent significance at 1%, 5%, and 10% levels, respectively. Note that the purpose of specifying models to obtain propensity scores is not to obtain determinants models, but only to match properly the treated and control units with their covariates.

<Table A2> Balancing Tests

Variables	Sample	All		Men		Women	
		t-stat.	p-val.	t-stat.	p-val.	t-stat.	p-val.
Age	Unmatched	29.12	0.000	26.13	0.000	21.93	0.000
	Matched	-0.61	0.543	-0.35	0.729	-2.37	0.018
Gender	Unmatched	1.66	0.096				
	Matched	0.46	0.646				
Father's education	Unmatched	4.37	0.000	1.27	0.203	5.67	0.000
	Matched	0.21	0.835	-0.13	0.895	1.90	0.058
Number of family members	Unmatched	-4.33	0.000	-3.22	0.001	-2.50	0.013
	Matched	-0.02	0.981	0.30	0.768	-0.76	0.450
Other big cities	Unmatched	1.59	0.111	1.93	0.054	0.00	0.996
	Matched	-0.89	0.372	-0.53	0.595	0.69	0.493
Kyeonggi province	Unmatched	-4.40	0.000	-4.19	0.000	-1.89	0.059
	Matched	-0.33	0.741	0.36	0.716	1.60	0.111
Other provinces	Unmatched	2.49	0.013	2.06	0.040	1.49	0.136
	Matched	0.20	0.838	-0.63	0.529	-0.61	0.539
Vocational high school	Unmatched	-9.72	0.000	-7.92	0.000	-6.09	0.000
	Matched	-1.81	0.071	-1.48	0.140	-3.04	0.003
Variables	Sample	All		Men		Women	
		LR χ^2	p-val.	LR χ^2	p-val.	LR χ^2	p-val.
All covariates	Unmatched	1,013.55	0.000	581.47	0.000	469.23	0.000
	Matched	5.35	0.720	4.27	0.749	19.83	0.006

Notes: The balancing test used in this study provides us with the extent of balancing of the variables used between two samples (the TR and NTR), before and after propensity score matching. Note that the t-statistic is based on regressing the given covariate on a treatment indicator, e.g., junior college transfer, before and after matching. The null hypothesis for the balancing test is that there is no systematic difference in means in the two samples. In other words, the t-statistic would increase in covariate imbalance. For all covariates, the LR χ^2 test used can be interpreted in the same manner. According to the test results, it is confirmed that our single nearest-neighbor matching reduces the covariate imbalance considerably. For all and men, the matched variables appear to be relatively well balanced in a sense that on the whole the statistics are not statistically significant. However, for women, good performance is not shown in the balancing test.

국문초록

대학편입, 자기선택, 교육투자 수익률에 관한 연구

황 진 태 · 김 성 민

본 연구는 전문대 졸업생들의 4년제 대학 편입 결정과 해당 편입의 초임 기준 수익률을 살펴보았다. 이러한 분석을 위하여 본 연구는 성향점수매칭(PSM) 방법을 통해 전문대 졸업생 중 4년제 대학 편입생과 유사한 특징을 가지는 비편입 전문대 졸업생의 초임 수준을 구하여 이를 평균적인 비편입생과 비교하였으며, 이를 통해 해당 편입에 대해 양(+)의 자기선택(positive selection)이 있는 것으로 보였다. 이러한 결과는 전문대 대비 4년제 대학 졸업생의 큰 임금 편차와 연계되어 해석될 수 있다. 그리고 편입을 통한 추가적 교육이 초임에 미치는 효과는 약 4~8% 정도 나타났다.

주제어: 대학편입, 자기선택, 성향점수매칭법