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Labor Market Effects of Participation in Shadow Education: Evidence from South Korea

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I study the effect of participation in shadow education (private tutoring) in the eleventh grade on the duration of job search for the first job after one's completing education. I find that participation in shadow education increases significantly the probability of exit from job search to employment of high quality which offers a regular staff position and a job that requires qualification above or commensurate with an individual's education level and has been desired by the individual. The effect of participation in shadow education on employment is particularly strong and large for poor academic performers in school. I also find that participation in shadow education in high school increases the educational attainment and the probability of getting better grade in post-secondary education for poor academic performers.

JEL Classification: I26, J21
Keywords: Shadow Education, Private Tutoring, Employment, Academic Performance

I. Introduction

Shadow education or private tutoring among primary and secondary school students is a universal phenomenon in many countries. Bray (1999) reports that shadow education is widespread in, for example, Brazil, Egypt, Hong Kong, Japan, Malaysia, Singapore, Taiwan, and South Korea. Using data from 1994–1995 TIMSS (the Third International Mathematics and Science Study) Baker et al. (2001) also show that shadow education for eighth-grade mathematics is common in many East European and East Asian countries, with participation rates ranging from 40 to 80 percent. Although intensity of participation in shadow education differs across

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countries, observers of education system throughout the world have commented on its growth (Baker et al., 2001; Dang and Rogers, 2008). Existing studies on shadow education mostly deal with the determinants of demand for shadow education (e.g., Bray and Kwok, 2003; Tansel and Bircan, 2006; Dang, 2007; Lee et al., 2009) or the effects of shadow education on academic outcomes such as test scores (Bray, 1999, Chapter 4; Kang, 2012; Ryu and Kang, 2013), advance to tertiary education (Choi, 2008), and overall academic performance in secondary school (Dang, 2007) or college (Kim, 2005). Kim (2010) conducts a comprehensive study on the effects of shadow education on academic outcomes.

The results of previous studies on the effects of shadow education on academic performance are mixed. The studies using Korean data have found in general that the effect of shadow education—measured by participation, hours, or expenses—on test scores is at best moderate and it differs by subject.[1] Choi (2008), on the other hand, reports that shadow education, measured by expenses, has a moderate but significant effect on the probability of getting into college. Kim (2010) also finds that participation in shadow education in the eleventh grade has a positive and significant effect on educational attainment, while shadow education in the eighth grade does not. Kim (2005), using data collected from surveys of students enrolled in four prestigious colleges in Korea, reports that students who have participated in shadow education in senior year of high school perform poorly academically in college compared to those who have not. Kim (2010) also finds that participation in shadow education in the eleventh grade is negatively associated with grades in college, after controlling for the hours of independent study in secondary school.

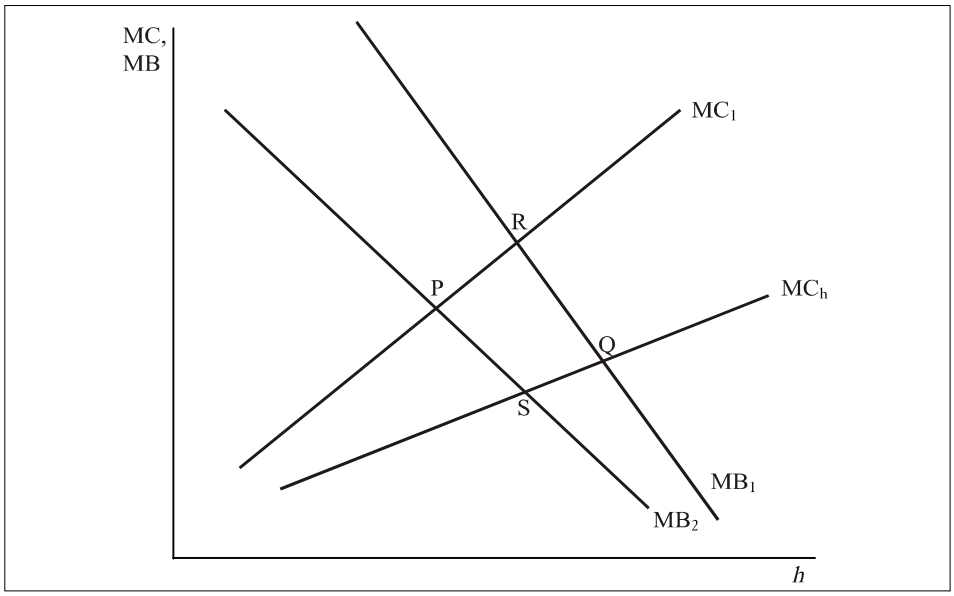
While we have a sizeable literature on the effect of shadow education on academic performance, so far little research has been done on the effect of shadow education beyond schooling such as labor market performance. An exception is Kim (2010) which finds that participation in shadow education has no effect on hourly wage, after controlling for hours of independent study during secondary school years, gender, parental education, years of schooling, labor market experience, and self-reported academic performance in the eighth grade or in college entrance exam. The effect of participation in shadow education on labor market performance should be a particularly important concern for policymakers who weigh the social return against the private return of investment in shadow education which may turn out to be socially wasteful. This research fills the gap in the literature.

This study examines the effect of participation in shadow education on the duration of the first job search after finishing formal education, using data from South Korea. In few countries do students participate in shadow education as extensively as in South Korea. According to the estimates published by the National Statistical Office of South Korea, 69% of all primary and secondary school students

[1] Look at Kim (2010) for a more extensive survey of Korean literature on this.

participated in shadow education in 2013. Total expenses for shadow education paid by Korean households in 2013 is estimated to be about 18.6 trillion Korean won, about three eighths of the total annual budget for public education of the country (about 50 trillion won). Not surprisingly in South Korea interests in issues related to shadow education are intense, which has led several institutions to collect data on shadow education on a large scale. We exploit the richness of the data collected in South Korea for this study.

[Figure 1] Demand for shadow education



We posit that the effect of shadow education may differ by an individual's performance in the formal education sector but that the relationship is a priori ambiguous. Figure 1 illustrates this point. An individual's choice of quantity of shadow education (h) is determined by the comparison of the marginal cost (MC) to the marginal benefit (MB) of shadow education. The marginal cost, consisting of monetary, time, and psychological costs, is likely to be increasing with h. Furthermore, mainly due to the psychological cost, it is likely to be higher for the poor performers (MC_l) than for the good performers (MC_h) in school (Spence, 1973). The marginal benefit is likely to be non-increasing with h. It is not, however, clear whether poor performers benefit more or less than good performers from shadow education.

It is possible that poor performers benefit more from shadow education than good performers, since they are likely to acquire more new knowledge than the good performers through shadow education. Furthermore, an individual's poor

performance at school may indicate that the individual needs different teaching materials or methods from those used in school, and so providing it through private tutoring is more likely to benefit poor performers than good performers. In such a case, in Figure 1 the choice of poor performers should be at point R and that of good performers at point S. At their chosen levels of shadow education, shadow education provides the greater marginal benefit to poor performers than to good performers, but the relationship between an individual's performance in school and the quantity of shadow education demanded is ambiguous.

On the other hand, since poor performers are likely to possess lower academic ability or less taste for academic work than good performers on average, it is also possible that poor performers benefit less from shadow education than good performers do. If that is the case, in Figure 1 the choice of good performers should be at point Q and that of poor performers at point P. Good performers demand more shadow education than poor performers do, but the relationship between the individual's performance in school and the marginal benefit of shadow education is ambiguous in this case.

With the data at hand we are not able to identify the MB or MC curves separately. Instead, we estimate the effect of participation in shadow education in the eleventh grade on labor market performance, given the choices made by individuals of different levels of performance at school in the eighth grade.

There is no experiment or quasi-experiment to be exploited to deal with the selection issue. In this study we try to reduce the selection bias as much as possible, although it can never be removed completely, by exploiting the rich set of information on family and personal characteristics which have not been used by the previous studies. Besides academic performance in the eighth grade (self-reported quintile in overall academic performance in the class), we have information on personal characteristics that are likely to be correlated with job search intensity and availability of job offers (gender, birth order, the level of formal education, and the year of graduation), father's education, family situation at 14 years of age (region of residence, parental co-residence status, maternal employment status, car ownership, and the number of rooms at home), individual characteristics at 14 years of age that are likely to be correlated with parental taste for the individual's education (being provided with own room or desk, the number of books at home, frequencies of conversations with the parents regarding school work and personal problems, frequency of having dinner together with the parents, and frequency of doing leisure activities with the parents), and the behaviors and experiences during the years of high school that are likely to be correlated with the individual's taste for academic work (taking a leave of absence from school, being tardy or absent from classes, and being disciplined by the school). We also use information on the quality of the university the individual has attended to control further the individual's ability or the quality of formal education. The quality of a university is measured by

the quintile of the average College Scholastic Ability Test score of the students who are admitted to the university in 2000. We actually have even more wider set of information, but we found that expanding the set of covariates further changes the results only slightly.

Controlling for the rich set of covariates, we find evidence that participation in shadow education significantly increases the probability of exit from job search to employment of high quality which offers a regular staff position and a job that requires qualification above or commensurate with the individual's education level and has been desired by an individual. The effect is particularly strong and large for those whose reported academic performance in the eighth grade belonged to the first three quintiles in the class. In fact, using interaction terms between the participation in shadow education dummy and the academic performance dummies, we find that the effect of shadow education is statistically significant only among the group of the poorest academic performers. We also find evidence that participation in shadow education increases the individual's educational attainment and the grade in post-secondary education, especially of the poorest academic performers in the eighth grade. These findings imply that participation in shadow education is likely to benefit the students lagging behind in the school more than the students doing well.

The balance of the paper is organized as follows. Section 2 describes the data. Section 3 presents the empirical model, estimation method, and estimation results. Section 4 concludes the paper.

II. Data

This study uses retrospective data collected by the supplementary survey of individuals aged between 15 and 35 in 2006—born in 1971 to 1991—of Korean Labor and Income Panel Study Wave 9 (KLIPS-9). The survey provides us with a rich set of information on the individuals' history of shadow education, living environment and relationship with the parents when the individual was 14 years old or in the eighth grade, various experiences in the middle and the high schools, and the first job held after formal education. For this study we use information collected from only those who finished schooling and graduated from a high school, a vocational two-year college, or a four-year university. The individuals whose reported age at graduation is lower than eighteen or higher than thirty are dropped from the sample due to concerns on measurement errors and excessive heterogeneity in the sample.

The key dependent variable for the analysis is the duration of the first job search after completion of schooling, the time it had taken for the individual to start the first job held for two months or longer since graduation. The data provide us with

two ways to construct the job search duration variable. One is to use the information on timing of graduation and of starting the first job, and the other is to use the self-reported duration of job search. Each method has its own problems.

The problem with the first method is that the survey asks only the year of graduation and only the year and the month of starting the first job, so we have to make assumptions regarding the timing of the two events. Since the academic year in Korea ends in February at all levels of schools and most graduation ceremonies are held in February, in our analysis the individuals are assumed to finish schooling on the first of February.[2] Employment is assumed to commence on the first day of the reported month of the reported year. The time unit is month. If the reported commencement of employment precedes graduation by no more than seven months, the job search duration is set to be one month. If the reported commencement of employment precedes graduation by more than seven months, the job search duration is set to be missing.

The problem with the second method is that the nature of the self-reported job search is unclear from the survey questions. The survey questions indicate that the individuals are asked about the job search duration after completion of schooling, but there is no direct information on how job search has ended, and it is not clear whether the exit from the job search coincides with starting the first job. In the analysis it is assumed that the job search activity refers to the first job search activity that has ended with starting the first job or being censored. The reported time unit is week, but for consistency the reported duration has been divided by four and the unit converted to month.

Both measures of the job search duration are used for the analysis. Excluding individuals with missing information on the covariates from the sample, 1893 observations of job search durations are available with the constructed duration and 1943 with the self-reported duration. The two measures are strongly correlated. The regression of the uncensored constructed duration on the self-reported duration indicates that the former is on average equal to the latter plus three months.[3] Whichever measure is used, the estimation results are very similar. In later sections, the results using the constructed duration are mainly presented.

We assume that an individual's job search ends in one of the following three states within twenty four months: exiting to employment of high quality, exiting to employment of low quality, and being right-censored. In order to determine the quality of employment, we use the following three criteria: whether the individual was hired as a regular employee; whether the qualification for the job was above or commensurate with the individual's education level; and whether the type of work

[2] This assumption is likely to over-estimate duration of job search for a small proportion of college and university students who graduated in July.

[3] The estimated regression line is $1.05 \times$ reported duration $+ 2.81$, with the standard errors equal to 0.04 and 0.13 respectively. The number of observations is 1511 and R^2 is 0.29.

was one that the individual had hoped to do before he or she graduated. Based on the individual's reports on the first job, if all the three criteria are met, the job search is considered to have ended with employment of high quality. If the individual's first job does not meet all the three criteria, the job search is considered to have ended with employment of low quality. If the individual fails to get any job within twenty four months, the job search is considered to have been right-censored. The key explanatory variable for our analysis is the dummy variable indicating whether the individual has participated in a type of shadow education for academic work—receiving private tutoring, attending a cram school, or subscribing to a periodical publication for cramming—in the eleventh grade. The survey also collects information on the number of hours of shadow education the individual has participated in. The dummy variable is preferred, since it is likely to be measured with the smaller error than the hour variable. Whichever variable is used, the results turn out to be qualitatively similar.

We include an extensive set of covariates, most of them collected by the supplementary survey of KLIPS-9, to control for personal characteristics and history that are likely to be correlated with the individual's participation or non-participation in shadow education, such as academic ability and performance prior to the eleventh grade, the family's economic situation during the individual's school years, parental taste for the individual's education, and the individual's taste for academic work. Previous studies have been limited in its ability to control for such variables, mainly because few surveys have collected such an extensive set of information.

The covariates included in the analysis are academic performance in the eighth grade (self-reported quintile in overall academic performance in the class), personal characteristics that are likely to be correlated with job search intensity and availability of job offers (sex, birth order, the level of formal education, and the year of graduation), father's education, family situation at 14 years of age (residential region, parental co-residence status, maternal employment status, car ownership, and the number of rooms at home), individual characteristics at 14 years of age that are likely to be correlated with parental taste for the individual's education (being provided with own room or desk, the number of books at home, and frequencies of conversations with the parents regarding school work and personal problems), and the behaviors and experiences during the years of high school that are likely to be correlated with the individual's taste for academic work (taking a leave of absence from school, being tardy or absent from classes, and being disciplined by the school). We also use information on the quality of the university the individual has attended. The quality of a university is measured by the quintile of the average College Scholastic Ability Test (CSAT) score of the students who are admitted to the university in 2000. The average CSAT scores have been collected by *Jinhaksa* and previously used by Lee et al. (2003). Although it can never be perfect, including the

large set of covariates correlated with an individual's shadow education status into the empirical model, which few previous studies have been able to do, may reduce the confounding effects of omitted variables, possibly to a substantial degree.

Figure 2 shows two charts of the Kaplan-Meier estimates of the survivor function of job search duration (Kalbfleisch and Prentice, 2002, Section 1.4). The chart on the left (chart A) regards getting any job as the exit from job search (the 'failure'), and the chart on the right (chart B) regards getting a job of high quality only as the exit from job search.

Chart (A) estimates that about one quarter of the job seekers are hired within a month into their job search activities, about a half within three months, and about three quarters within a year. The exit rate decreases with the job search duration. Participation in shadow education appears to make little difference in the rate of exit to any employment. On the other hand, chart (B) estimates that the individuals who have participated in shadow education are more successful in finding a job of high quality than those who have not. Fifty five percent of the participants are estimated to find a job of high quality within two years after graduation, but only forty seven percent of the non-participants are estimated to do so. The log-rank test of equality of survivor functions (Kalbfleisch and Prentice, 2002) rejects the null hypothesis of equality at the 1% level.

[Figure 2] The Kaplan-Meier estimates of the survivor functions, by shadow education participation dummy

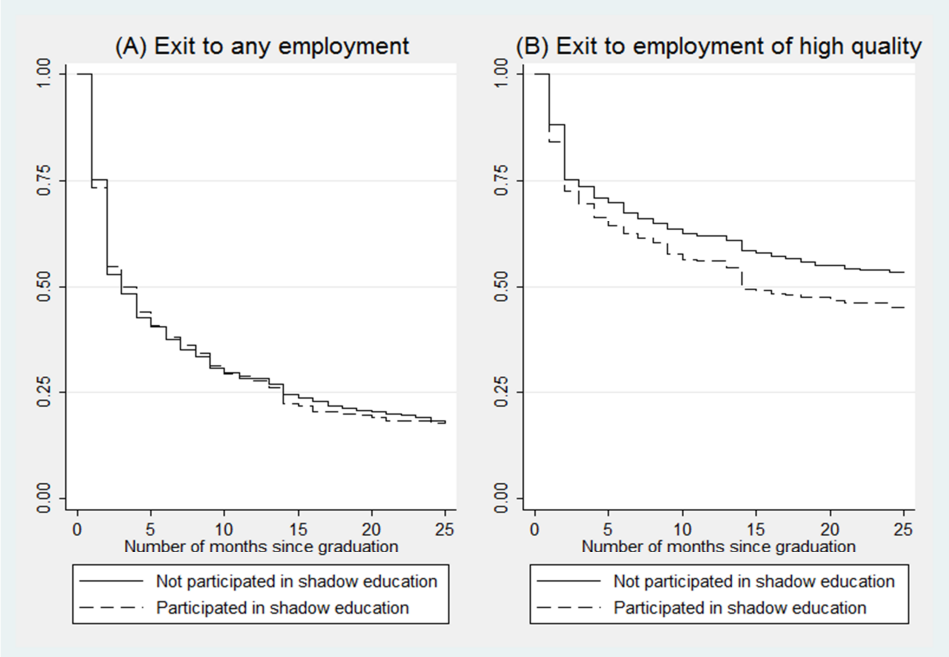


Chart (B) of Figure 2 raises the possibility that shadow education has effects on the individual's labor market performance beyond the schooling years. However, since the Kaplan-Meier estimates shown in Figure 2 are obtained without controlling for any covariate, we cannot exclude the possibility that the apparent effect of shadow education is explained away by the omitted differences between the participants and the non-participants. Semiparametric hazard models with covariates are estimated in the later section.

[Table 1] Summary statistics of the variables

Variable	Mean	S.D.
Job search ends with:		
exit to employment of high quality	0.36	
exit to employment of low quality	0.44	
being right-censored	0.20	
Uncensored job search duration in months	4.56	5.20
Academic performance in the eighth grade		
Fifth quintile in class	0.19	–
Fourth quintile in class	0.28	–
Third quintile in class	0.45	–
Second quintile in class	0.08	–
First quintile in class	0.01	–
Shadow education participation dummy	0.36	–
Participation rate by academic performance		
Fifth quintile in class	0.49	–
Fourth quintile in class	0.43	–
First three quintiles in class	0.28	–
Weekly hours of shadow education		
All	3.02	4.89
Participants only	8.41	4.61
Male	0.41	–
Eldest child	0.35	–
Level of formal education		
High school	0.40	–
Two-year vocational college	0.29	–
Four-year university	0.31	–
Quintile of the average CSAT score		
First	0.03	
Second	0.05	
Third	0.06	
Fourth	0.05	
Fifth	0.07	
Missing	0.05	
Father's years of education	9.95	3.53
Situation at 14 years of age		
Father was absent	0.06	–

Mather was absent	0.03	–
Mather was working	0.57	–
Owned a car	0.30	–
Number of rooms at home	2.67	0.72
Had own room	0.44	–
Had own desk	0.68	–
Residential region at age 14		
Seoul	0.20	–
The other metropolitan cities	0.32	–
Non-metropolitan areas	0.48	–
Number of books at home age 14		
0 to 10	0.09	–
11 to 25	0.30	–
26 to 100	0.45	–
101 to 200	0.12	–
201 to 500	0.03	–
More than 500	0.01	–
Relationship with the parents at 14		
Talked about school life		
Rarely	0.22	–
1-2 times a year	0.16	–
1-2 times a quarter	0.10	–
1-2 times a month	0.22	–
Weekly or more often	0.30	–
Talked about personal problems		
Rarely	0.38	–
1-2 times a year	0.20	–
1-2 times a quarter	0.14	–
1-2 times a month	0.17	–
Weekly or more often	0.11	–
Experiences at high school		
Had ever taken leave of absence	0.005	–
Had ever been tardy	0.19	–
Had ever been absent without an excuse	0.04	–
Had ever been disciplined by the school	0.01	–
Year of graduation		
1989 – 1993	0.18	–
1994 – 1997	0.25	–
1998 – 2001	0.26	–
2002 – 2006	0.31	–
Number of observations	1893	

Table 1 shows the summary statistics of the variables used in the statistical analysis. Out of 1893 observations of job search durations, 685 durations (36%) end with exit to employment of high quality, 830 durations (44%) with exit to employment of low quality, and 378 durations (20%) with right-censoring. The

mean uncensored duration of job search is 4.6 months. The maximum duration is 25 months.

The self-reported academic performance in the eighth grade appears to be reported less than accurately. If the individuals are randomly selected and the reports are accurate, the frequencies should be about equal across the quintiles. The reported frequencies are, however, skewed. Only 9% of the respondents report that their academic performance was in the first two quintiles in the class. Although the skewed distribution may be partly due to sampling of KLIPS or to construction of this particular sample, misreporting seems to be the main reason.[4] Nevertheless strongly correlated are the self-reported academic performance in the eighth grade and the education level achieved by the individual, which provides us with some confidence in accuracy of the self-reported performance. 68% of the respondents with self-reported performance in the highest quintile have attended a university and 42% of them have attended one with the average CSAT score in the top two quintiles; 40% and 13% of the respondents in the next quintile have done so respectively; and 15% and 4% of the respondents in the lower quintiles have done so respectively. In most analyses the lowest three quintiles are combined into one category to lessen the potential confounding effect of misreporting of the grade. Other combinations, such as combining only the first two quintiles into one and dividing the whole into only two categories of the first three quintiles and the next two quintiles, have been experimented with. The results are qualitatively similar.

36% of the individuals in our sample report that they have participated in shadow education in the eleventh grade. The participants have spent on average 8.4 hours a week for shadow education. There is a substantial variation in the participation rate across academic performance categories. The better the reported academic performance, the higher the expected participation rate. The relationship is likely to be explained by family background such as economic status and by parental and individual preference. It should be noted that the rate of participation in shadow education has increased over time. In our sample the participation rate climbs from 32% among those born in 1970 to 1974 (673 observations in total) to 38% among those born in 1981 to 1988 (338 observations in total).

About four tenths of the individuals in the sample are male and one third are the eldest among siblings. Four tenths graduated from high school only, and three tenths each graduated from a two-year vocational college and from a four-year university. About a quarter of the university graduates report that they graduated from a university with the average CSAT score in the top quintile. Fifty seven percent of the respondents report that their mother had worked when they were 14 years old. About one fifth lived in Seoul, the capital city, and about one half lived in

[4] The distribution of the reported grades of the original sample is very similar to that reported in Table 1.

a metropolitan city including the capital when they were 14 years old.

There is a wide variation in the reports of the individual's relationship with the parents at age 14. Individuals were more likely to talk about the school life than personal problems with the parents when they were 14. One fifth report that they had ever been tardy while they were high school students, and four percent report that they had ever been absent from school without an excuse. The year of graduation ranges from 1989 to 2006. About seventy percent graduated in the 1990s.

III. Estimation Method and Results

3.1. Estimation Method

First we estimate the effect of shadow education on the rate of exit to any employment regardless of job quality. Let $F(t|x)$ denote the distribution function of the job search duration T conditional on the covariates x. Then the hazard rate at time t since graduation to any employment from job search given the vector of covariates x is

$$\lambda(t|x)=\lim_{h\to 0}\frac{P(t\le T\le t+h|T\ge t,x)}{h}=\frac{f(t|x)}{1-F(t|x)}=-\frac{d\log[1-F(t|x)]}{dt}. \quad (1)$$

We use Cox proportional hazards model that assumes

$$\lambda(t|x)=\lambda_0(t)e^{x'\beta}, \quad (2)$$

where $\lambda_0(t)$ is the unspecified nonnegative baseline hazard rate that depends only on t. The model and the estimation procedure for β are well documented in textbooks of duration analysis, for example, Kalbfleisch and Prentice (2002, Chapter 4). Kiefer (1988) provides a survey of economic applications of the proportional hazards model and other models of hazard functions mostly used for analysis of job search durations.

Next we distinguish exit to employment of high quality from exit to employment of lower quality. Let ε denote the cause of exit from job search which is equal to 1 if exit is caused by employment of high quality and 2 if exit is caused by employment of lower quality. Let $F_j(t|x)$ denote the cumulative incidence function (Kalbfleisch and Prentice, 2002, p. 252) for exit by cause j conditional on covariates x, that is the conditional probability that job search ends by time t due to cause j or $P(T\le t,\varepsilon=j|x)$. We use the estimation method proposed by Fine and Gray (1999) for proportional subdistribution hazard model. The

subdistribution hazard function of exit to employment of high quality is defined as follows

$$\lambda_1(t|x) = -\frac{d\log[1-F_1(t|x)]}{dt} = \lim_{h\to 0}\frac{P[t \le T \le t+h, \varepsilon = 1 | T \ge t \cup (T \le t \cap \varepsilon \ne 1), x]}{h}. \quad (3)$$

and specified to be

$$\lambda_1(t \mid x) = \lambda_{10}(t)e^{x'\gamma}, \quad (4)$$

where $\lambda_{10}(t)$ is the unspecified nonnegative baseline hazard rate that is a function only of t. The formulations imply that

$$F_1(t|x) = 1 - exp[-\lambda_{10}(t)e^{x'\gamma}]. \quad (5)$$

It should be noted that the risk set associated with $\lambda_1(t \mid x)$ in formulation (3) is unnatural, since in reality those who have already got a job of lower quality prior to time t are not at risk at t. Thus the subdistribution hazard has no straightforward interpretation. Rather, the signs and the magnitudes of the coefficients γ show the effects of the covariates on the probability that the job search ends by exit to employment of high quality. This contrasts with the cause-specific proportional hazard model for competing risks which assumes the realistic cause-specific hazard rates but has the opposite interpretation problem (Cameron and Trivedi, 2005, Section 19.2).

3.2. Exit to any Employment

Table 2 shows the estimated hazard ratios of $(=e^{\hat{\beta}})$ the Cox proportional hazard model (2) which does not distinguish the quality of employment. The table consists of two panels with four columns each. Panel (I) shows the results without interaction between the shadow education participation dummy and the academic performance dummies; Panel (II) shows the results with the interaction terms. For brevity no estimates other than those of the shadow education participation dummy, the academic performance dummies, and their interaction terms are shown. In each panel, column (A) shows the results without any other covariates, column (B) the results with only education level dummies as additional covariates, column (C) the results with all the additional covariates but education level dummies, and column (D) the results with the full set of covariates.

[Table 2] Hazard ratio estimates of exit to any employment

Variable	(I) Without interactions				(II) With interactions			
	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
Participated in shadow education	1.012	1.016	1.098	1.085	1.067	1.060	1.155	1.129
	(0.22)	(0.29)	(1.55)	(1.33)	(0.83)	(0.73)	(1.75)	(1.46)
Reported academic performance in eighth grade								
Fifth quintile	.958	1.004	1.008	.999	.960	1.000	1.016	.993
	(-0.61)	(0.05)	(0.10)	(-0.01)	(-0.44)	(-0.00)	(0.16)	(-0.07)
×Participated in shadow education	–	–	–	–	.973	.988	.960	.991
					(-0.19)	(-0.08)	(-0.28)	(-0.06)
Fourth quintile	.984	.998	.955	.943	1.043	1.048	1.006	.988
	(-0.26)	(-0.03)	(-0.73)	(-0.91)	(0.55)	(0.60)	(0.08)	(-0.15)
×Participated in shadow education	–	–	–	–	.858	.880	.871	.881
					(-1.22)	(-1.01)	(-1.08)	(-0.98)
Are the following covariates included?								
(1) Education level dummies	No	Yes	No	Yes	No	Yes	No	Yes
(2) Eldest child dummy, sex, year of graduation	No	No	Yes	Yes	No	No	Yes	Yes
(3) Father's education, presence of parents, maternal labor market status, residential region, car ownership, number of rooms at 14	No	No	Yes	Yes	No	No	Yes	Yes
(4) Had own room, had own desk, number of books at home, relationship with parents at 14	No	No	Yes	Yes	No	No	Yes	Yes
(5) Had taken leave, had been tardy, had been absent, had been disciplined in high school	No	No	Yes	Yes	No	No	Yes	Yes
Wald test χ^2 -statistics and p-values								
H_0: Academic performance coefficients are jointly zero	0.37	0.01	0.66	0.96	1.91	1.11	1.81	1.98
	[0.83]	[1.00]	[0.72]	[0.62]	[0.75]	[0.89]	[0.77]	[0.74]
H_0: Shadow education coefficients are jointly zero	–	–	–	–	1.58	1.19	3.61	2.83
					[0.66]	[0.75]	[0.31]	[0.41]

Note: The asymptotic Z-values of the coefficient estimates are in the parentheses.

According to the estimation results shown in Table (2), participation in shadow education has no significant effect on the probability of exit to any employment from job search. In panel (I) participation in shadow education is estimated to increase the exit rate by 1 to 10 percent, but the increase is not statistically significant even at the 10% level under any specification. In panel (II) the coefficients associated with shadow education are not statistically significant individually or jointly at any conventional level under any specification.

Furthermore, there is no evidence that the past academic performance has any effect on the exit rate to employment. The estimated hazard ratios of academic performance dummies are very close to one, and none of them is statistically significant under any specification. This result is somewhat surprising, considering that the specifications (B) and (D) do not control for the educational attainment of the individual. It is likely due to that an individual of lower qualification or ability searches for a job with the lower expectation than an individual of higher qualification or ability, which shortens the duration of job search, everything else equal.

Among the other covariates, the individual's educational attainment, gender, and the year of graduation turn out to have significant correlation with the exit rate, while family background, the relationship with the parents at age 14, or experiences at high school have largely insignificant relationship with the exit rate. Tertiary education is estimated to increase the exit rate by 10 to 20 percent; men's job search duration is significantly longer than women's; and those who graduated after the Asian financial crisis search longer for a job than those who graduated prior to the crisis.

3.3. Exit to Employment of High Quality

The results in the previous section suggest that participation in shadow education has little effect on the rate of exit to employment from job search of those who have entered the labor market after completing schooling. It is, however, possible that participation in shadow education augments human capital and thereby raises the participant's reservation wage, which should extend the duration of job search but improve the quality of employment attained. The similar logic can explain why educational attainment has no significant relationship with the exit rate to employment. If that is the case, failure to distinguish the quality of employment in the analysis will result in underestimation of the positive effect of shadow education or ability on labor market performance of individuals. In order to address the issue, in this section, we estimate the sub-hazard ratios and the associated cumulative incidence function of exit to employment of high quality in the presence of competing risk of exit to employment of low quality, using the model (4).

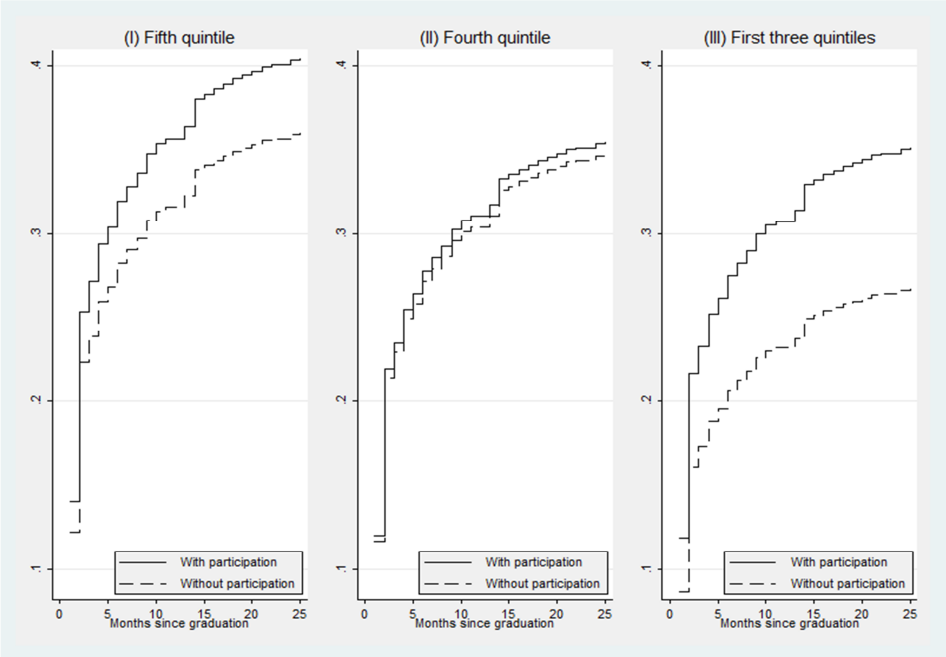
[Table 3] Sub-hazard ratio estimates of exit to employment of high quality

	(I) Without interactions				(II) Without interactions			
Variable	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
Participated in shadow education	1.191	1.127	1.249	1.206	1.409	1.292	1.490	1.393
	(2.30)	(1.53)	(2.60)	(2.18)	(3.03)	(2.20)	(3.25)	(2.66)
Reported academic performance in eighth grade								
Fifth quintile	1.358	1.272	1.429	1.344	1.447	1.312	1.585	1.438
	(3.20)	(2.34)	(3.48)	(2.73)	(2.85)	(1.98)	(3.40)	(2.55)
×Participated in shadow education	–	–	–	–	.829	.894	.766	.833
					(-0.98)	(-0.59)	(-1.37)	(-0.93)
Fourth quintile	1.290	1.216	1.281	1.217	1.497	1.391	1.465	1.373
	(2.98)	(2.21)	(2.77)	(2.14)	(3.75)	(2.98)	(3.39)	(2.77)
×Participated in shadow education	–	–	–	–	.685	.715	.707	.737
					(-2.19)	(-1.94)	(-1.97)	(-1.73)
Are the following covariates included?								
(1) Education level dummies	No	Yes	No	Yes	No	Yes	No	Yes
(2) Eldest child dummy, sex, year of graduation	No	No	Yes	Yes	No	No	Yes	Yes
(3) Father's education, presence of parents, maternal labor market status, residential region, carownership, number of rooms at 14	No	No	Yes	Yes	No	No	Yes	Yes
(4) Had own room, had own desk, number of books at home, relationship with parents at 14	No	No	Yes	Yes	No	No	Yes	Yes
(5) Had taken leave, had been tardy, had been absent, had been disciplined in high school	No	No	Yes	Yes	No	No	Yes	Yes
Wald test χ^2 -statistics and p-values								
H_0: Academic performance coefficients are jointly zero	13.74	7.18	14.28	8.50	19.02	11.09	18.75	11.58
	[0.001]	[0.028]	[0.001]	[0.014]	[0.001]	[0.026]	[0.001]	[0.021]
H_0: Shadow education coefficients are jointly zero	–	–	–	–	10.28	6.16	10.09	7.70
					[0.016]	[0.104]	[0.012]	[0.053]
H_0: Interaction term coefficients are jointly zero	–	–	–	–	4.83	3.81	4.29	3.07
					[0.089]	[0.149]	[0.117]	[0.216]

Note: The asymptotic Z-values of the coefficient estimates are in the parentheses.

Table 3 shows the estimation results of the sub-hazard ratios of the shadow education participation dummy, the academic performance dummies and their interactions. Each column of Table 3 uses the same specification as that of its corresponding column of Table 2. Figure 3 shows the cumulative incidence function estimated from the results in column (II-D), by shadow education status and academic performance in the eighth grade, with the other covariates at their mean.

[Figure 3] Estimated cumulative incidence function of exit to employment of high quality in the presence of competing risk of exit to employment of low quality, by academic performance and shadow education participation status, under specification (II-D) of Table 3



Comparison of the results in Table 3 with those in Table 2 reveals that distinction of employment of high quality from employment of lower quality makes a notable difference. Participation in shadow education and the better performance in school are estimated to increase the exit rate to employment of high quality significantly.

In panel (I) participation in shadow education is estimated to increase the sub-hazard rate of exit to employment of high quality by 19 to 25 percent without controlling for educational attainment and by 13 to 21 percent with controlling for educational attainment. The coefficient is statistically significant at the 5% level in all columns but (B). In our sample, the estimates imply that participation in shadow

education increases the probability of ending job search due to exit to employment of high quality within two years since graduation by 3 to 6 percentage points on average, everything else equal.

In panel (II) we find that the effect of shadow education is likely to be greater for those whose academic performance in school is sub-par than for those who perform better. If an individual's academic performance in the eighth grade belonged to the first three quintiles in the class, it is estimated that participation in shadow education would increase the sub-hazard rate of exit to employment of high quality by 41 to 49 percent without controlling for educational attainment and by 29 to 39 percent with controlling for educational attainment. The interaction term coefficients are all negative, implying that the effect of shadow education is smaller for the better academic performers in school.

The cumulative incidence functions estimated under the specification (II-D) depicted in Figure 3 illustrate this. It shows that in all academic performance groups participation in shadow education increases the cumulative probability of exit to employment of high quality. For those with academic performance in the fifth quintile, the cumulative probability of exit to employment of high quality at twenty four months of job search is estimated to increase from 36 percent to 40 percent with shadow education, everything else equal; for those with academic performance in the fourth quintile, from 35 to 36 percent; and for those with academic performance in the first three quintiles, from 26 to 35 percent.

The results shown in Table 3 Panel (II) and the charts in Figure 3 suggest strongly that the size of the effect of shadow education depends on the individual's academic achievement at school. In fact, statistical tests fail to reject the null hypothesis that the effect of shadow education is zero even at the 10% level for the individuals with academic performance in the fifth or the fourth quintile, which suggests that participation in shadow education may have only the 'remedial' effect. This interpretation should be made with caution, however, since the test results of joint significance of the interaction term coefficients are rather ambiguous. The *p*-values are around the borderline with the significance level of 10% if the educational attainment is not controlled for, but the tests fail to reject the null hypothesis even at the 10% level if educational attainment is controlled for.

The smaller coefficient size with educational attainment among the covariates suggest that the effect of shadow education on employment is explained partly by its effect on the individual's educational attainment. That the coefficient is still statistically significant at the 5% level in three out of the four cases and that the coefficient size does not drop substantially with inclusion of educational attainment dummies imply that participation in shadow education has other effects. It may increase the probability of getting into a post-secondary educational institution of higher quality or better reputation, getting more popular major, improving the post-secondary academic performance, or simply the stock of human capital not directly

related with the educational attainment. Furthermore, comparison of columns (A) and (B) to columns (C) and (D) in each panel shows that controlling for the additional covariates increases the estimated size of the coefficient estimates only slightly.

Unlike the results in Table 2, the individual's academic performance in the eighth grade has a strongly positive relationship with the probability of getting a job of high quality. Figure 3 illustrates the relationship clearly. The relationship between academic performance and the rate of exit to employment of high quality is weaker when education level is controlled for than not, but the coefficients associated with academic performance are still jointly significant at the 3% or smaller levels in all specifications. It suggests that academic performance in the eighth grade is likely to be correlated with the individual's unobserved ability or stock of human capital that is in turn positively correlated with the probability of getting a job of high quality after finishing schooling, even after controlling for the level of education.

Table 3 reports the estimation results with shadow education participation dummy, constructed job search duration, and three categories of academic performance. To check whether the results are sensitive to how those key variables are defined, the competing risks model has been estimated using alternative variables, and the results are shown in Table 4. Table 4 consists of six columns. Column (I) replicates the results of Table 3 column (II-D) for comparison; column (II) shows the results with only two categories of academic performance—whether the individual's performance belonged to the fourth to fifth quintile or to the lower quintiles; column (III) shows the results with the hours of shadow education variable instead of the participation dummy variable; column (IV) shows the results with reported duration described in Section 2 and the participation dummy; column (V) shows the results with reported duration and the hour variable; and the final column (VI) shows the results for exit to regular employment instead of a high-quality job. Note that the number of observations differs from one column to another due to different number of missing observations. Columns (II) to (VI) use the same set of additional covariates as used in column (I).

The specification in column (II) is devised out of concern that the apparently greater effect of shadow education on employment of the individuals with poor academic performance than on employment of the individuals of better academic performance may be attributed to the greater heterogeneity of individuals in the excluded academic performance category—the poorest performance—than those in the included two categories. In column (II) we combine the fourth and the fifth quintiles into one category in order to increase heterogeneity of individuals that belong to the combined category. The result is that the effect of participation in shadow education is still smaller for the included group of good academic performers than for the excluded group of poor academic performers, and the effect

[Table 4] Sub-hazard ratio estimates of exit to employment of high quality: Results with alternative variables

Variable	(I) Table 3 (II-D)	(II) Two categories	(III) Hours	(IV) Reported duration	(V) Reported duration and hours	(VI) Exit to regular employment
Shadow education dummy / hours	1.393	1.388	1.031	1.271	1.021	1.334
	(2.66)	(2.63)	(2.89)	(2.25)	(2.30)	(3.51)
Academic performance in eighth grade						
Fifth quintile	1.438	–	1.419	1.369	1.375	1.226
	(2.55)		(2.69)	(2.63)	(2.95)	(2.14)
×Shadow education dummy / hours	.833	–	.984	.923	.992	.846
	(-0.93)		(-0.91)	(-0.48)	(-0.55)	(-1.22)
Fourth quintile	1.373	–	1.333	1.327	1.305	1.174
	(2.77)		(2.66)	(2.90)	(2.90)	(2.05)
×Shadow education dummy / hours	.737	–	.974	.853	.987	.769
	(-1.73)		(-1.53)	(-1.07)	(-0.90)	(-2.11)
Fourth to fifth quintile	–	1.390	–	–	–	
		(3.17)				
×Shadow education dummy	–	.779	–	–	–	
		(-1.62)				
Number of observations	1893	1893	1891	1943	1941	1893
Wald test χ^2-statistics and p-values						
H_0: Shadow education coefficients are jointly zero	7.70	7.16	9.05	6.42	6.27	12.90
	[0.053]	[0.028]	[0.029]	[0.093]	[0.099]	[0.005]
H_0: Interaction term coefficients are jointly zero	3.07	2.62	2.51	1.14	0.87	4.67
	[0.216]	[0.106]	[0.285]	[0.566]	[0.647]	[0.097]

Note: The asymptotic Z-values of the coefficient estimates are in the parentheses.

for the former group is not statistically significant at any conventional level. The interaction term coefficient is marginally insignificant at the 10% level. This result suggests that the limited effect of shadow education on employment of good academic performers is not likely due to construction of the academic performance dummies.

Column (III) shows that using the hours of shadow education variable instead of the participation dummy makes little substantial difference to the estimation result. It is estimated that an additional hour of shadow education significantly increases the sub-hazard rate of exit to employment of high quality by 3 percent for the individuals with the poorest academic performance in school, and that the effect of shadow education is smaller for the better performers. The effect of shadow education is statistically significant at conventional levels only for the poorest performers.

Columns (IV) and (V) show that using the reported job search duration as the dependent variable produces the qualitatively similar results as using the constructed duration. The estimated coefficients are smaller, but the key results still stand. The shadow education coefficients are jointly significant at the 10% level; participation in shadow education or an increase of the hours of shadow education has a positive and significant effect on exit to employment of high quality of the poorest performers in school; and the effect of shadow education is smaller and insignificant for the better performers in school.

Column (VI) addresses some concern that the definition of a "high-quality" job is arbitrary and restrictive. The results show that changing the definition to just a regular employment—whether the respondent is employed as a regular or an irregular staff is self-reported—does not change the estimation results much. The sizes of the coefficients are only slightly different from those in column (I).

Table 5 is another check of robustness of the results. Table 5 shows the estimation results under the same specifications of Table 3 except that the education level dummies in columns (B) and (D) of both panels are expanded to subdivide the university level into six — five by quintile of the average CSAT score of the university and one for missing CSAT score. In this way we can see whether the effect of shadow education on exit to employment of high quality still exists even when the quality of the university an individual graduated from is controlled for. It can also reduce further the confounding effects of unobserved heterogeneity such as ability of the individual.

It turns out the results of Table 5 are not that different from those of Table 3. The coefficient sizes are almost identical. The results suggest that the effect of shadow education on labor market performance is not entirely explained by its effect on the individual's education level of the quality of the university the individual is admitted to.

[Table 5] Sub-hazard ratio estimates of exit to employment of high quality controlling for quintile of average CSAT score of university

	(I) Without interactions				(II) Without interactions			
Variable	(A)	(B)	(C)	(D)	(A)	(B)	(C)	(D)
Participated in shadow education	1.191	1.125	1.249	1.200	1.409	1.307	1.490	1.403
	(2.30)	(1.50)	(2.60)	(2.11)	(3.03)	(2.29)	(3.25)	(2.70)
Reported academic performance in eighth grade								
Fifth quintile	1.358	1.268	1.429	1.361	1.447	1.323	1.585	1.467
	(3.20)	(2.23)	(3.48)	(2.77)	(2.85)	(2.03)	(3.40)	(2.69)
×Participated in shadow education	–	–	–	–	.829	.870	.766	.818
					(-0.98)	(-0.73)	(-1.37)	(-1.04)
Fourth quintile	1.290	1.214	1.281	1.214	1.497	1.399	1.465	1.380
	(2.98)	(2.18)	(2.77)	(2.10)	(3.75)	(3.03)	(3.39)	(2.81)
×Participated in shadow education	–	–	–	–	.685	.700	.707	.721
					(-2.19)	(-2.05)	(-1.97)	(-1.84)
Are the following covariates included?								
(1) Education level dummies & quintile of average CSAT score	No	Yes	No	Yes	No	Yes	No	Yes
(2) Eldest child dummy, sex, year of graduation	No	No	Yes	Yes	No	No	Yes	Yes
(3) Father's education, presence of parents, maternal labor market status, residential region, car ownership, number of rooms at 14	No	No	Yes	Yes	No	No	Yes	Yes
(4) Had own room, had own desk, number of books at home, relationship with parents at 14	No	No	Yes	Yes	No	No	Yes	Yes
(5) Had taken leave, had been tardy, had been absent, had been disciplined in high school	No	No	Yes	Yes	No	No	Yes	Yes
Wald test χ^2 -statistics and p-values								
H_0: Academic performance coefficients are jointly zero	13.74	6.85	14.28	8.67	17.13	11.21	18.75	12.22
	[0.001]	[0.033]	[0.001]	[0.013]	[0.002]	[0.024]	[0.001]	[0.016]
H_0: Shadow education coefficients are jointly zero	–	–	–	–	10.28	6.51	10.09	7.83
					[0.016]	[0.089]	[0.012]	[0.050]
H0: Interaction term coefficients are jointly zero	–	–	–	–	4.83	4.22	4.29	3.51
					[0.089]	[0.121]	[0.117]	[0.173]

Note: The asymptotic Z-values of the coefficient estimates are in the parentheses.

3.4. Additional Results: Effects of Shadow Education on Education Level, Post-secondary Academic Performance and Wage of the First Job

So far we have examined the effects of shadow education on the duration of job search after formal education. In this section we present four additional estimation results that are likely to be of interests to researchers and policy makers, namely effects of shadow education on educational attainment, academic performance in post-secondary education, on log monthly salary of the first job, and on log hourly wage of the first job. It should be cautioned that the last three results are obtained using selected samples, and thus the results may not be generalized to the population.

Column (A) of Table 6 shows the estimation result of the ordered logit model for the final educational attainment, using the same set of additional covariates as used under the specifications labeled (C) of Tables 2 and 3. High school, two-year vocational college, and four-year university are coded 0, 1, and 2 respectively. The result suggests that participation in shadow education increases the educational attainment everything else equal, and that the size of the effect is negatively related with the individual's academic performance in the eighth grade. It is estimated that in our sample participation in shadow education increases the probability of attending university of the poorest performer group from 14 to 27 percent on average, that of the next group from 30 to 43 percent, and that of the best group from 55 to 59 percent. The effect is statistically significant at the 1% level for the poorest performer group and the next, but it is not statistically significant for the best performer group. This result is consistent with the results in panel (II) of Table 3. That shadow education increases educational attainment is also consistent with Choi (2008) and Kim (2010). Choi (2008) finds that an increase of expenses on shadow education raises the probability of an individual's advancement to tertiary education and Kim (2010) finds that participation in shadow education in high school does.

Column (B) of Table 6 shows the estimation result of the ordered logit model of academic performance in post-secondary education. The dependent variable is the self-reported academic performance in a two-year vocational college or a university. Its distribution is as follows: the fifth quintile (coded 5)–24%, the fourth quintile (coded 4)–39%, the middle quintile (coded 3)–34%, the second quintile (coded 2)–3% and first quintile (coded 1)–0.4%. The additional covariates are identical to those of columns labeled (D) in Tables 2 and 3. Participation in shadow education is estimated to have a positive effect on the grade achieved in a post-secondary educational institution by the poorest performer group, and its effect is statistically significant at the 5% level. The effect is close to zero and not statistically significant for the other two groups of better performers in the eighth grade. This result is also consistent with the results in panel (II) of Table 3. It should be noted, however, that

[Table 6] Additional estimation results

Variable	Coefficient estimates					
	(A) Educational attainment	(B) Post-secondary grade	(C1) Log monthly salary	(C2)	(D1) Log hourly salary	(D2)
Received shadow education	.961	.382	.069	.026	.142	.044
	(6.49)	(1.99)	(2.05)	(0.78)	(3.04)	(0.98)
Academic performance in eighth grade						
Fifth quintile	2.461	1.936	.307	.200	.350	.194
	(12.80)	(8.54)	(8.63)	(5.51)	(7.03)	(3.79)
×Received shadow education	-.743	-.340	.039	.051	-.018	.004
	(-2.59)	(-1.12)	(0.67)	(0.90)	(-0.24)	(0.06)
Fourth quintile	1.141	1.081	.113	.084	.164	.106
	(7.90)	(5.54)	(4.04)	(3.07)	(4.36)	(2.73)
×Received shadow education	-.226	-.481	.013	.011	-.006	-.012
	(-0.98)	(-1.76)	(0.26)	(0.22)	(-0.09)	(-0.17)
Number of observations	1893	1098	1659		1657	
Model	Ordered logit	Ordered logit	OLS		OLS	
Specification of the additional covariates is the same as Tables 2 & 3 columns labeled	C	D	A	C[b]	A	C[b]
H_0: Shadow education coefficients are jointly zero[a]	54.90	4.37	4.46	1.47	7.99	0.67
	[0.000]	[0.225]	[0.012]	[0.222]	[0.000]	[0.573]
H_0: Interaction term coefficients are jointly zero[a]	6.73	3.29	0.07	0.42	0.01	0.02
	[0.035]	[0.193]	[0.791]	[0.656]	[0.932]	[0.976]

Note: The asymptotic Z-values of the coefficient estimates are in the parentheses. [a]The test statistics are χ^2-test statistics in columns A and B and F-test statistics in columns C and D. [b]The year of employment dummies are used instead of year of graduation dummies and age and squared age at commencement of employment are also included.

the three shadow education coefficients are not jointly significant at any conventional level.

The result that shadow education has positive effects on grades in college for some students is somewhat different from those of Kim (2005) and Kim (2010). It should be noted, however, that Kim (2005) surveyed students only in four top universities that are likely to be very good academic performers in the eighth grade. Kim (2010) does not look separately at good and poor academic performers. Their results and ours suggest that participation in shadow education in high school is unlikely to have a positive effect on academic performance in college for most students. The positive effect is limited to poor academic performers in secondary school.

Columns (C1) to (D2) show the results of OLS regressions of log monthly salary and log hourly wage of the first job. There is no additional regressor in columns (C1) and (D1), while in columns (C2) and (D2) the additional regressors are identical to the covariates of columns labeled (C) in Tables 2 and 3 except that the year of employment dummies are used instead of year of graduation dummies and age and squared age at commencement of employment are also included. The amounts are adjusted for inflation using the consumer price index that is equal to 100 in 2005. Hourly wage is monthly salary divided by monthly hours of work. The mean and standard deviation of monthly salary in the sample are 1.13 million Korean won and 0.76 million Korean won; and those of hourly wage are 7.26 thousand Korean won and 15.47 thousand Korean won.

Without any additional regressor, status of participation in shadow education is estimated to have a significant relationship with the salary. A participant is expected to receive the higher salary than a non-participant. For example, among the poorest academic performers in the eighth grade, a participant is estimated to receive 7 percent higher salary per month or 14 percent higher salary per hour than a non-participant. Controlling for the other regressors, however, the differences between the participant and the non-participant decrease substantially, and they are not jointly significant. This implies that much of the relationship between the shadow education status and the salary can be explained by the personal and the family characteristics, unlike the relationship between the shadow education status and the job search duration. Note that this result is comparable to Kim (2010) that finds no significant effect of shadow education on salary.

3.5. Discussion

Some may suggest that the significant coefficient of the shadow education participation dummy does not necessarily imply that one accumulates human capital through shadow education, and rather that the estimation result is due to a spurious correlation created by a third factor. One such factor is the family

connections that may speed up an individual's job search process. If the families of the participants in shadow education are better connected than the families of the non-participants, probably because they are wealthier, the participants are likely to be more successful in finding employment than the non-participants, everything else equal.

To test validity of the argument, we have used the data on methods of job search. The supplementary survey of young individuals of KLIPS-9 provides information on up to three methods of the first job search used by the respondents. There are eleven methods listed in total (except for 'others') such as school counselors, friends and relatives, employment offices, etc. Using the information, we can identify those that used personal and family connections for job search, and study whether the connections are more likely to be used by the participants than the non-participants.

We have found no evidence that supports such argument. In fact the evidence indicates the opposite—personal or family connections are less likely to be used by participants than non-participants. In our sample, controlling for the academic performance in the eighth grade and the educational attainment and using the linear probability model, we find that the probability that the personal and family connections are used among the participants is lower by about 6 percent than among the non-participants. The difference is statistically significant at the 2% level. Using the interaction terms, we find that the estimated difference is even greater among the poor academic performers belonging to the first three quintiles—9% and statistically significant at the 1% level. Controlling for the other covariates decreases the difference, but it does not change the overall picture. Among the poor performers, the estimated difference is still about 7% and statistically significant at the 5% level.

IV. Conclusion

In this study we estimate the effect of participation in shadow education in the eleventh grade on the duration of job search for the first job after completion of the formal education. This longer-term effect of shadow education on an individual's labor market performance has not been studied before. Controlling for the rich set of covariates, few of which have been used by previous studies, we find evidence that participation in shadow education increases significantly the probability of exit from job search to regular position or employment of high quality which offers a regular staff position and a job that requires qualification above or commensurate with the individual's education level and has been desired by the individual.

The effect is particularly strong and large for those whose reported academic performance in the eighth grade belonged to the first three quintiles in the class. In fact, using interaction terms between the participation in shadow education dummy

and the academic performance dummies, we find that the effect of shadow education is statistically significant only among the group of the poorest academic performers. The first channel through which shadow education helps them in the labor market is by raising their educational attainment, as shown in Column (A) Table 6. The results in Tables 2 to 5 suggest, however, that there are additional channels. One of them is its positive effect on academic performance in post-secondary school, as shown in Column (B) Table 6. Shadow education seems to help the relatively poor academic performers prepare better for post-secondary education, and the better performance in college should help the individual in labor market. The other possible channels, which are not examined in this paper, are to help them get better grades in high school, get into better vocational college and to allow them major in more marketable and competitive subjects in post-secondary school. It is also possible that shadow education simply helps individuals accumulate more human capital or build capacity to acquire more in the future as formal education does. Unfortunately examination of such channels requires much more detailed information about individuals than what we currently have.

Although we control for the set of covariates that is richer than that previously used in most studies, definitive causal interpretation of our results may be premature. It is still possible that the estimated coefficients are biased by unobserved factors. If demand for shadow education for the poorest performer group is partly determined by the unobserved amount of potential for future improvement—e.g., unobserved work ethic—the estimated effect for the group is likely to be biased upward. Thus the estimates of this paper should be viewed with some caution. Barring a social experiment, it would be very difficult to measure the educational and non-educational effect of shadow education free of any bias. It is also possible that shadow education has effects different from those estimated in this paper on employment beyond the first job. As one accumulates more experience in the labor market, initial differences caused by shadow education may dissipate.

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