University Prestige and Choice of Major Field: Evidence from South Korea

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1 Introduction

Major field choice of college attending students attracts attention from various perspectives that range from university administrators and education experts to labor-market researchers, general public and the media. An individual's major choice in colleges is a part of occupation choice that influences the labor-market outcomes during his/her life-time working career (Blakemore and Low (1984); Siow (1984); Zarkin (1985); Paglin and Rufolo (1990)). Differences in patterns of major choice are also known for one of factors that explain male-female wage differentials among college graduates (Daymont and Andrisani (1984); Gerhart (1990); Loury (1997)).

Various studies have examined the observed patterns and determinants of the major choice of college students, and have identified several factors that influence a choice of a major field. Studies find that future labor-market outcomes of different majors are closely related with an individual's choice of a major field. Freeman (1976) shows that a starting salary of a college graduate has significant impact on the major choice, while Berger (1988) shows that the stream and present value (rather than the starting values) of earnings are more important determinant. Other than the labor-market outcomes after graduation, several studies report that an individual chooses the major field of college study on the basis of an individual's personal interest

and expectation of life-time labor force participation (for women) (Polachek (1978)) and job preferences (e.g. importance of making money, helping other, or becoming a leader) (Daymont and Andrisani (1984)), pre-collegiate capability and preparation (Polachek (1978); Paglin and Rufolo (1990); Turner and Bowen (1999)), the option value of a major in the form of graduate school attendance (Eide and Waehrer (1998)), the perceived probability of success in a particular field (Montmarquette, Cannings, and Mahseredjian (2002)).

In most of these studies and their empirical models of major choice, individuals are considered to make one-dimensional decisions about a major field on the implicit assumption that their schools (colleges or universities) are homogeneous, and that their institutional attributes do not influence students' choice of major fields[2]. However, in many countries in which higher educational institutions are structured by a hierarchical system in terms of their (formal and informal) rankings and reputations, individuals intending higher education in those institutions are likely to jointly decide where to go to university and what major field to concentrate. That is, rather than a one-dimensional decision, an individual's major choice is a part of (at least) two-dimensional decision about the type of school to attend and the major field of study. In this paper, we set up an estimation model for an individual's joint decision about a type of university and a major field, in order to examine whether a university's prestige influences an individual's choice of major field, and to what extent an individual's choice of major varies between prestigious universities and non-prestigious universities.

Most of studies on major choice in undergraduate institutions have examined individuals attending colleges and universities in western countries like U.S., Canada and U.K. Unlike these studies, we apply the empirical model for joint decisions on a university to attend and a major field to the case of South Korea. South Korea is known as a country that invests a large amount of private and public money in admission to prestigious universities. Like Japan, South Korea's

[2]Although not closely related to our study, there exist some studies on college major choice that take into account the effect of a school's institutional aspects on an individual's major choice. Solnick (1995) examines how women's desired field of study changes during college years, and how the patterns of changes vary by the type of college attended (all-female schools vs coeducational institutions). She finds that women at single-sex institution are more likely than their counterparts at coed schools to shift from female-dominated subjects to male-dominated fields during their college careers. Canes and Rosen (1995) investigates the extent to which the ratio of female faculty members in a given department is associated with the share of female students in that department. They do not find evidence that an increase in the share of women on a department's faculty leads to an increase in its share of female majors.

university-system is characterized by a hierarchy structured by the informal rankings. Graduates from prestigious universities enjoy a large amount of benefits after graduation in terms of earnings and employment in the primary sector[3]. Given the large premium associated with prestigious universities, these universities enjoy a high degree of competition among applicants, and become more selective in the admission policies. As a result, South Korean students are likely to first decide which university they are going to go and then which major they are going to concentrate in a university. If this is the case, the choice or successful attendance to a prestigious university is a leading determinant of students' decisions on higher education, while the choice of major field can be given a secondary importance[4].

In this study, using a nationally-representative household survey, we examine the major-choice patterns of individuals who have entered 4-year universities during the last 20 years (1981-2001) in South Korea, and show that the patterns significantly vary between a group of prestigious universities and non-prestigious universities. As a factor that induces a student's choice of a major field, in the empirical models, we examine the impacts of an individual's post-graduation likelihood of employment in the large-firm sector as well as the predicted present-value earnings, a measure of labor-market outcome traditionally employed in studies of a college major choice. Given that the large-firm sector is viewed as the primary sector of the South Korean labor market that provides higher earnings and better job security, individuals are faced with varying degree of large-firm employability over different majors (even in the same type of universities). In response to it, individuals are likely to make their decisions on the major field of university study. In this study, we find that, in South Korea, rather than the stream of future earnings, the probability of large-firm employment after graduation plays a more significant

[3]It is often said that a graduation from Seoul National University in South Korea, or from University of Tokyo and Kyoto University in Japan is a high-status track to an individual's economic and social success.

[4]During the 1980s in South Korea, the process of high school graduates' college application is often characterized as a wait-and-see policy and speculative choices. Facing excessive demand for higher education in universities in general as well as in prestigious universities, the government required an individual to make a single application to a university-department combination in each round (two or three rounds per year) of university application season (from November to January of the following year). During this season, universities opened application desks on the campus, and they released the updated (by an hour, sometimes) figures of the number of applications received and the total number of pre-determined intakes per department, until the application deadline. Potential applicants waited in front of the desks, and, at the last minute, submitted their application to a department that had a lower rate of competition for admission. This scene was not unusual on university campuses during the application season, and the tendency of the wait-and-see policy were known to be much stronger in several prestigious universities in South Korea.

and important role in the decisions of a major field. This suggests that a study on a college major choice can be improved by examining various measures of labor-market outcomes, and that a strong candidate is the future probability of large-firm employment after graduation in South Korea. The remainder of the paper is organized as follows. In Section 2, we explain the importance of a university's prestige in an individual's major choice. We set up an econometric model for a joint decision about a university type and a major field in Section 3. Data are described in Section 4, and the empirical results are explained in Section 5. Section 6 concludes the paper.

2 Decisions about Type of University and Major Field

There are several reasons that an individual with a given qualification intends to attend a prestigious university. First, prestigious universities are more likely to supply better capabilities to enhance human capital of students by providing better curriculum, faculty quality and student bodies. Evidence from studies of U.S colleges suggests that more selective (possibly prestigious) universities provide higher institutional quality of education in terms of faculty quality and salaries, endowment per student, and educational and general expenditures per student (Solomon (1975); Astin and Henson (1977); Conrad and Blackburn (1985)). Human capital theory predicts that a better quality of education and the accompanying enhancement of an individual's productivity leads to higher earnings in the labor market. Higher rate of return in the form of higher earnings will induce students to attend more prestigious universities, as long as they are qualified. Second, prestigious schools have another function than simply giving their students better quality of education. As signalling theories of education suggest, these schools provide information-deficient employers in the labor market with signals which contain information on their graduates' qualities and productivity. Graduates of prestigious universities are believed to have higher innate quality (unobservable to employer at the time of employment), let alone the enhanced quality due to their superior college education. Given this signalling function of schools, individuals prefer prestigious universities to non-prestigious ones, if they can choose between the two types of universities, since the former leads to higher net bene-

fits after graduation. Third, prestigious schools tend to have alumni networks that can better serve their graduates' labor-market success. Evidence exists that the possession of a bachelor's degree from a top-ranked college facilitates the ascent to top management with identical educational credentials in the U.S (Useem and Karabel (1986)), and that graduates from prestigious universities have better chances to be matched with best jobs and top employers through the schools' provision of introductions to employers with their institutional social capital in South Korea (Lee and Brinton (1996)) and in Japan (Brinton and Kariya (2001)). Given this network function of universities, students will also be willing to attend more prestigious universities.

Various undergraduate institutions may have different degree of comparative advantages over these three dimensions. They are also likely to have varying degree of advantages over different major fields[5]. Prestigious schools are likely to have absolute advantages of all of these three dimensions over non-prestigious universities[6]. However, as long as the relative merit of a university over each of the three functions vary over different major fields, it is possible that patterns of students' major choice vary by the type of universities. That is, students will respond to the variations in a university's merits by choosing different field of majors. For instance, those who intend to choose the engineering major are likely to give less importance to the prestige (as a signalling device) of a university to attend than those intending, say, humanities major. It will be relatively easy for a non-prestigious university to provide its students with engineering skills comparable to those obtained in prestigious universities by investing in educational assets (e.g. training equipments and better faculty). As far as the skills acquired are relatively homogeneous between two types of universities, and entering a prestigious university involves higher degree of competition and various (physical, psychic and monetary) costs, one is more likely to choose a non-prestigious university and to major in engineering. That is, a school's function of human capital enhancement receives more weight in decisions for those intending the engineering major.

[5]For example, Wise (1975, pp.359-60) reports that the returns to an individual's undergraduate grade point average(GPA) and his rank in graduate school depend upon the major chosen in the U.S. Loury and Garman (1995, p.293) mention the possibility that choices among college major and college selectivity are correlated holding years of schooling constant. Smith and Naylor (2001, pp.51-52) also show that the effect of attending an independent school on degree performance (e.g first, upper second, lower second degree, etc.) varies across subjects in UK universities. Bratti (2002, p.435) notes the possibility that the university effect on students' degree performance can be different across subject, as the quality of departments may vary within the same university in UK.

[6]In the South Korean university system, prestigious universities are not necessarily those providing higher quality of college education.

In contrast, the same individual will be more inclined to attend a prestigious university, when he/she wishes to major in, say, humanities. As the skill contents of this field are not as directly linked to labor market requirements as those of engineering, prestigious universities are more likely to serve as institutions providing signals on their graduates' unobservable productivity.

3 Estimation Framework

3.1 Structural Model of University-Type Decision and Major Choice

In empirical analysis, we consider that an individual makes a joint decision about the type of university to attend and the major field of study. We specifically examine the joint decision over two types of universities (prestigious and non-prestigious) and J different major fields in the analysis. Let H_i denote a dummy variable for an individual i's attendance to a prestigious university, and M_i also denote a discrete random variable for i's chosen major field. Define P_{ihm} as the probability that the individual i attends the university type h and the major field m, i.e. $Pr(H_i = h, M_i = m)$ $(h = 0, 1;\ m = 1, 2, \cdots, J)$. Define P_i^h as the (marginal) probability of the university type h (i.e. $Pr(H_i = h)$), and P_{im}^h as the conditional probability of the choice of major field m within the university type h, (i.e. $Pr(M_{ih} = m|H_i = h)$). The addition of h to M_i is to highlight the given type of attending university h. Given the two marginal and conditional probabilities, we can decompose the joint probability P_{ihm} into the product of P_i^h and P_{im}^h. We consider both marginal and conditional probabilities as being generated by the latent models that govern each of the observed choice of the university type and major field.

First, we consider the model of a type of an attending university. Let H_i^* denote the latent random variable that governs a student's likelihood of attending a prestigious university. An individual's entrance to a university usually involves at least three distinct stages: student application, college admission, and student acceptance decisions. Factors that influence any of these three stages will change the level of H_i^*. In our model for the attending university-type, we do not separately consider each of the three stage decisions, as the information from the data is limited. Instead, we set up the reduced-form model with one equation representing the three processes altogether. We suppose that an individual's attendance to a prestigious university is

affected by the pre-collegiate academic capability (measured by centralized examination scores), and various personal characteristics. The estimation model is set up as follows:

$$H_i^* = \alpha_0 S_i + \alpha_1 X_{1i} + \epsilon_{1i} \tag{1}$$

where α_0 and α_1 are parameter vectors, S_i is i's relative pre-collegiate capability measured by the percentile of his/her examination score in the population distribution, X_{1i} includes i's personal and family characteristics (including the intercept) affecting the attendance to a prestigious type. The attendance to a prestigious university will also depend on the attributes of an university such as private-university status and the geographic location. These factors are included in X_{1i}. The ϵ_{1i} is the error term that summarizes unobservable factors affecting the attendance to a prestigious university.

In this latent model, we do not observed H_i^* directly, but instead observe the type of i's attending university. Recall that H_i is a dummy variable that takes 1 if i attends a prestigious university, and 0 if a non-prestigious type. Assuming the ϵ_{1i} follows the logistic distribution, we set up a logit model for the university-type decision, and the probability of i attending the prestigious type of university is given by :

$$P_i^1 = \Pr(H_i = 1) = \frac{exp(\alpha_0 S_i + \alpha_1 X_{1i})}{1 + exp(\alpha_0 S_i + \alpha_1 X_{1i})} \tag{2}$$

The probability of i attending non-prestigious type of university is given by $P_i^0 = \Pr(H_i = 0) = 1 - P_i^1$.

Second, we set up the model of major choice, given that the university-type decision is made. Let M_{ihm}^* denote the level of indirect utility associated with the individual i's choice of major m in a given university type h. Similarly, the level of indirect utility M_{ihm}^* will depend on individual-specific variables as well as attributes of the major itself such as the expected earnings and probability of large firm employment for a particular major. Thus we consider the

following statistical model for choice of major field at the given university type h:

$$M^*_{ihm} = \beta_{hm} S_i + \gamma_{hm} X_{2i} + \delta_{h1} \cdot EW_{ihm} + \delta_{h2} \cdot EF_{ihm} + \epsilon_{2ihm} \quad (3)$$
$$(h = 0, 1; \quad m = 1, 2, \cdots, J)$$

where β_{hm} and γ_{hm} are major-specific parameter vectors for a given type h, δ_1 and δ_2 are parameters that measure the impact of i's major-specific (given h) expected earnings EW_{ihm} and expected probability of large firm employment EF_{ihm}, respectively, X_{2i} is i's individual-specific characteristics (including the intercept) affecting the major choice in the university type h, and ϵ_{2ihm} is the error term that captures unobserved variations in preferences, academic capability, etc., and in the attributes of alternative majors. For a given type of university to attend, an individual chooses a major that generates a maximum utility. That is, given h, one chooses a major m if $M^*_{ihm} > M^*_{ihm'}$ for all $m' \neq m$. Similar to the model for the university-type decision, we do not observed M^*_{ihm} directly, but instead observe the actual major choice made by i, M_{ih}, where $M_{ih} = m$ if a major m is chosen among J different majors.

Assuming that ϵ_{2i} follows the independent extreme value distribution, following the conditional logit specification of McFadden (1973) and many other studies of major choice, we can write the conditional probability that an individual i chooses major m at a given type of university h, as

$$P^h_{im} = \Pr(M_{ih} = m | H_i = h) = \frac{exp(\beta_{hm} S_i + \gamma_{hm} X_{2i} + \delta_{h1} \cdot EW_{ihm} + \delta_{h2} \cdot EF_{ihm})}{\sum_{j=1}^{J} exp(\beta_{hj} S_i + \gamma_{hj} X_{2i} + \delta_{h1} \cdot EW_{ihj} + \delta_{h2} \cdot EF_{ihj})} \quad (4)$$
$$(h = 0, 1; \quad m = 1, 2, \cdots, J)$$

In the model of major choice, we set the humanities major parameters β_{h1} and γ_{h1} (for each h) as zeros for normalization. We use the major-specific earnings and probabilities of large firm employment that are predicted based on the university graduates' labor-market outcomes for each major and university-type (see below). The major-specific variables are actually used as differences with the humanities' variables within a given university-type, since choice is made on the basis of their differences rather than their levels.

Given the marginal and conditional probabilities, an invididual i's joint probability of choosing a major m while attending a university type h is expressed by

$$P_{ihm} = P_i^h \times P_{im}^h$$
$$(h = 0, 1; \quad m = 1, 2, \cdots, J)$$

3.2 Prediction of Future Earnings and Probabilities of Large-Firm Employment

In the equation (2) and (4), we need measures of post-graduation earnings and probabilities of large-firm employment expected when one makes decisions on the major field and attending university-type. We proxy these measures by the earnings and probabilities that are predicted on the basis of university graduates' labor-market outcomes for each major.

First, the stream of earnings for each major of a given university-type is predicted using the estimated coefficients of the following earnings equation models. Suppose that the earnings of graduates with each major m is determined by the following earnings equation :

$$W_{it} = \theta_1 Y_{it} + \theta_2 S_i + \theta_3 H_i + \varepsilon_i \tag{5}$$

where $(\theta_1 - \theta_3)$ are parameter vectors of each earnings equation, W_{it} is the monthly earnings (in log) of a graduate i with a major m in various years(t), and Y_{it} is a vector that includes dummy variables for i's sex, marital status, birth regions, graduation cohorts (the year 1981-90, 1991-97, and 1998-2001), their interactions with sex, and observation years, and values of potential labor market experience (in log) after graduation and working hours at the year t. As defined earlier, S_i denotes i's percentile examination score, and H_i a dummy variable for i's attendance to a prestigious university. All the variables are measured as of the year of earnings observation.

Given the estimates of (5), following Berger (1988), we construct the (average) present value of monthly earnings of a graduate i with the major m for 13 years after graduation by:

$$\widehat{EW}_i = log[\frac{1}{13}\sum_{s=1}^{13}[exp(\widehat{W_{is}})](1+r)^{-(s+4)}] \tag{6}$$

where r is a discount rate which is set at 0.05. The power $(s+4)$ reflects the fact that students make their major choices when they enter the 4-year university[7]. We confine the calculation of present value earnings to the first 13 years, as we have the small number of graduates having more than 13 years of potential labor market experience. We use $\widehat{EW}_i$ for each m and h as a proxy for EW_{ihm}.

Second, the probability of large-firm employment is predicted in a similar fashion. The probability is estimated for each major by the following model:

$$F_{it} = \tau_1 Z_{it} + \tau_2 S_i + \tau_3 H_i + \zeta_i \tag{7}$$

where $(\tau_1 - \tau_3)$ are parameter vectors of the large-firm employment equation, F_{it} is a dummy variable taking one if a graduate i with a major m works in a large firm of more than 1,000 employees in a particular year (t), and Z_{it} is a vector that includes personal characteristics such as sex, marital status, birth regions, graduation cohorts, and potential labor market experience (in log) after graduation at t. Likewise, given the estimates of (7), we predict the probabilities of i's large-firm employment 5 years after graduation, and use them in (4) as a proxy for EF_{ihm}.

4 Data

4.1 Description of Data

For empirical analysis, we use a South Korean national household survey titled "Korean Labor and Income Panel Study" (or KLIPS). The KLIPS is a longitudinal survey administered by the Korea Labor Institute, a government-sponsored research organization, which annually in-

[7] In South Korea, until recently around mid 1990s, the convention has been that students apply to a specific department in a specific university, thereby making their decisions of a major field when they enter a university. (In recent years, the convention changes to an application to a broad-defined field at the entrance.) Once entering a university, it has been fairly difficult for one to change major fields as well as departments before graduation. Moreover, most of male students have to perform compulsory military duties, whose duration varies from two to three years, depending an individual's physical condition and the cohort of draft. (Since early 1980s, the duration of military service has been decreasing, and it is currently 24 months for men without some particular physical disabilities.) Although university students are allowed by law to postpone the military duties until after graduation from universities, a large proportion of male students complete their service before graduation. According to the South Korean data (KLIPS) to be used and described later for the main analysis, about 80 percent of those who completed military service started it during the university careers. Taking account of this fact for male students, we use the power $((s+7))$ in the equation (6) rather than $(s+4)$ for male students, while using the latter for female students.

terviews 5,000 Korean households and 13,783 household members over 15 years of age from 1998 onward. The respondent households and individuals of this survey are designed to represent the population of South Korean households and individuals[8]. This survey collects a wide range of information on individuals that includes a respondent's demographics, labor market status and employment-related records. We use the KLIPS data for the survey years 1998-2001 to estimate the equations for monthly earnings and probability of large-firm employment.

The KLIPS also collects the information on higher education of respondents. The information includes the name of the university and department that a respondent attends (or has attended), and the years of university entrance and graduation. The survey do not ask respondent to report their scores of the centralized and government-administered college entrance examination (the College Scholastic Ability Test(CSAT), or *dai-hak-su-hak-nung-ryuk-si-hum* in Korean), which is required for a university application and is used as the most important determinant of university admission. To obtain a respondent's CSAT score, we use a data base of *Jin-Hak-Sa*, one of the major private companies in South Korea that provides a wide range of university entrance information like Barron's Educational Series Inc. in the U.S. This data base contains average CSAT scores of entering students for every department of every 4-year university each year from 1994 to 2001. Since the full points of the CSAT score increased from previously 200 to 400 in the year 1997 CSAT, we convert the level of the CSAT scores into the percentiles, assuming that the population distribution of the CSAT scores follows a normal distribution. For example, a score x is converted to a percentile score by the formula $\Phi(\frac{x-m_x}{s_x}) \times 100$ where $\Phi(\cdot)$ is a CDF of the standard normal distribution, and m_x and s_x are the population mean and standard deviation, respectively, of the CSAT scores of the corresponding year.

In South Korea, there exists no formal measure of a university's prestige that are publicly available as well as widely agreed. However, given that the CSAT scores have been the single most important determinant in the university entrance every year since 1981, the CSAT average of a university's entering students each year provide guiding information for ranking universities in South Korea. We calculate the 1994-2001 averages of each university's average CSAT scores

[8]For details of the KLIPS, see Korea Labor Institute (1998).

of entering students, using *Jin-Hak-Sa*'s percentile CSAT scores. On the basis of the 1994-2001 percentile CSAT averages of each university, we rate a total of 200 4-year universities in South Korea, and classify top 17 universities as prestigious and the other universities (about 180 universities) as non-prestigious. The prestigious type of universities thus identified are given in Appendix Table 1[9]. The Seoul National University, Pohang University of Science and Technology, Yonsei, Korea, and Sogang Universities are among the group of top prestigious universities in South Korea, and they, on average, attract students with the CSAT scores within the top 5 percentile ranges. The most of prestigious universities are private universities and located in the Seoul metropolitan region.

In the analysis, we confine major fields to six fields: humanities, social science, science, engineering, education, and business. Medical field and other miscellaneous fields that are not grouped into the six major fields are excluded from the analysis due to the small observations. Analysis is also confined to the students who entered the university from the year 1981 to 2001, since, prior to 1981, the system of university entrance was decentralized to individual universities, and no information is available to measure a student's relative position in the population distribution of academic capability (as in the CSAT scores).

4.2 Proportion of Chosen Majors and Labor-Market Outcomes

INSERT TABLE 1 HERE.

Table 1 shows the proportion of individuals who choose each major field by the university type for men and women. For men, the engineering field has been the most popular field of university study for the past 20 years in South Korea. The 42.4 percent of 4-year university-educated men choose the engineering field. The fields of social science, humanities and science follow it. When we examine the distribution of the major fields by the type of university one attends, we find a fairly different patterns of major choices between prestigious and non-

[9]To supplement our method of university ratings, we rely on the *Joongang Daily*'s evaluation survey of South Korean universities. (The *Joongang Daily* is one of five major daily newspapers in South Korea.) The *Joongang*'s survey of South Korean universities first started in 1994, and, every year, it publishes the university's rankings over a variety of dimensions as well as the overall rankings in a daily newspaper (during September). For the year 2003, the *Joongang*'s survey publishes the overall ranking of top 30 universities, and we compare the *Joongang*'s overall rankings with our 1994-2001 percentile CSAT averages of each university in Appendix Table 1.

prestigious type of universities[10]. While the engineering field is a dominant field of men's major choice in both prestigious and non-prestigious universities, those men that currently attend and have attended prestigious universities choose the field of social sciences (26.6 percent) more often than those attending non-prestigious universities (16.9 percent). While proportions of other majors are fairly close between two groups of universities, the increase in the social sciences proportion accompanies the decrease in the engineering proportion within the group of prestigious universities.

For women, in contrast, two of the most popular major fields are humanities and social science. They explain nearly a half of women's overall major choice. The fields of science, education, engineering and business follow the two leading majors. When we examine the major choice across the type of universities, we also find varying patterns between them[11]. While the humanities and social science stands as two main fields of choice in both types of universities, the proportion of science are fairly close to those of humanities and social sciences within the group of non-prestigious universities. In the group of prestigious universities, the engineering and education fields follows the two leading majors of humanities and social science.

As suggested by our empirical model and other studies for major choices, these varying patterns of major choice between two types of universities will be related to the expected labor market outcomes of each major in each type of universities. In Table 2, we describe an individual's predicted monthly earnings and their (average) present values, and the predicted probability of large-firm employment after graduation for each major of each type of university[12]. This individual has the following characteristics: the CSAT 85th percentile, married, graduation cohort 1990-1997, birth region Seoul and 227 monthly working hours.

INSERT TABLE 2 HERE.

First, for a representative man, the engineering major in non-prestigious universities has a good chance of getting higher earnings and employment in large-sized firms relative to other

[10] A χ^2 test rejects the hypothesis that the patterns of major choice are same between the groups of prestigious and non-prestigious universities at the 0.3 percent significance level.

[11] A χ^2 test also rejects the hypothesis of the same patterns of major choice between two groups of universities at the 2.8 percent significance level.

[12] The predicted monthly earnings and their present values are calculated using the estimates of (4) and the equation (6). The predicted probabilities of large-firm employment are generated using the estimates of (7).

majors. The predicted monthly earnings for 5 years of labor market experience and average PV earnings are the highest among the majors in the group of non-prestigious universities. The predicted probabilities of large-firm employment (at 5 and 10 years after graduation) are also high relative to other majors. In contrast, graduates from prestigious universities have better chances of higher earnings and large-firm employment, when they choose the social sciences (the second most popular major in this type of university). This field is associated with the opportunity of higher earnings and the highest probability of large-firm employment at 5 years after graduation. Although the engineering field of prestigious universities does not lead to relatively high earnings, it provides an above-medium rate of large-firm employment 5 and 10 years after graduation.

Second, for a representative woman, the humanities and social sciences majors (two main choices of major) in non-prestigious universities are among those generating the highest earnings, and their probabilities of large-firm employment are high relative to other majors in the group of non-prestigious universities. As for the labor-market outcomes of majors in prestigious universities, the humanities produce relatively high earnings and the highest probability of large-firm employment, and the social science leads to the second highest (behind humanities) probability of large-firm employment. Similar to the labor-market outcomes of a representative man, those of a representative woman are closely associated with her (unconditional) probability of a major choice. Using the empirical model described earlier, we next verify the importance of a university's prestige and a student's major choices, and their relationship with future labor-market outcomes.

5 Empirical Results

5.1 Model Estimates

Table 3 and 6 show the estimates of empirical models outlined in Section 3. We implement two different sets of specifications that vary over explanatory variables to be controlled. The first set (Model 1 and 2) of specifications examines the attendance to a prestigious university and the choice of major field, not controlling an individual's predicted labor-market outcomes (monthly

earnings and probability of large-firm employment). In contrast, the second set (Model 3 to Model 6) controls them in the estimation.

Specifically, Model 1 controls only a small set of characteristics that include the percentile CSAT score (S_i) and a university's location, private-university status, and an individual's sex in X_1 of the university-type equation, and the CSAT score and sex in X_2 of the major-field equation. Model 2 controls a set of characteristics that, in addition to those controlled in Model 1, include the father's education level and (broad-defined) occupations, and an individual's birth region both in X_1 and X_2. Model 1 and 2 are designed to examine the decisions of the major field and attendance to a prestigious university on the basis of the percentile CSAT scores, a major determinant of university entrance.

In contrast, the second set of models controls the predicted labor market outcomes of an individual in the major field choice equation, while dropping the CSAT scores from it. It is to highlight the within-individual association between predicted labor-market outcomes and the choice of major fields within a given university type. Since the percentile CSAT scores are a major determinant of university entrance in South Korea, it is possible that the impact of future labor-market outcomes on major choice can be masked by the effects of the CSAT scores in the model with their control. The CSAT scores can serve as a proxy variable for the labor-market outcomes, and makes the latter's marginal effects redundant in the estimation model with the control of the former[13]. To avoid this possibility, we drop the CSAT scores in the major choice equations. Instead, their effects on the labor-market outcomes are considered in the generation of predicted monthly earnings and probabilities of large-firm employment as in (5), (6) and (7). Model 3 and 4 controls either the predicted PV monthly earnings or probability of large-firm employment, while Model 5 controls both. To see the changes in estimates when the CSAT scores are considered in the major choice equations, Model 6 controls a full set of characteristics

[13]Suppose, for instance, that students with the 90th percentile CSAT score tends to attend one of prestigious universities and choose the social science major, while those with 50th percentile tend to attend one of non-prestigious universities and choose the engineering major. When one attempts to explain the patterns of university-type and major choices of these students, the CSAT scores can provide valuable information. That is, the higher CSAT scores are known to be associated with prestigious universities and social science major in them. However, if one is interested in the factors (other than the CSAT scores) that induce these decisions and their relationship with labor-market outcomes, the CSAT scores would have to be dropped from the set of variables to be controlled. Otherwise, the effects of labor-market outcomes are those that are left to be explained after the CSAT scores explain the major parts.

including the CSAT scores and predicted labor-market outcomes as well as an individual and family-background characteristics. Model 6 verifies the claim on the leading role played by the CSAT scores in the university-type and major field decisions.

INSERT TABLE 3 HERE.

Table 3 reports the estimates of Model 1 and 2. According to the table, the CSAT scores are one of very significant determinants of one's type of attending universities and the major field. In both models, they significantly influence the attendance to a prestigious university[14], and their effects are jointly significant in the major field equations within each type of universities. When evaluated at the means of explanatory variables, the university-type equation estimate (i.e. 0.197 (s.e. 0.016)) for the CSAT scores of Model 2 implies that a 1 percentile upward movement in the CSAT score from the 80th to the 81st percentile increases the probability of a male student's attending a prestigious university by 0.043 (from 0.296 at the 80th to 0.339 at the 81st). It also implies that a 1 percentile upward movement from the 90th to the 91st percentile increases the probability by 0.035 (from 0.751 at the 90th to 0.786 at the 91st).

As expected from the characteristics of the prestigious universities in Appendix Table 1, a university's location in Seoul has a significant effect on its becoming a prestigious university. However, the private-university status does not have an independent significant effect on a university's type. An individual's sex, birth regions, and family backgrounds including the father's education level and occupations do not have significant effects on one's attendance to a prestigious university.

According to Table 3, the CSAT scores are also a significant determinant of one's major field within a given type of university. From the estimates of Model 2, it is clear that, within the group of prestigious universities, an individual's higher CSAT scores significantly increase the probability of choosing business majors relative to humanities major. Within the group of non-prestigious universities, the higher CSAT scores significantly increase the probability of

[14] As discussed earlier, as an individual's attendance to a university is determined by the three stages of a student's application, university's admission, and his/her acceptance, which particular stage(s) the CSAT scores affect the most is not clear from the estimation result. However, given that prestigious universities are more selective in their admissions (due to high competition) in South Korea, we suspect that the CSAT scores affect the university admission stage the most.

choosing social science, engineering and business majors, and decrease that of choosing science major relative to humanities major. The joint effects of the CSAT scores on major choice within each type of university are highly significant[15].

An individual's sex is also a significant determinant of major choices within each type of university. Also, from the estimates of Model 2, men are more likely to choose social science, engineering and business majors than humanities within the group of prestigious universities. Similarly, men are more likely to choose social science, science, engineering and business majors and less likely to choose education major than humanities within the group of non-prestigious universities[16]. The joint effects of sex on major choice within each type of university are highly significant. However, socio-economic and ascriptive characteristics such as the father's education and occupations, and an individual's birth regions rarely affect the choice of majors in each type of university.

5.2 Predicted Probabilities of a Chosen Major by Type of University

To better interpret the estimates of Model 2 and to examine the importance of a university's prestige on the major choices, we construct the predicted probabilities of a student's major for each type of university, when his/her CSAT scores change from the 95th to the 60th percentile with other characteristics kept constant at the mean values. Table 4 shows a male student's probabilities, and Table 5 shows a female student's. For instance, from Table 4, a male student with the 90th percentile CSAT score has a 0.123 probability of choosing humanities major while attending a prestigious university, and he also has a 0.143 probability of choosing engineering major while attending a non-prestigious university. The probabilities can be interpreted likewise for other majors within each type of university.

INSERT TABLE 5 HERE.

[15] A Wald test rejects the joint hypothesis of no effects of the CSAT scores on major choice within the group of prestigious universities. The value of the test statistic is 39.7, whose p-value is less than 0.001. The corresponding Wald test for the group of non-prestigious universities also reject the hypothesis. The statistic is 12.9, whose p-value is less than 0.025.

[16] These major-choice patterns of South Korean students are similar to those of U.S students reported by Polachek (1978, p.500), Turner and Bowen (1999, p.294) and Montmarquette, Cannings, and Mahseredjian (2002, p.550). They show that male students are more likely to major in engineering and business, while female students in education and humanities in the U.S.

INSERT TABLE 6 HERE.

First, those men at the top 95th percentile CSAT scores, whose probability of attending a prestigious university is 0.890, are most likely to choose the engineering major in a prestigious university. The choice probability is 0.316. Very close to the engineering probability is the choice probability of the social science major in a prestigious university (0.270). The third preferred choice is the humanities major in a prestigious university, whose probability is 0.125. In contrast, their probability of choosing any major in a non-prestigious university is very low. As the percentile CSAT scores go down from the 95th to the 90th and 85th percentiles, rank of major choices (engineering and social science as two leading choices, and humanities as a third preferred choice) remains unchanged within the group of prestigious universities. These patterns of major choices within prestigious universities are similar to those given in Table 1, which shows the engineering and social science majors are two leading choices, and humanities are a third preferred choice for men within the group of prestigious universities.

Second, those men at the top 80th percentile CSAT scores, whose probability of attending a prestigious university is 0.296, are most likely to choose the engineering major in a non-prestigious university. Their choice probability is 0.387. The second preferred choice of major is the social science in a non-prestigious university, whose choice probability (0.115) is less than half of the engineering probability. When the CSAT scores decreases from the 80th percentile, the engineering major continues to be the leading choice, and the social science occupies the second preferred choice with less than a half probability of the engineering's in the groups of non-prestigious universities. These patterns are also similar to those shown in Table 1 for the group of non-prestigious universities. As the percentile CSAT score decreases, an individual's probability of choosing any major in a prestigious university declines.

Third, the third columns of each panel of Table 4 present the gaps in the probabilities of each major between two types of universities. To our main interest, they show the importance of a university's prestige in a student's major choice. If an individual chooses a major field of study with no consideration of a university's prestige, that is, if an individual makes one-dimensional choice over different majors, ignoring a type of university to attend, we expect no significant gaps in the probability of a major field between two types of universities. As the probability of

attending a prestigious university is set to be a half in such a case, the predicted probability of a particular major will be equally divided between the groups of prestigious and non-prestigious university. However, if an individual's likelihood of attending a prestigious university is explicitly considered in estimation rather than viewed as a random assignment as earlier, we can expect that a predicted probability of attending a prestigious university is generally different from a half, and that the gaps exist in the probability of a major field between the group of prestigious and non-prestigious universities[17].

From Table 4, we find strong evidence that a university's prestige has a significant impact on an individual's major choice. If a male student has the CSAT scores within the top 90th percentile and hence his probability of attending a prestigious university is higher than 0.751, then each probability of choosing the humanities, social science, science and engineering majors in a prestigious university are significantly higher than the corresponding probabilities of each major in a non-prestigious university. For example, the probability that a male student, who has the 90th percentile CSAT score, chooses social science is 0.226 in a prestigious university, and 0.040 in a non-prestigious university. The gap in the probabilities of social science is 0.186 (s.e. 0.042) between two types of universities, and it is significantly different from zero. Moreover, such gaps rise, as the percentile CSAT scores and hence the probability of attending a prestigious university increase. In contrast, if the same male student has the CSAT scores below the 70th percentile and hence his probability of attending a prestigious university is less than 0.055, then the probability of each and every major are significantly lower in a prestigious university than in a non-prestigious university. Likewise, the absolute gaps rise, as the percentile CSAT scores and the probability of attending a prestigious university decrease.

[17]Suppose that we estimate a one-dimensional model of university major choices with no consideration of a university's prestige, and that we construct an individual's predicted probability of, say, engineering major as 0.5, on the basis of the model's estimates. Since the model does not explain the variation of the major-choice probabilities over different types of universities, we expect that this individual's probability of engineering major is same across the two types of universities. That is, since the probability of attending a prestigious university is assumed to be a half in a random assignment between the two types of universities, the choice probability of engineering major will be 0.25 in each group of prestigious and non-prestigious universities. As a result, the gap in the engineering probability will not exist between two types of universities. However, if attending a prestigious university is not a random assignment as considered in our estimation, such gap will exist, and the results will be that the more the probability of attending a prestigious university differs from a half, the bigger the absolute value of the gap becomes between two types of universities.

In contrast to the previous two cases, when the male student has borderline CSAT scores around the 85th and 80th percentile, which are associated with 0.530 and 0.296 probabilities, respectively, of attending a prestigious university, some probabilities of majors are fairly close between two types of universities. For the 85th percentile, the gaps in the major-choice probabilities do not significantly differ across two types of universities for all the majors except humanities. For the 80th percentile, the gaps for humanities, social science, science, and education majors significantly do not vary over two types of universities, while they do for engineering and business majors. In this region of the percentile CSAT scores, students seem to choose among many alternative combinations of a university-type and a major. The result is that the probability of attending a prestigious university is close to a half and that the gap in the major-choice probabilities is not wide between the two types of universities.

The findings of patterns of gaps in major-choice probabilities between two types of universities suggest that a university's prestige serves as a factor that significantly affects a male student's major choices, whether he has the CSAT score in the top percentiles or in the lower percentiles. Impacts of the university type are more pronounced, when a student has a highest percentile CSAT scores (within top 90th percentile) or a lower percentile scores (below 80th percentile). In these cases, the choice probabilities of each major significantly differ between the two types of universities. Those who have borderline percentile CSAT scores (around 80th and 85th percentiles) also make joint decisions of the university type to attend and their major field, although the gaps in the probabilities of chosen majors between two types of universities do not differ so much, as the probability of attending a prestigious university is close to half, an outcome close to that of a seemingly random assignment.

Fourth, when we examine women's predicted probabilities of chosen majors by the university-type in Table 5, we also find the importance of a university's prestige in the their major choices, although women's patterns of major choice are somewhat different from men's as shown in Table 4. Those women at the top 95th percentile CSAT scores are most likely to choose the humanities major (a 0.350 probability), which is followed by the social science (0.199) and engineering (0.147) majors in the group of prestigious universities. Those women at the 80th percentile CSAT scores, whose probability of attending a prestigious university is 0.263, are

most likely to choose the social science major within the group of non-prestigious universities (0.180). The second preferred choice of major is the humanities, whose choice probability (0.161) is fairly close to the probability of social science major. It is in contrast to a huge gap in men's choice probabilities between the most preferred major (engineering) and the second preferred one (social science) in the group of non-prestigious universities for those having the below-80th percentile CSAT scores. Similar to men's cases, within top 95th percentile CSAT scores and below the 80th percentiles, women's choice probability of a major significantly vary across two types of universities. However, in borderline CSAT scores around the 90th and 85th percentile, which are associated with 0.719 and 0.489 probabilities, respectively, of attending a prestigious university, the probabilities of choosing each major are fairly close between two types of universities.

5.3 Effects of Future Labor-Market Outcomes

In Section 5.2, we examine an influence of an individual's pre-collegiate capability (represented by the percentile CSAT scores in this study) on the attendance to a prestigious university and a chosen major, and the importance of a university's prestige in the major choice. Given such findings, in this section, we look into the factors that induce such outcomes. Specifically, we associate an individual's major-choice patterns within a given university-type with measures of post-graduation labor-market outcomes that expected at the time of decisions. As a measure of future labor-market outcomes after graduation, we use the following two variables: the predicted present-value monthly earnings and probability of large-firm employment. The former measure is one that is widely used in studies of university major choices to represent a payoff to a chosen major (see Berger (1988), Eide and Waehrer (1998) and Montmarquette, Cannings, and Mahseredjian (2002)). The latter is one that we consider in addition to the traditional measures of major-specific characteristics in order to characterize the patterns of major choice in South Korea.

In South Korean labor market, an employment in a large-firm sector is viewed as a labor market success of an individual. There is evidence that the large-firm sector carries a variety of primary sector advantages over the small and medium-firm (secondary) sectors. Compared

with the latter, the large-firm sector shows a large amount of wage advantages for an observably same individual, and higher job stability, lower rate of turn-over and job displacement, more favorable work environment, and advanced labor relations. Providing such advantages for their employees, the large firms enjoy a high level of competition among college graduates, and become more selective in hiring job applicants[18]. Such selection leads to low rate of large-firm sector employment for those graduating from non-prestigious universities relative to those from prestigious universities. Moveover, the ratio of the probability of large-firm employment for prestigious-university graduates to non-prestigious university graduates varies by the major field. For example, according to Table 2, the probability that an individual, who has the 85th percentile CSAT score, is hired by a large firm is significantly higher, when he/she graduates from a prestigious university especially with humanities or science majors. When the same individual majors in business, graduation from a non-prestigious university increases the probability of large-firm employment. The ratios are statistically insignificant for other majors. The ratios are likely to increase for all the majors, when an individual has a CSAT score below the 85th percentile.

As previously discussed, when we examine the effects of future labor-market outcomes on decision on the university-type and major choices, we first drop the CSAT scores for the major choice equation. Given that the percentile CSAT scores are a major determinant of university entrance in South Korea, the impact of the percentile CSAT scores may dominate other alternative sources of effects, and the latter can be interpreted as those left to be explained after the CSAT scores explains most of parts, when they are controlled in the estimation. To avoid this possibility, we eliminate the CSAT scores from the major choice equation in Model 3-5, and use them in Model 6 to examine the leading role played by the CSAT scores in the major choice within a given type of university. Other explanatory variables controlled in Model 3-6 are same as those of Model 2. Table 6 shows the estimates of Model 3-6.

When a single measure of future labor-market outcome is considered in the estimation as in Model 3 and 4, it is found that both the PV monthly earnings and the probability of large-firm

[18]This situation is very similar to the Japanese labor market for college graduates reported by Sakamoto and Powers (1995).

employment individually have significant effects on an individual's choice of major in a given type of university. The PV monthly earnings significantly affect an individual's choice of major within the group of prestigious universities, although their effects are not found so significant within the group of non-prestigious universities. The probability of large-firm employment highly significantly affects an individual's major choices in both types of universities. When both of the two measures are simultaneously controlled in the estimation as in Model 5, however, only the probability of large-firm employment remains to have a significant effect on an individual's major choice, whereas the PV monthly earnings fails to significantly affect the major choice independently. This result is in contrast to, as well as supplements, previous studies on major choices that report the PV earnings are a significant determinant to an individual's major choices. Our result suggests that a study on an individual's major choice can be improved by examining various measures of labor-market outcomes. This study find that, in the South Korean labor market, the significant effect of an individual's PV monthly earnings on major choices is due to its association with the probability of large-firm employment, and that the latter is a real determinant of one's major choice within a given type of university.

Although a more thorough examination is further required, a plausible explanation can be offered for the dominance of probability of large-firm employment in major choice in South Korea. We believe the finding is closely related with the dualistic structure of the South Korean labor market by firm size[19]. As mentioned earlier, the large-firm sector is viewed as the primary sector that provides its employees with better compensation, job stability, work environment, and labor-relations. In contrast, the sector of small and medium-sized firms is viewed as the secondary sector that offers lower quality of jobs over all such dimensions. Given this dualistic structure, workers' mobility between two sectors, especially upward mobility from the secondary to the primary sector, is limited, and an individual can enjoy a far greater benefits in the large-firm sector, once employed. Responding to this structure of labor market, South Korean

[19]See Cho (1998, Ch.12) regarding the dualistic structure of South Korean labor market. Studies on Japan can have an implication to the South Korean case, since South Korea and Japan share similar features in the labor market structure (for example, seniority wage system and enterprise unionism (Aoki (1988))). Sakamoto and Chen (1993) show the dual structure (by firm size) of Japanese labor market. Analyzing Japanese men entering the labor market from 1954 to 1975, Sakamoto and Powers (1995) find that the the relative ranking of educational attainment is highly associated with employment in the primary sector (white-collar occupations in government agencies, public corporations, or large firms in the private sector).

students will tend to prefer a university and a major that offer higher probability of large-firm employment.

5.4 Marginal Effects of Future Probability of Large-Firm Employment on Major Choice

Given the limitation of our data, it is not possible that we explore possible changes in the effect of large-firm employability on the major choices in greater detail, when the additional variables are added that are known to significantly affect an individual's major choices (such as the personal interest, job preferences, graduate school attendance and the perceive probability of success, etc.). However, as we have the CSAT percentile scores available, we can examine the changes in the effects of labor-market outcomes, when an individual's pre-collegiate academic capability is controlled along with them. According to Model 6's estimates of Table 6, even when the CSAT scores are controlled, the effect of probability of large-firm employment is found highly significant at the conventional level of significance, while that of the predicted PV earnings remains insignificant. This verifies the strong effect of the former on an individual's major choices in South Korean universities. When we examine the changes in magnitude of the estimate of the probability of large-firm employment before and after the CSAT scores are controlled, we find weaker effect of the expected probability of large-firm employment after it is added (see below). This confirms the prediction that, as the percentile CSAT scores are a major determinant of university entrance in South Korea, the percentile CSAT scores will play a leading role in an individual's choice of major in a university, and that other sources of effects on the choices can become weak.

To interpret the estimates of the probability of large-firm employment and the changes in its influences when the CSAT scores are controlled, we calculate the marginal changes in the probability of each major choice due to the change in the probability of large-firm employment, using the estimates of Model 5 and 6. They are reported in Table 7[20]. The first panel of the table

[20]The marginal changes of the probability of each major choice with respect to the probability of large-firm employment are calculated for each h by the following formula:

$$\frac{\partial P_{im}^h}{\partial EF_{ihm'}} = P_{im}^h[1(m = m') - P_{im'}^h]\delta_2$$

shows the changes in probability of a chosen major with respect to the expected probability of large-firm employment, based on the estimates of Model 5, which does not control the CSAT scores. The second panel shows them, when the estimates are used of Model 6, which does control the CSAT scores, and they are evaluated at the 85th percentile CSAT score. The third panel shows the same changes of the second panel, except that the estimates are evaluated at the 50th percentile CSAT score for each major within the group of non-prestigious universities.

According to the first panel, when the model is estimated with no control of the CSAT scores, it is found that the 10 percentage point increase in the future probability of large-firm employment for humanities major leads to the increase in the probability of own major choice by the amount of 0.018 within the group of prestigious universities. It also leads to the decrease in the probability of social sciences and science majors of a prestigious university all by 0.003. Interpretations for other values can made in a similar fashion. Within the group of non-prestigious universities, the impact of the future probability of large-firm employment becomes larger in its magnitude. For example, the 10 percentage point increase in the future probability of large-firm employment for humanities major leads to the increase in the probability of own major choice by the amount of 0.043. Other cross effects are also larger in absolute magnitude between majors within the group of non-prestigious universities.

When the estimates are obtained under the control of the CSAT scores, the marginal changes in the probability of a chosen major with respect to the expected probability of large-firm employment become smaller than the previous cases. When the Model 6's estimates are evaluated at the the 85th percentile CSAT score, the magnitudes of the own and cross marginal changes for each major are about a half of those changes obtained with no reference to the CSAT scores within the group of prestigious universities. The weakening effects of the expected probability of large-firm employment on a major choice are not as evident within the group of non-prestigious universities, when the Model 6's estimates are evaluated at the 85th percentile CSAT score. However, when they are evaluated at the 50th percentile CSAT score, for which an individual's probability of attending a prestigious university is about 0.001, the weakening effects of the

The changes are evaluated for a man who has mean values of the explanatory variables, and the 85th and 50th percentile CSAT scores.

expected probability of large-firm employment becomes very evident within the group of non-prestigious universities. The magnitude of the effects are less a third of those calculated with no control of the CSAT scores. All of these changes in the marginal effects confirms the weaker effect of the expected probability of large-firm employment, when the percentile CSAT scores are controlled in the estimation.

6 Concluding Remarks

In this paper, we have examined an individual's major choice in 4-year universities, using an estimation model for the joint decision about a type of university and a major field. From the analysis to South Korean students' patterns of major choice during last 20 years (1981-2001), we find that a university's prestige has a significant impact on their choice of major field of university study. Impacts of a university's prestige are found more pronounced, when a student has a highest percentile CSAT scores (within top 90th percentile) or a lower percentile scores (below 80th percentile). In these cases, the choice probabilities of each major significantly differ between the group of prestigious and non-prestigious universities. Those who have borderline percentile CSAT scores (around 80th and 85th percentiles) also seem to make joint decisions of the university type to attend and their major field, although the gaps in the probabilities of chosen majors between two types of universities do not differ so much. For these individuals, the probability of attending a prestigious university is close to half, an outcome close to that of a random assignment.

When we associate an individual's patterns of major choice with measures of future labor-market outcomes (i.e. the predicted PV earnings and probability of large-firm employment), we find that, in South Korea, rather than the stream of future earnings, the probability of large-firm employment after graduation plays a more significant and important role in the decisions of a major field in university study. Our result suggests that a study on an individual's major choices can be improved by examining various measures of labor-market outcomes. In the case of South Korea, a strong candidate is the future probability of large-firm employment after graduation. Such a significant influence of the probability of large-firm employment is viewed

as students' response to dualistic structure (by the firm size) of the South Korean labor market. Facing limited mobility between the primary and secondary sectors, South Korean students will tend to prefer a university and a major that offer higher probability of large-firm employment.

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Table 1: Major Choice of Men and Women in South Korea

	Men			Women		
		University Type			University Type	
Major Field	Total(%)	Prestigious	Non-Prestigious	Total(%)	Prestigious	Non-Prestigious
Humanities	13.4	15.4	12.8	28.1	37.4	26.3
Social Science	19.2	26.6	16.9	20.9	20.6	21.0
Science	11.1	8.1	12.0	16.7	7.5	18.6
Engineering	42.4	35.1	44.7	12.8	15.9	12.1
Education	3.9	3.9	3.9	13.1	13.1	13.1
Business	10.1	10.8	9.9	8.4	5.6	8.9
Number of Sample	1,090	259	831	635	107	528

Table 2: Monthly Earnings and Probabilities of Large-firm Sector Employment by Major Fields

Major Field	University Type: Prestigious	University Type: Non-Prestigious	Ratio	University Type: Prestigious	University Type: Non-Prestigious	Ratio
Men :	Monthly Earnings (KRW 1,000)					
	5 Years of Experience			Average of Present Value		
Humanities	1,536	1,610	0.95	1,165	1,222	0.95
Social Science	1,880	1,634	1.15	1,428	1,242	1.15
Science	1,903	1,513	1.26	1,446	1,150	1.26
Engineering	1,861	1,779	1.05	1,427	1,364	1.05
Education	2,160	1,651	1.31	1,690	1,291	1.31
Business	1,723	1,540	1.12	1,309	1,171	1.12
	Probability of Large Firm Employment					
	5 Years of Experience			10 Years of Experience		
Humanities	0.367	0.185	1.99	0.445	0.238	1.86
Social Science	0.517	0.406	1.27	0.527	0.416	1.27
Science	0.187	0.025	7.45	0.198	0.027	7.36
Engineering	0.360	0.408	0.88	0.576	0.625	0.92
Education	0.280	0.110	2.55	0.396	0.172	2.31
Business	0.312	0.471	0.66	0.384	0.550	0.70
Women :	Monthly Earnings (KRW 1,000)					
	5 Years of Experience			Average of Present Value		
Humanities	1,593	1,486	1.07	1,209	1,127	1.07
Social Science	1,359	1,306	1.04	1,033	993	1.04
Science	1,068	1,031	1.04	810	782	1.04
Engineering	1,636	1,020	1.60	1,242	775	1.60
Education	1,582	1,324	1.20	1,202	1,005	1.20
Business	1,978	1,065	1.86	1,501	808	1.86
	Probability of Large Firm Employment					
	5 Years of Experience			10 Years of Experience		
Humanities	0.431	0.229	1.89	0.512	0.291	1.76
Social Science	0.424	0.320	1.33	0.434	0.329	1.32
Science	0.134	0.017	7.87	0.143	0.018	7.80
Engineering	0.177	0.209	0.85	0.342	0.389	0.88
Education	0.131	0.046	2.88	0.203	0.074	2.72
Business	0.411	0.577	0.71	0.489	0.652	0.75

Note : The Korean Won(KRW) is the year 2000 constant. The US$1 was equivalent, on average, to KRW 1,131 in the year 2000.

Table 3: Model Estimates: Model 1 and 2

	Model 1		Model 2	
University Type		Non-		Non-
Explanatory Variables	Prestigious	Prestigious	Prestigious	Prestigious
University Type Equation :				
Intercept	-18.528(1.289)**		-18.871(1.467)**	
CSAT Score	0.198(0.014)**		0.197(0.016)**	
Location Seoul	1.658(0.346)**		1.747(0.367)**	
Private University	-0.380(0.365)		-0.269(0.391)	
Men	0.132(0.222)		0.166(0.247)	
Father's Education	No		-0.010(0.036)	
Father's Occupation	No			
Agricultural Worker			-0.514(0.392)	
Professional			0.361(0.367)	
Administrative & Sales			0.599(0.400)	
Service Worker			0.115(0.340)	
Birth Regions	No		Yes	
Major Fields Equation :				
Social Science :				
Intercept	-4.356(2.300)*	-0.491(0.216)**	-3.552(2.468)	-0.889(0.475)*
CSAT Score	0.041(0.025)*	0.005(0.004)	0.034(0.026)	0.008(0.004)**
Men	1.142(0.333)**	0.541(0.184)**	1.339(0.399)**	0.486(0.204)**
Father's Education			-0.018(0.059)	0.017(0.032)
Science :				
Intercept	1.075(1.910)	0.152(0.213)	-1.489(2.532)	-0.406(0.496)
CSAT Score	-0.029(0.021)	-0.012(0.004)**	0.005(0.027)	-0.009(0.004)**
Men	0.923(0.475)*	0.325(0.196)*	0.942(0.570)*	0.284(0.216)
Father's Education			0.014(0.080)	0.013(0.034)
Engineering :				
Intercept	-5.026(2.259)**	-1.327(0.229)**	-3.473(2.261)	-1.756(0.457)**
CSAT Score	0.045(0.024)*	0.011(0.003)**	0.033(0.024)	0.014(0.004)**
Men	1.675(0.347)**	2.066(0.191)**	1.796(0.397)**	2.079(0.210)**
Father's Education			0.019(0.058)	0.013(0.030)
Education :				
Intercept	2.165(1.980)	-0.847(0.272)**	1.305(2.030)	-1.964(0.654)**
CSAT Score	-0.035(0.022)	0.003(0.005)	-0.044(0.023)*	0.008(0.005)
Men	-0.401(0.478)	-0.491(0.256)*	0.034(0.566)	-0.487(0.280)*
Father's Education			-0.035(0.093)	-0.005(0.043)
Business :				
Intercept	-11.171(4.254)**	-1.329(0.272)**	-11.226(4.752)**	-1.275(0.570)**
CSAT Score	0.099(0.045)**	0.005(0.004)	0.105(0.050)**	0.011(0.005)**
Men	1.510(0.506)**	0.838(0.227)**	1.408(0.541)**	0.734(0.251)**
Father's Education			-0.044(0.078)	-0.064(0.038)*
Humanities :	Reference	Reference	Reference	Reference
Number of Sample	20,136		17,484	
Log-Likelihood	-2,957.7		-2,500.3	

Note : Numbers in parentheses are standard errors. * and ** indicate that the estimate is significant at the 10% and 5% levels, respectively.

Table 4: Predicted Probability of Chosen Majors by University-Type: Men

University Type Major Fields	Prestigious	Non- Prestigious	Gap	Prestigious	Non- Prestigious	Gap
	CSAT : 95th Percentile			CSAT : 90th Percentile		
Humanities	0.125	0.008	0.116**	0.123	0.020	0.103**
			(0.030)			(0.025)
Social Science	0.270	0.017	0.253**	0.226	0.040	0.186**
			(0.038)			(0.042)
Science	0.061	0.005	0.056**	0.059	0.013	0.046**
			(0.019)			(0.021)
Engineering	0.316	0.064	0.251**	0.265	0.143	0.122**
			(0.042)			(0.051)
Education	0.014	0.004	0.010	0.018	0.009	0.009
			(0.009)			(0.012)
Business	0.104	0.011	0.093**	0.061	0.025	0.036
			(0.026)			(0.026)
	CSAT : 85th Percentile			CSAT : 80th Percentile		
Humanities	0.100	0.040	0.060**	0.063	0.063	-0.00001
			(0.022)			(0.020)
Social Science	0.155	0.076	0.079	0.082	0.115	-0.033
			(0.050)			(0.046)
Science	0.047	0.026	0.020	0.029	0.043	-0.015
			(0.023)			(0.022)
Engineering	0.182	0.264	-0.083	0.097	0.387	-0.290**
			(0.064)			(0.060)
Education	0.018	0.017	0.001	0.014	0.025	-0.011
			(0.014)			(0.014)
Business	0.029	0.046	-0.017	0.011	0.069	-0.058**
			(0.026)			(0.021)
	CSAT : 70th Percentile			CSAT : 60th Percentile		
Humanities	0.014	0.094	-0.079**	0.002	0.108	-0.105**
			(0.031)			(0.048)
Social Science	0.013	0.157	-0.144**	0.002	0.167	-0.165**
			(0.022)			(0.018)
Science	0.006	0.071	-0.065**	0.001	0.090	-0.089**
			(0.014)			(0.013)
Engineering	0.016	0.497	-0.481**	0.002	0.496	-0.494**
			(0.036)			(0.034)
Education	0.005	0.035	-0.030**	0.001	0.037	-0.036**
			(0.009)			(0.008)
Business	0.001	0.091	-0.091**	0.0001	0.094	-0.094**
			(0.015)			(0.013)

Note : Numbers in parentheses are standard errors. * and ** indicate that the estimate is significant at the 10% and 5% levels, respectively.

Table 5: Predicted Probability of Chosen Majors by University-Type: Women

University Type Major Fields	Prestigious	Non- Prestigious	Gap	Prestigious	Non- Prestigious	Gap
	CSAT : 95th Percentile			CSAT : 90th Percentile		
Humanities	0.350	0.025	0.324**	0.315	0.058	0.257**
			(0.073)			(0.052)
Social Science	0.199	0.032	0.167**	0.151	0.070	0.081
			(0.060)			(0.056)
Science	0.067	0.011	0.055	0.059	0.027	0.031
			(0.034)			(0.035)
Engineering	0.147	0.024	0.120**	0.112	0.051	0.061
			(0.050)			(0.045)
Education	0.039	0.019	0.020	0.043	0.041	0.003
			(0.026)			(0.034)
Business	0.071	0.016	0.056	0.038	0.034	0.004
			(0.036)			(0.027)
	CSAT : 85th Percentile			CSAT : 80th Percentile		
Humanities	0.229	0.108	0.121**	0.129	0.161	-0.031
			(0.039)			(0.042)
Social Science	0.093	0.126	-0.033	0.044	0.180	-0.136**
			(0.052)			(0.042)
Science	0.042	0.054	-0.012	0.023	0.083	-0.060**
			(0.033)			(0.028)
Engineering	0.069	0.089	-0.020	0.033	0.123	-0.090**
			(0.041)			(0.032)
Education	0.039	0.074	-0.034	0.028	0.105	-0.078**
			(0.038)			(0.036)
Business	0.016	0.060	-0.044*	0.005	0.084	-0.079**
			(0.024)			(0.023)
	CSAT : 70th Percentile			CSAT : 60th Percentile		
Humanities	0.024	0.219	-0.195**	0.003	0.240	-0.237**
			(0.064)			(0.090)
Social Science	0.006	0.227	-0.221**	0.001	0.229	-0.228**
			(0.032)			(0.035)
Science	0.004	0.125	-0.121**	0.001	0.150	-0.150**
			(0.022)			(0.026)
Engineering	0.004	0.146	-0.141**	0.0004	0.138	-0.138**
			(0.024)			(0.024)
Education	0.008	0.133	-0.125**	0.002	0.134	-0.132**
			(0.025)			(0.023)
Business	0.0004	0.103	-0.103**	0.00002	0.101	-0.101**
			(0.020)			(0.019)

Note : Numbers in parentheses are standard errors. * and ** indicate that the estimate is significant at the 10% and 5% levels, respectively.

Table 6: Model Estimates for Labor-Market Outcomes: Model 3-6

University Type Explanatory Variables	Prestigious	Non- Prestigious	Prestigious	Non- Prestigious
Major Fields Equation :	Model 3		Model 4	
PV of Earnings (in Log)	1.084(0.531)**	0.144(0.233)		
Probability of Large-Firm Employment			0.014(0.003)**	0.028(0.007)**
CSAT Score	No	No	No	No
Major Fields Equation :	Model 5		Model 6	
PV of Earnings (in Log)	0.624(0.550)	-0.137(0.240)	0.760(0.557)	0.087(0.272)
Probability of Large-Firm Employment	0.026(0.007)**	0.015(0.003)**	0.021(0.008)**	0.008(0.004)**
CSAT Score	No	No	Yes	Yes

Note : Numbers in parentheses are standard errors. * and ** indicate that the estimate is significant at the 10% and 5% levels, respectively. Other explanatory variables controlled in the estimation are same as those of Model 2. The estiamates for variables not reported can be available upon request.

Table 7: Changes in Probability of a Chosen Major with Respect to the Probability of Large-Firm Employment

	Major Fields					
Probability of :	Humanities	Social Science	Science	Engineering	Education	Business
Attributes in:	Model 5 Estimates					
Prestigious						
Humanities	0.018	-0.003	-0.003	-0.009	-0.001	-0.002
Social Science		0.019	-0.003	-0.010	-0.001	-0.002
Science			0.018	-0.009	-0.001	-0.002
Engineering				0.036	-0.002	-0.006
Education					0.006	-0.001
Business						0.013
Non-Prestigious						
Humanities	0.043	-0.010	-0.006	-0.017	-0.003	-0.006
Social Science		0.040	-0.006	-0.016	-0.002	-0.006
Science			0.026	-0.009	-0.001	-0.003
Engineering				0.056	-0.004	-0.009
Education					0.012	-0.001
Business						0.026
	Model 6 Estimates Evaluated at the 85th Percentile CSAT					
Prestigious						
Humanities	0.008	-0.001	-0.001	-0.005	-0.0004	-0.001
Social Science		0.011	-0.001	-0.007	-0.001	-0.001
Science			0.006	-0.003	-0.0003	-0.001
Engineering				0.021	-0.002	-0.004
Education					0.004	-0.0004
Business						0.007
Non-Prestigious						
Humanities	0.039	-0.011	-0.006	-0.016	-0.003	-0.003
Social Science		0.035	-0.005	-0.014	-0.002	-0.003
Science			0.021	-0.008	-0.001	-0.002
Engineering				0.045	-0.003	-0.004
Education					0.010	-0.001
Business						0.012
	Model 6 Estimates Evaluated at the 50th Percentile CSAT					
Non-Prestigious						
Humanities	0.010	-0.002	-0.001	-0.005	-0.0005	-0.001
Social Science		0.012	-0.002	-0.006	-0.001	-0.001
Science			0.009	-0.005	-0.0004	-0.001
Engineering				0.021	-0.002	-0.004
Education					0.003	-0.0003
Business						0.007

Appendix Table 1: List of Prestigious Universities in South Korea

Name of University	1994-2001 Average CSAT Percentile	*Joongang*'s Ranking	Location	National / Private
1. Seoul National University	98.7	3	Seoul	National
2. Pohang University of Science and Technology	98.4	1	Kyongsang	Private
3. Yonsei University	96.8	4	Seoul	Private
4. Korea University	96.5	5	Seoul	Private
5. Sogang University	95.1	7	Seoul	Private
6. Seoul National University of Education	93.6	-	Seoul	National
7. Ewha Womans University	92.9	9	Seoul	Private
8. Hanyang University	92.1	7	Seoul	Private
9. Hankuk University of Foreign Studies	92.1	21	Seoul	Private
10. Ajou University	90.3	18	Kyongki	Private
11. Handong Global University	89.6	-	Kyongsang	Private
12. Chung-Ang University	89.0	12	Seoul	Private
13. Hongik University	88.7	-	Seoul	Private
14. Pusan National University	87.9	10	Kyongsang	National
15. University of Seoul	87.7	22	Seoul	National
16. Sungkyunkwan University	87.5	6	Seoul	Private
17. Kyung Hee University	86.3	16	Seoul	Private