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Soomyung Jang

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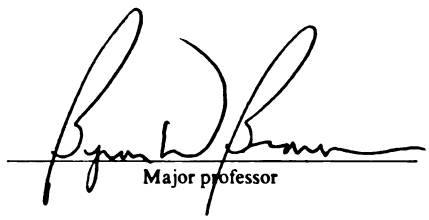

Major professor

Date June 16, 2000

Two Essays on Work and Education

By

Soomyung Jang

A DISSERTATION

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

Department of Economics
2000

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ABSTRACT

TWO ESSAYS ON WORK AND EDUCATION

By

Soomyung Jang

Using samples of high school seniors from two data sets, the NLS-72 and HS&B, this study examines the determinants of employment during high school and explores the effects of employment during high school on college attendance and the choice of college major.

In the examination of the determinants of high school employment, we focus on academic ability, socio-economic status, and local economic conditions. The findings are as follows: first, the relationship between high school employment and academic ability is non-linear. Students with medium academic ability work most and students with high academic ability work moderate hours if they work. Second, students from families with mid-level socio-economic status work more hours and hold more jobs than students from families in either the bottom socio-economic status or the top socio-economic status. Third, local economic conditions, such as the employment growth rate and the unemployment rate are decisive factors in determining employment during high school. Fourth, in 1980, students with high academic ability and high socio-economic status participated in the labor force more intensively than similar high school students did in 1972.

In Chapter 2, we utilize multinomial logit and probit models to explore the effects of high school employment on college attendance, and on the choice of college major. As

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in previous studies, we find that high school work experience, in general, is negatively related to college attendance, particularly four-year college attendance. However, this negative relationship does not necessarily mean that work experience affects college attendance negatively since students who do not intend to attend college may choose to work more. Controlling for such endogeneity, work experience for the students in 1972 appears to increase college attendance, while in 1980, it affects college attendance negatively. This change in the relationship over time seems to be related to changes in the characteristics of student workers between 1972 and 1980.

Conditional on attending college, we find that high school work experience is strongly associated with choice of major. Students who work during their senior year in high school are more likely to choose majors that lead to high-paying jobs later. The longer students work during their senior year, the more likely they are to choose business or engineering as a major, versus majoring in liberal arts or education curricula. This association is stronger among males than females.

The relationship between high school work experience and the choice of college major does not appear to be attributable to certain unobservable characteristics, such as a greater tendency to work, that leads some students to choose 'practical majors' which facilitate future employment. Rather, the association seems to occur because high school work experience influences the choice of college major.

These findings contribute to our understanding of why there are positive effects of high school work experience on later earnings, despite its negative association with post-secondary education.

To my beloved ones, Hyunju, Doore and Sunna

ACKNOWLEDGEMENTS

Being born

Giving birth

Both are fear and labor

With joy of new life

As I begin my career as a fledgling economist, I would like to thank my committee members for their help in guiding me through this dissertation. The chair of my committee, Professor Byron W. Brown guided my work with patience and devotion. His strong support and encouragement were invaluable for helping me get through this program peacefully. He has my very highest respect both as a teacher and as a person.

My special thanks go to Professor Lalonde who left this school while advising me. Despite the long distance between us, he constantly gave me advice and comments through letters, e-mail, and telephone calls. His professional direction, along with his trust and confidence, were a priceless source of support that enabled me to finish this program.

As the final members of my committee, Professors Woodbury and Plank made substantial contributions to my dissertation through their timely comments and thoughtful critiques. I truly appreciate their help and support. Without my committee members' help, this thesis would not have been possible, although I am responsible for any remaining mistakes.

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I am greatly indebted to my wife, Hyunju and my daughters, Doore and Sunna who gave me tremendous support and love, and who have endured the most difficult hardship due to my studies in the U.S. Since returning to Korea, my wife has raised my daughters all by herself while working. From the depths of my heart, I give thanks to her. I am so very grateful that my daughters have grown to be such wonderful children. My thanks also go to my parents and my parents-in-law. Their support and patience have been great encouragement for me while I finished my degree. I would also like to thank my brother, Soochan and his family for their warm support and comfort. My brother-in-law, Byungwook's, generous support was extraordinarily helpful and greatly appreciated.

Also, I would like to thank Pastor Lee and his church for their deep friendship and kind support. I would like also to thank friends of mine who helped me throughout my study. Some of them are: Chirok Han and his family, Sungwon Kim and his wife, Jess Reaser, Jason Nantan, Mike Khoury, Chieng Cheng, Donggeun Kim, Heeson Choi, , Dong Wook Han, Ali Berker, Professor Taekho Kwon, Eunjong Shin and Jintae Kim, Pat Sedan, my special friends and workers.

If today I were a farmer,
In my orchard, I would pick up
well ripened apples.
I would give a basket full of apples
to each one of you.
In the future,
fruits from my life will be given to each one of you.

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CHAPTER 1
DETERMINANTS OF HIGH SCHOOL EMPLOYMENT

1. Introduction

Working during high school has been an important research topic for economists and educators because of its policy implications for transition from high school to work or to post secondary education. Most studies have focused on the effects of such working experience on subsequent earnings, subsequent employment and subsequent schooling. As our review below reveals, many of the studies indicate that high school employment has positive effects on later employment and earnings (Ruhm 1997, Carr 1996, Meyer and Wise 1982, Spephenson 1981, Stern and Kakata 1989, Marsh 1991). Some of these studies explain these positive effects through observable or unobservable individual heterogeneity (Light 1999 and Hotz et al 1999).

Other studies found some negative effects, especially of long working hours, on educational aspects such as higher absenteeism from school (Lillydahl 1990), high drop out rate (Marsh 1991, Steel 1991),lower college attendance (Carr, Wright and Brody (1996), lower long-term educational attainment (Carr, Wright and Brody 1996).

This study focuses on two other important issues related to high school employment. First, in chapter one, we investigate the determinants of high school employment. We claim that by focusing on the determinants of high school employment, we are able to understand better why high school employment has such positive effects on later earnings and employment, and/or why it has negative effects on educational outcomes. Second, in chapter two, we explore the effects of high school employment on

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post-secondary educational choices such as college attendance and college major choices. We contend that in this investigation, we also are able to understand the two contrasting effects of high school employment on later earnings (or employment) and later educational aspects.

In this introduction, first, by reviewing previous studies on the effects of high school employment on later earnings or later employment,[1] we explain why investigating the determinants of high school employment is important, and then, we summarize what we find in our investigation on the determinants of high school employment.

1.1 Previous studies on the effects of high school employment on later earnings and employment.

The previous studies on the effects of high school employment differ from one another in several important respects. In our review, we focus on the different econometric methods, different measures of high school work experience, and control variables included in their analyses. This review is summarized in Table 1-1-1. We concentrate on the most recent studies (for other studies, see Ruhm 1997).

In most of these studies, the following wage (employment) equation is estimated by the ordinary least squares method (OLS).[2]

$$Y_{itj} = X_{itj}\alpha + Z_i\gamma + HW_{i0}\beta + \varepsilon_{itj} \qquad (1\text{-}1)$$

[1] In the second chapter, we review those studies on the effects of high school employment on later education.

[2] Also educationl attainment measured in terms of continuous variable can be estimated in this framework.

Table 1—1:

Author and Source	Data and Variables
[illegible]	[illegible]
[illegible]	[illegible]
[illegible]	[illegible]

Table 1—1-1: The effects of high school employment on later earnings*

Author and Source	Data, Samples and Dependent Variable	Econometric Methods and Specifications.	Measurement of High School Work Experience/Control Variables**	Key Findings
Carr, Wright, and Brody (1996)	1. NLSY. 2. 16-19 in 1979, enrolled in high school as of May 1, 1979 3. Earnings in 1990 (12 years later after high school graduation (238)	1.OLS $\ln Y_i = X_i\beta + \gamma H_i + \varepsilon_i$ 2. Linear function of high school work experience measure.	1. The number of weeks worked or the number of hours per week, in 1978 (including summer). regardless of the high school grades in which each student were enrolled at that time. 2. Hours worked during 1990 and years of schooling included	1. for every additional hour worked as a teenager in 1978, one can expect to earn $1.87 more in 1990. 2. Positive effects on later employment. 3. significant negative effects on educational attainment.
Ruhm (1997)	1. NLSY. 2. Those who were high school freshmen or sophomores in 1979, remained enrolled in school through their senior year. 588 males and 561 females. 3. Average hourly wages over the 3-year period 1988-90: 6-9 years after high school	1. OLS, IV and treatment effect method***. $\ln Y_i = X_i\beta + \gamma H_i + \delta H_i^2 + \varepsilon_i$ 2. Quadratic functions of high school work experience. 3. Work experience in each high school grade are separate in the estimation equation.	1. two different measures. One is hours worked during the reference week in each grade and the other is the average hours per week in each grade. 2. Work experience and schooling after high school are not included.	1.students who work 10 to 20 hours during their senior year earn much more (15~20%) annually 6-9 years later than students who have not worked and obtain 2. Students who work during high school work more later than their counterparts. (iii) Student workers have higher occupational status later on. 3. IV method and treatment effects method are not successful.
Light (1999)	1.NLSY 2. Male high school graduates who have not attended college during the first nine years after high school graduation. (685 male and 5689 observations) 3. Hourly wages for each year during the 9 years after high school graduation.	1. GLS and IV/GLS (Hausman and Taylor 1981)**** $\ln Y_{it} = X_{it}\alpha + Z_i\beta + \gamma H_i + \varepsilon_{it}$ 2. (i) Linear function of high school work experience measure. (ii) categorical variable for average working hours per week (iii) Interaction between years of high school work experience and the dummies of years after high school 3. Basically no distinction between working in the junior year and working in the senior year. However, only work experience during the senior year is included in some estimation.	1. (i)Cumulative hours worked in grade 11 and grade 12 (only excluding summer time) divided by 1800 in order to make it a year unit, assuming that 25 hours per week on the average is one year of high school work experience. (ii) the average number of hours per week in grades 11-12. Three dummies 1-10, 11-20, 21 or more are made for this measure. 2. Work experience after high school and Number of Credits in each subject: (a)Humanities/social studies (b) mathematics/natural science (c)vocational subjects (d) other subjects	1. High school students who work intensively tend to take more vocational courses while taking fewer courses in other subjects. 2. They work far more intensively after high school graduation. (iii) After controlling for the above two factors, high school employment proves to have a small and relatively short-lived effect on post-school wages. 3. A young man who works an average of 25 h per week in grades 11 and 12 earns about 6% more than his nonemployed counterparts 6 years after high school graduation. The estimated premium is smaller at other points in his early career.

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Meyer and Wise (1982)	1. NLS-72 (1972 High School Seniors). 2. High school graduates who are not enrolled in college. 3. Weeks worked or wage rates in the year in one, two, three and four years after high school graduation.	1. The following wage or weeks worked equation is jointly estimated with the college attendance equation because of potential bias due to the possible correlation between A_{it} and ε_i $\ln Y_{it} = X_{it}\beta + \gamma H_i + aA_{it} + \varepsilon_i$ where A_{it} is college attendance choice. 2. Categorical variable for the average hours worked during senior year.	1. Categorical variables which represent the average work hours for either paid or non-paid jobs during the senior year: categories are for weeks worked: 1-5, 6-10, 11-15, 16-20, 21-25, 26 to 30, and 31 or more. Categories are for wages are1-15, 16-30, and 31 or more 2. school years and work experience are controlled for in the wage equation estimates.	1. Those who worked between 16 and 20 hours, and those who worked over 30 hours in the senior year earn 12%, 18% more respectively than those who did not work at all. 2. An additional five hours per week in the senior year, up 20, is associated with 1.5 more weeks worked per year in each of the four post-high school years.
Hotz, Xu, Tienda, Ahituv 1999	1.NLSY 2.Separate samples for Whites, Blacks, Hispanics. Those males who were between the ages of 13-16 in 1978, and who would be between 24-27 at the 1989 interview. 3. Wages in each working status(j) at age 17, 22, and 28-(1) if j =1, working while in school, (2) if j =2, working in non-school, part-time employment, (3) if j =3, working in full-time employment.	1. (i) OLS (ii) simultaneous estimation of wage equations, with selection equation to correct for (contemporaneous) selectivity of wages, associated with different types of employment. (iii) Unified dynamic, selection model (Cameron and Heckman 1991) $\ln Y_{itj} = X_{it}\alpha + Z_i\beta + u_{itj}$ The selection equation is as follows: Selection into employment status 1: school and part time only) or status (3) : full-time employment) or status (4): part-time employment) $V_{itk} = \max_{j \in J}\{V_{itj}\}$, V_{itj} - utility if individual i chooses state k from six states at age t to max his utility. $V_{itj} = X_{it}\gamma + Z_i\delta + \varepsilon_{itj}$ 2. The number of years of work attending high school are entered in the linear form	1.Years of working while attending high school. No distinctions across work in different grades. No measure of work intensity. Students who worked are treated as homogenous. 2. After making six, mutually-exclusive activity categories, *****, they construct measures of (i) number of years of work while attending high school. (ii) number of years of work while attending college. (iii) number of years of part-time, non-school-related, work. (iv) number of years of full-time work. (v) number of years of accumulated number of years attending school and not working (vi) number of grades completed. (vii) number of years spent enlisted in the military. All these variables are included.	By comparing the returns to a year of working while attending high school to the return to a year of schooling without working, they find that after controlling for unobserved heterogeneity, there are no positive effects of working while attending high school on wages.

Notes: * This summary table focuses on the earnings equations. Those studies on the effects of high school employment on later schooling are not summarized in this table. ** The common control variables: an ability measure (test scores), and family background variables are included in all the studies. Thus, not reported. ***The instrumental variables used for identification in Ruhm's study are geographic characteristics (local unemployment, the region of the county, SMSA and urbanity) in the senior year. ****The instrumental variables used for identification in Light study are (i)(Deviations from within-person means of each time-varying regressor) + (the within-person means of each exogenous regressor) (ii) per capita family income during the senior year of high school.(iii) unemployment rate during the senior year of high school.
(iv) a dummy which indicates 'urban' if student lives in that year (v) a dummy (the high school offers a distributive education program. ***** The following are the categories: (1)school only, (2) school and part-time only (3) full-time employment. (4) part-time employment (and no school attendance) (5) enlisted in military. (6) other non-school and non-work activity.

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where Y_{itj} is the hourly wage or earnings (or a measure of employment such as weeks worked) at a certain year (t) after high school graduation, in a particular employment status (j), such as working while attending college; HW_i is a measure of working experience during high school, such as the average hours worked during the senior year;[3] X_{itj} represents a vector of certain characteristics of an individual i at the year t in a particular employment status (j), such as the previous working experience except during high school, and the years of schooling; Z_i represents other control variables which do not change over time, such as an ability measure, family background, race, or geographical characteristics. However, most studies estimate a single wage equation at one point in time without distinguishing employment status. Thus, in most cases, we can omit the time and employment status subscripts.

In the studies that estimate the single wage (employment) equation by OLS and when high school work experience is specified linearly[4], the positive and significant values of the coefficient β is interpreted as evidence of the positive effects of high school employment on later earnings or employment (Spephenson 1981, Stern and Kakata 1989, Marsh 1991, Carr 1996). In these studies, the sub-scripts t and j are assumed to be fixed in the equation (1-1). The most recent such study is Carr et al. (1996), which investigates the long-term effects of high school employment on earnings, employment, and educational attainment, 10 years after high school graduation. Their

[3] Some studies specify this high school work experience in the quadratic form or a categorical variable which represents working hour categories and in those cases, this term a vector of variables which are related to high school work experience

[4] When high school work experience is specified in the quadratic form and the effects of two terms of high school work experience are different, the two effects can be adjusted to see the net effect.

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study includes a rich set of controls for background characteristics. Using a sub-sample of the National Longitudinal Survey of Youth (NLSY), Carr et al. (1996) show that for every additional hour worked during high school in 1978, one can expect about $2.00 more in annual earnings for wage and salary earners in 1990. Also, they estimate the equation with years of school completed 10 years after high school as the dependent variable, and find that each additional 100 hours worked in high school in 1978 reduce by .03 to.04 the number of completed years of post-secondary schooling.

However, their study has some limitations. First of all, their measure of high school work experience is imprecise because they use the total hours worked only in 1978 regardless of what grade students were enrolled in. Because the respondents of their sample were 15-18 years old in 1978, hours worked can represent either hours worked in the junior year or in the senior year or other grades, depending on what grade a student was enrolled in 1978. Then, hours worked in other grades are naturally omitted. Moreover, they do not distinguish between working during the academic year and summer vacation.[5]. Second, they do not control for working experience after high school.[6] We can expect that high school work experience is positively related to later work experience. Thus, high school work experience should indirectly increase later earnings through later working experience. Since Carr et al omit working experience after high school, we can not see the direct effects of high school working experience on later earnings. Third, a more fundamental problem with this kind of OLS estimation is a

[5] Most other studies distinguish working during the academic year and summer vacation and focus on the work experience during the academic year. Because, during the summer vacation, there is not much academic obligation from students, these studies do not regard this experience as a special work experience which affects their academic performance or work productivity.

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possible selection bias. If a student works during high school and earns more later because he has a higher ability which is not observable, this will cause correlation between HW_i and ε_i, and a positive bias in the estimates of the effects of working experience during high school on wage or earnings.

To solve this endogeneity problem, several studies use the instrumental variable method (IV) (Lillydahl 1990; Ruhm 1997; Light 1999). In the first stage regression, typically, the following reduced form of working hours equation is estimated,

$$HW_i = X_{itj}\pi + Z_i\phi + S_i\kappa + \upsilon_i \qquad (1\text{-}2)$$

where S_i represents the instrument variable for identification; HW_i represents a continuous variable which measures high school work experience; and X_{itj} and Z_i are the same as in (1-1). After this equation is estimated, the predicted value of HW_i instead of HW_i itself is put into the second stage regression for the earnings (wage or employment) equation.

Two main studies which use IV are Ruhm (1997) and Light (1999).[7] With the NLSY data set, Ruhm (1997) utilizes both IV and OLS method when estimating single wage or weeks worked equations. His sample is those who were high school freshmen or sophomores in 1979, and who remained enrolled in school through their senior year and were interviewed in 1991. The main dependent variable is the average annual earnings over the 3-year period of 1988-90 divided by hours, or weeks employed (for the employment equation). There is no distinction according to employment status. Thus, the

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[6] Carr et al include hours worked during 1990. However, it is not a correct measure of work experience after high school.

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sub-script t is fixed and the sub-script j can be dropped from equations (1-1) and (1-2). Ruhm's measurement of high school employment is much more accurate than Carr et al's (1996). Ruhm uses two different sources of information on high school employment. One is hours worked during the week prior to the survey data. The other is average hours worked per week from the work history file in NLSY. Hours worked in the senior year and the junior year are separately recorded and specified in the quadratic form in the regression analysis.

To control for the possible observable selectivity bias, Ruhm includes extensive background variables with the OLS method. From OLS regressions, he concludes that there is a significant positive effect of hours worked in the senior year of high school on later earnings. For example, those who worked between 10 and 20 hours per week during their senior year earn 6-16 % annually more and have higher occupational status later than those who did not work at all.

To control for the possible unobservable selectivity bias, Ruhm uses geographic characteristics (local unemployment, the region of the county, SMSA and lived in urban area during high school) as instruments. However, his IV estimates generate large standard errors for the 'hours worked' coefficients. Even though the coefficients of hours worked during the senior year by the IV method are much larger than the corresponding OLS estimates, the standard errors of those coefficients are much larger than the corresponding OLS standard errors.[8] resulting in imprecise measurement of the effect of

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[7] Lillydahl (1990) does not describe his method very well. He does not specify what his instruments are. Thus, here, we do not review his study.

[8] For an example, one of Ruhm's IV estimates of the coefficient of hours worked during the senior year is .1093 while its standard error is .2625. One comparable OLS estimates of the coefficient is .0168 while its standard error is .0066.

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high school employment. Another problem with Ruhm's study is that working experience and schooling after high school graduation are not controlled for.[9]

Light's study (1999) is quite different from Ruhm (1997) in several respects. First, she uses a restricted male sample of non-college bound high school graduates from the NLSY sample. Her sample consists of high school graduates who report no post-secondary enrollment during their first 9 year following graduation. This sample restriction means that we can drop the sub-script j in the equation (1-1) because employment status is regarded as the same in the relation to college attendance, and that schooling is naturally controlled for because all individuals in the sample are high school graduates.

Second, her measure of high school employment and how she controls for it in her analyses differ from Ruhm's (1997). One of Light's measures of high school work experience is the cumulative number of hours worked during the junior and senior academic years divided by 1800[10] and is specified in linear form in the regression analysis. She also uses work experience during the senior year divided by 900 and specified in linear form.[11] To control for non-linearity, she also includes in her specification an alternative measure of high school employment consisting of three dummy variables indicating whether the average number of hours per week worked in grades 11 and 12 is between 1 to 10 hours, 11 to 20 hours, or more than 20 hours. Later,

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[9] Ruhm(1997) uses also the treatment effects method. In the first stage regression, the probit model is run, where job-holding in the senior year is the dependent variable. In the second stage regression, the inverse Mill's ratio from the probit model is included as an additional covariate. Another interesting thing is that Ruhm never attempts to control for the possible selection bias in the weeks worked equation.

[10] By doing so, she converts high school work experience to "one-year unit", assuming that an individual who works 25 hours per week on the average for two, 36-week long academic years earns one year of high school work experience.

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she also includes interaction terms between high school work experience during the junior and senior year and dummy variables indicating years since high school graduation to see if the effect of high school work experience changes over time.

Third, Light estimates multiple wage equations by the method of Generalized Least Squares (GLS) and a variant of the instrumental variables/generalized least squares method (IV/GLS Hausman and Taylor 1981). The dependent variable is the natural logarithm of the CPI-deflated hourly wages earned on jobs held in each year during the first 9 years after high school graduation. Thus, nine wage equations are estimated together by the GLS. To control for the observed heterogeneity, she includes work experience after high school graduation and the number of high school credits in humanities/social studies, mathematics/natural sciences, and vocational subjects in addition to other various background and ability variables. To control for the unobservable heterogeneity, she utilizes IV/GLS with the same instrument variable for identification in each equation.[12]

By comparing GLS and IV/GLS estimates, Light concludes that an individual who works 25 hours per week on the average during his junior and senior years of high school, earns 6% more per hour than one who does not work at all, while an individual who works 10 hours per week on the average in his senior year and zero hours in his junior year earns 1.2% more per hour. However, these positive effects are short-lived as evidenced by the fact that these wage premiums fall to zero within 8 years of high school

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[11] However, she never uses working experience during the junior year and senior year separately in the regression analysis.

[12] The instrumental variables are 1) the deviations from within-person means of each time-varying regressor plus the within-person means of each exogenous regressor; 2) per capita family income during the senior year of high school; 3) local unemployment rate during the senior year of high school; 4) a dummy variable

graduation. Thus, the direct effect of high school employment on later earnings turns out to be small and relatively short-lived compared to Ruhm's findings. One thing to notice in comparing the IV/GLS estimates with the GLS estimates, is that the coefficients of hours worked during high school by IV/GLS are much larger than those by GLS, which suggests that high school employment intensity is negatively correlated with the unobserved, personal heterogeneity.

There are other studies which are concerned about another possible bias in the estimates of the effects of high school employment on later earnings. For many high school graduates, 1 to 4 years after high school graduation is still the transition period from schooling to work. During this period, individuals need to make choices about whether to attend college and whether to work during their college years if they attend college, and so on. Thus, some studies are concerned about the possible bias in the estimates of effects of high school employment on later earnings (employment) due to the effects of such individuals' choices of employment or schooling. For example, estimating the unbiased effects of high school work experience in the earnings equation for non-college bound high school graduates is difficult if an individual's college attendance decision is related to his wage rates or if college attendance is related to working experience during high school.[13] To control for such selection bias, wage equations are estimated with the selection equation. Meyer and Wise (1982), and Hotz et al (1999) are examples of such studies.

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which indicates 'urban' if student live in a city in that year; 5)a dummy variable which indicates whether the high school offers a distributive education program or not.

[13] Many studies show that high school working is negatively related to college attendance (Carr, Wright and Brody 1996, Marsh 1991.)

When Meyer and Wise (1982) estimate the effects of high school employment on the wages and weeks worked during the first four years after high school graduation for those not in college in each year, they estimate simultaneously the following college attendance equation along with equation (1-1).[14]

$$q_{it} = 1 \text{ if } Q_{it} \geq 0$$

$$q_{it} = 0 \text{ otherwise}$$

$$Q_{it} = X_{itj}\lambda + Z_i\theta + W\rho + \mu_{it} \qquad (1\text{-}3)$$

where q_{it} is college attendance status at time t; Q_{it} is an individual's utility for school attendance at time t; and W represents a vector of other variables which could affect school attendance choice. [15]

When Meyer and Wise (1982) estimate the effects of high school employment in, their measure of high school employment is a categorical variable for hours worked in jobs held during the high school senior year. After controlling for bias due to simultaneous decisions on working and college attendance, Meyer and Wise find a significant positive effect of working hours during the senior year of high school on later earnings for high school graduates who were not attending college at the year. For example, individuals who worked 16-20 hours per week are estimated to earn annually about 12% more than those who did not work at all in high school even after work experience after high school is controlled for. They claim that "depending upon the amount of work in high school and estimated weeks worked based on other

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[14] Thus, we can rewrite the equation (1-1) as $\ln Y_{it} = X_{it}\beta + \gamma H_i + aA_{it} + \varepsilon_i$, where A_{it} is college attendance choice. Meyer and Wise are concerned about the possible correlation between errors in the equation (1-1) and (1-3).

characteristics, the estimated 'effect' on annual earnings of high school work could be as high as 30 or 35%" (p279). These effects are much larger than Light's estimate[16] and even larger than Ruhm's estimates.

However, the Meyer and Wise study uses a different data set, NLS-72, while most studies use the NLSY. The respondents of NLS-72 are an earlier cohort than the NLSY sample. Another study which uses the 1966-74 Youth in Transition Study data (YTS), the sample of which is an earlier cohort than the NLSY sample, also shows that those employed during high school earned about 27% more than others five years after graduating from high school (Mortimer and Finch 1986).[17] However, we do not know whether the changes in the estimated gains from high school work experience arise from whether the selection into student employment is vary across cohorts or whether these gains have truly changed over time.

Another study which utilizes a similiar simultaneous equation approaches as Meyer and Wise is Hotz, et al. (1999). They use the sample of NLSY males who were between the ages of 13-16 in 1978 and who were between 24-27 in 1989. By tracing each individual's school and work experience during the period between 1978 and 1989, Hotz, et al. (1999) create the following six mutually-exclusive activities statuses: (1)school only, (2) school and part-time only, (3) full-time employment, (4) part-time employment

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[15] Meyer and Wise do not include the high school employment measure in the control variables for the college attendance equation because of their concern about the possible reverse causation.

[16] Meyer and Wise's estimates are comparable with Light's in the senses that (1) both the samples are non-college bound high school graduates even though Light's sample is more restricted, and (2) both working experience are controlled for. However, they control for different sources of selection bias. Light controls for selection bias directly related to high school work experience by IV/GLS method while Meyer and Wise control for selection bias rising from college attendance choices by simultaneous equation method.

[17] We do not review their study in detail because (1) their study focus on the other outcomes such as academic achievement and educational attainment, (2) their study relies on the mean difference analysis (ANOVA) instead of regression analysis; moreover their study does not control for selection bias.

without school attendance, (5) enlisted in military, and (6) other non-school and non-work activity. They then measure the number of years of work while attending high school, the number of years of work while attending college, the number of years of part-time, non-school-related, work, the number of years of full-time work, the number of years of attending school and not working, the number of grades completed, and the number of years spent enlisted in the military. All these variable are included as independent variables in the equation (1-1). Thus, high school work experience is defined as the number of years of work while attending high school.

Then, the wage equations in the form of (1-1) in the employment categories of the above named (2), (3) and (4) at age 17, 22, 27 are simultaneously estimated with the status choice equations. Since more than two alternatives are given, the status choice equation becomes complicated as follow. The individual i chooses status k from the six feasible categories of status named above.

$$V_{itk} = \max_{j \in J} \{V_{itj}\},$$

where V_{itj} is the utility if individual i chooses state k from six states at age t. The utility function can be defined thus:

$$V_{itj} = X_{it}\gamma + Z_i\delta + \eta_{itj} \qquad (1\text{-}4)$$

where X_{it} is a vector of age specific variables, and Z_i is a vector of time constant individual specific variables. First, error terms in (1-1) and (1-4) are assumed to be correlated only across j (to correct for contemporaneous selection bias for different types of employment). Later, these error terms are allowed to be correlated across j and t (to correct for dynamic selection bias).

After equations (1-1) and equation (1-4) are estimated simultaneously, the rate of return to the years of work while attending high school is compared to the rate of return to the years of attending school and not working. Hotz, et al. find that, when the bias due to simultaneous decisions on these choices at a certain point in time is controlled for, the rate of return to the years of work while attending high school is much higher than the rate of return to the years of schooling only. However, when, the dynamic selection bias is controlled for, there is no larger return to the years of work while attending high school than the years of schooling only. Hotz, et al. conclude that the positive effect of high school employment on later earnings is spurious and arises from heterogeneity across individuals. These results greatly contrast with Ruhm's results. In another respect, these results also contrast with Ruhm's IV and Light's IV/GLS results, in which the rate of return to high school employment becomes larger when the unobserved individual heterogeneity is controlled for. Hotz, et al. (1999) implies that the high school work experience is positively correlated with unobserved, personal heterogeneity, while Ruhm (1997) and Light (1999) suggest that high school work experience is negatively correlated with unobserved, personal heterogeneity.

However, we need to pay attention to the basis of Hotz, et al.'s (1999) findings. Firstly, Hotz, et al. (1999) do not distinguish schooling without work in high school from schooling without work in college. Thus, comparing the rate of return to the years of work while attending high school to the rate of return to the years of schooling only might not be appropriate to identify the effect of high school employment. Secondly, as Light (1999) points out, student workers are treated as homogenous group regardless of how many hours they work. Working a few hours and working more than 20 hours while in

school is treated the same. Also, working is treated as the same regardless of what grades students work in. Working a couple of hours per week should be distinguished from working 20~30 hours per week. Fourthly, like Light (1999), the working experience after high school is controlled for in this study by the measures of various experiences. Thus, there still exists the possibility that high school employment has some positive effects on later employment even if there is no such effect on wages.

Our review of the previous research on the effect of high school employment on later earnings reveals that the effects of high school employment are very complex and the results vary greatly across studies. In this chapter, we focus on the determinants of high school employment rather than its effects. By summarizing issues raised by the above review, we contend that identifying the determinants of high school employment is important in understanding the later effects of high school employment. The important issues in the above review as follows.

First, definitions and measurements of high school work experience differ across studies. Different specifications, not to mention different econometric methods, seem to affect the results. To find the correct estimates the effects of high school employment on later earnings or employment, above all we need to define high school work experience clearly because the different measures of high school employment could capture the different characteristics of student workers who have different high school work experience. Ruhm(1997) uses hours worked per week in the senior year and the junior year separately[18] and specifies these hours in the quadratic form in the regression analysis. Meyer and Wise (1982) use the average hours worked per week during only the senior

year and uses a categorical variable in the regression analysis. Carr, et al. (1996) use hours worked in 1978 regardless of grades, for those who were 15-18 in 1978, and specifies these hours in linear form in the regression analyses. Hotz, et al. (1999) treat all student workers as homogenous group regardless of how many hours they work and specifies them in linear form. Light (1999) is more careful in measuring high school work experience and specifies it in various functional forms. However, her sample is very restricted.

Second, most studies which find lower or no positive effects of high school employment on later earnings,[19] control for working experience after high school (Light 1999 and Hotz et al 1999). By contrast Ruhm (1997) and Carr et al (1996) who use the same NLSY data set do not control for working experience and find large positive effects of high school employment.[20] These results together imply that even when the direct effect of high school employment on later earnings is small, there still are strong positive effects of high school employment on later employment opportunities. Then, we need to explain why such positive effects occur. However, there after no studies which attempt to control for bias in the estimates of the effects of high school employment on after-school employment.

Third, the results also seem to depend on the samples used different studies. Some studies use NLS-72, which is for the cohort of high school seniors in 1972 or some use

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[18] As mentioned earlier, Ruhm uses hours worked during the reference week or hours worked per week on the average.

[19] When we compare only the results by a similar method such as OLS or GLS results across studies, inclusion or exclusion of after-high school work experience affects the results greatly.

[20] Using NLS-72 data set, Meyer and Wise (1982) find large and significant positive effects of high school work experience on later earnings even after they control for the working experience. However, since they are using different data set, we do not know how much controlling after-school work experience reduces the positive effects.

YTS, which is for the 2 to 3 years earlier cohort than the NLS-72 cohort, while other studies use NLSY which is the sample of those who were born between 1957 to 1964 and are 14 to 21 years old on January 1 1979. The positive effects of high school work experience on later earnings for earlier cohorts seem to be larger than for more recent cohorts. High school employment has not changed in both terms of job-holding and working hours since late 1960 (Ruhm 1997). However, the characteristics of student workers could have changed. The changes in the characteristics of student workers could have caused the changes in the effects. In our study, by using two comparable data sets across time, NLS-72 and the HS&B senior data set, we investigate any changes in the characteristics of student workers from 1972 to 1980.

Fourth, as mentioned earlier, studies which try to control for the selectivity bias imply two opposite possibilities in the relationship between high school employment and the unobserved individual heterogeneity, depending on the econometric methods. If the unobserved individual heterogeneity represents a kind of individual productivity, the relationship could be either positive or negative. Examining the relationship between high school employment and observable characteristics might help to understand better the true relationship between high school employment and the unobserved individual heterogeneity. For example, if high school employment is positively correlated with a ability measure which is observable, high school employment is might positively correlated with the unobserved individual heterogeneity.

In identifying determinants of high school employment, we focus on the following elements which could be related to high school employment: the local economic conditions, an academic ability measure, and family background, and difference in the

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effects of these factors on high school work experience between two years, 1972 and 1980. By doing so, we address several issues raised from our literature review to a certain degree. First of all, if high school student workers live in areas with good economic conditions, a factor which causes higher demand for their labor, and they also live in places with similar conditions after they graduate from high school, the gains in employment and earnings could be spuriously related to high school work experience; i.e., the employment (or wage) and the labor market conditions are strongly correlated. Actually, most studies investigate the short-term effects of high school work experience on earnings as we see in our Table 1-1-1 (1 to 5 years after high school graduation), which could be problematic because the local economic conditions might not change dramatically during a short period.

Second, examining the relationship between high work experience and academic ability (or family background) could explain why different measures (or different specifications) of high school work are related to different results in estimates of its effects to some degree. For example, students with higher academic ability (and/or better family background) are less likely to hold jobs in earlier grades because of their own or their parents' commitment on their future education.[21] If students with higher ability (or better socio-economic status,) work more intensively during their senior year, the larger effects of working hours during the senior year than working hours in the junior year, on later earnings and employment (when they are separately entered in the earnings equation as Ruhm 1997) could be simply selection bias. Or there is a possibility that students with

[21] Since main required activities for high school students are academic activities, working while in high school might be so different from working without such academic duties. College preparation is also an

higher academic ability (and/or better family background) might work moderate hours even if they work. Thus, the non-linear specifications of high school work experience might just capture the hidden non-linearity relationship between working hours and academic ability.

Third, by observing any changes in academic ability and family backgrounds of high school workers between two years, 1972 and 1980, and comparing the different results in the estimates of effects of high school employment across cohorts by the previous studies, we can suggest one possible answer why there is difference in the effects of high school employment on later earnings. If more students with higher social status and higher academic ability work more in more recent years than before, and they have the smaller positive effects for high school work experience, the changes in positive effects of high school employment might come from other sources.[22]

Fourth, careful observations of the relationship between those observable characteristics such as test scores or family socio-economic backgrounds, and high school employment might help to understand the relationship between those unobservable characteristics and high school employment.

1. 2 Major Findings

Using two comparable, nationally representative high school senior data sets, NLS-72 (National Longitudinal Study: the High School Class of 1972), and HS&B (High School and Beyond), we observe several important characteristics of the determinants of

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issue related to working during high school. Most students could finish their college preparation by their junior or early senior year.

[22] We discuss this issue further in the conclusion.

high school employment. Firstly, factors that indicate job availability, such as local labor market or economic conditions, race and community type, are very important in the determinations of job-holdings and working hours during high school senior and junior year. Secondly, academic ability is related to employment during the senior year in non-linear fashion. Students with the highest and lowest academic ability tend to work fewer hours than those who are in the middle range of academic ability. Thirdly, more able students tend work in the senior year rather than in the junior year. Fourthly, students from white middle class families work most. Students from low and upper class tend to work less. Fifthly, more able and more affluent students hold jobs more in 1980 than in 1972, and work more intensively in 1980 than in 1972. These finding are explained in more detail as follows.

(1) With respect to factors for job availability: with the HS&B senior group data, which has the labor market indicator file, we find that for both males and females, county unemployment rates are negatively correlated to job-holdings or working hours during high school. Other market indicators such as the percentage of people employed within a county, the growth rate of employment, the average per capita income, and its growth rate, have a positive impact on high school senior student employment.

Race could be an indicator for job availability. Blacks, Hispanics and Asians are much less likely to work during high school than Whites and they work less if they do work. Since youth unemployment rates are much higher and persistent among these minority groups, especially Blacks, the significant and negative effects of being Black on job-holdings and working hours during high school senior year certainly shows the lower job availability for them.

Community type is also important for job availability, for females, those who live in urban and suburban areas work more than those who live in rural areas. For males, community types do not matter possibly because students who live in rural areas also have as much work as those in urban and suburban due to family farming. Considering these relationships, we can infer that high school employment is strongly related to job availability. High school student workers or high students who work intensively live in the areas (or conditions) where there are more jobs around them or more demand for their labor.

(2) With respect to the ability measures (standardized test scores): The linear relationship between high school employment in the senior year and test scores has changed noticeably between 1972 and 1980. In 1980, for both males and females, students with high test scores have higher probability of job-holdings or of working heavy hours after other factors are controlled for, while in 1972, students with high test scores were less likely to hold jobs or working longer hours than others. In 1980, the positive relationship between test score and senior year employment gets stronger when 'working in junior year' is controlled for because 'working in junior year' is negatively related to test scores. Thus, more senior students with higher academic ability tend to participate in labor force and employment in 1980 than in 1972.

However, in both years, the relationship between test scores and employment (job-holdings and hours worked in the senior year) seems to be nonlinear rather than linear, possibly because the students with lower test scores have difficulty finding jobs and those with high test scores tend to concentrate on their academic activities during high school. Thus, students with high test scores tend to work moderate hours if they

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work. When we put test scores and test scores squared together as independent variables into a binary dependent variable models of job-holding or a tobit model for hours worked, the coefficient of test score is always significant and positive, while that of test scores squared is almost always significant and negative. Results from a categorical specification of test scores in the those regressions also reflect the non-linearity of the relationship. This non-linearity make it difficult to control for ability bias in the earnings or wage equations.

(3) With respect to family background: in both 1972 and 1980, students who are in families with medium socio-economic backgrounds work more than those from low or high socio-economic status after other factors such as test scores, local economic conditions, and previous working experience are controlled for. However, the importance of socio-economic status in the determination of high school employment gets reduced in 1980. More student from affluent families seem to work in 1980 than in 1972 in their senior year even after all other factors are controlled for. However, students from more affluent family still seem to work moderate hours even if they work.

(4) With respect to working in the junior:[23] The working in the junior year and test scores seems to be linearly and negatively related.[24] Students with higher academic ability are less likely to hold jobs during their junior year and they are more likely to work fewer hours even when they hold jobs than students with lower or medium academic ability. With other factors held constant, the coefficients of test scores are negative and significant in the linear form of test scores, while the coefficients of test scores and test scores squared are not significant when the quadratic form of test scores are specified.

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Also students from families with high socio-economic backgrounds are less likely to begin to work in the junior while students from middle class family still work most even in the junior year.

Another important fact regarding working in the junior year is that after other factors are controlled for, those who work in the junior year work more in the senior year. Working experience during junior year is a single predominant factor in the determinations of job-holdings and working hours in the senior year. We are not sure whether working experience during junior year help students to find jobs and work more during their senior year, or whether those who work in both years have an unobservable heterogeneity such as a tendency to work.

(5) With respect to other factors: in addition to these influences, there are some important factors, such as whether the mother works or not when students are in high school, whether the respondents have children or not, which high school programs they are in.

In the next section, previous studies on the determinants of high school employment are briefly reviewed, and in the third section, our data and strategy are described. In the fourth section, the results are explained, and in the conclusion, the implications of our findings are discussed in the context of the previous research on its effects of high school employment on later earnings and employment.

[24] We discuss the possible casual effects relationship between these factors later.

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2. Previous Studies on the determinants of high school employment.

There are a few previous studies which investigate the determinants of high school students' employment, such as job-holdings and/or hours worked. Even within these small number of studies on this issue, the determinants of high school employment is a secondary concern and is only briefly examined because the main concern of these studies is to explore the effects of high school employment on later earnings, employment or schooling.

These studies mostly utilize two basic schemes: either the OLS with hours worked during high school as the dependent variable[25] or the binary dependent variable (probit or logit) framework with job-holding as the dependent variable. In the OLS method, the following simple high school work experience equation is estimated.

$$H_i = \beta_1(ability) + \beta_2(familyfc) + \beta_3(labormkt) + \beta_4(others) + u_i \quad (2\text{-}1)$$

where H_i is a continuous measure of high school work experience, such as the average working hours per week during high school; *ability* is test scores; *familyfc* is a vector of family background variables, such as race, family income and parents' education; *labormkt* is a vector of local labor market indicators, such as local unemployment rate; and *others* is a vector of other factors which could possibly affect high school employment.

With the same independent variables, the following binary dependent analysis is also exploited,

$$JH_i^* = XB + e$$

$JH_i = 1$ if JH_i^* is larger than zero

$= 0$ otherwise (2-2)

where JH_i^* is an underlying latent variable which indicates individual's utility from job-holding during high school; X is the vector of all the observable factors which can affect job-holding utility such as test scores, family background variables, labor market conditions; e is a continuously distributed variable independent of X; and the distribution of e is symmetric about zero. Depending the assumptions regarding the distribution, the probit or logit model is estimated.

In our review of previous studies, we pay attention to how authors measure high school employment (or working hours) differently, and whether they include labor market conditions as control variables, and whether the relationships between high school employment and ability measures, or high school employment and family background, are specified as linear or non-linear. Why these factors are important is explained in the course of this study. These studies are summarized in table 1-2-1.

Table 1-2-1: Determinants of High School Employment.

Author and Source	Data and Method	Findings
Marsh (1991)	HS&B Sophomore data: The correlation between background variables (and/or ability variables) and hours worked. OLS for the average hours worked during the last three years of high school.	Hours worked is modestly related to background variables such as family socio-economic status. Negative and insignificant relationship between hours worked and test scores.
Ruhm (1997)	NLSY. OLS for the hours worked during the senior year and Probit model for job-holding during the senior year.	High local unemployment rate is negatively related to job-holdings. Standardized test scores is positively but insignificantly related to job-holdings. Blacks have lower probability to hold jobs. Family income is positively related to job holdings.

[25] Tobit model instead of OLS is also used (See Stern et al 1997)

Dustman, Rajaj and Ssoest (1996)	NCDS from England. Hours worked equation is estimated as a part of a three equation structural model. Two other equations are: school success equation and school leaving decision equation.	Regional unemployment rate, attending private school, and being handicapped significantly negative effects on hours worked. The number of younger siblings, a working mother, and ability measures have positive effects on hours worked.
Stern, Finkelstein, Urquiola and Cagampang (1997)	NCRVE data. Logit for job-holdings during the senior year, and Tobit for hours worked are estimated.	Blacks and Hispanics are less likely to be employed and tend to work less hours. Students whose parents are high school graduates tend to work more.

Using the HS&B sophomore data, Marsh (1991) explores the effects of background variables (such as socio-economic status, race, sex, attending public schools, and mother working) and sophomore outcomes (such as test score, grades, home work, honors and so on) on average hours worked during the years in high school, and on the hours worked in each year separately. He concludes that working is only modestly related to background variables, especially to family socio-economic status. Also, he finds a negative relationship between sophomore outcomes (especially grade and test scores) and working hours,[26] which could imply either that those who work more during high school are less qualified,[27] or that 'working' affects high school students' performance negatively.

However, his research has several weaknesses and can be criticized on several grounds. First of all, Marsh basically relies on correlation analysis instead of regression analyses such as the OLS or the binary dependent variable method.[28] Thus, he assumes only linear relationships between hours worked during high school and socio-economic status, and academic ability. However, there is a high possibility that those relations could

[26] However, using the same data set, Crawford(1997) finds a strong positive relationship between test score and working hours. The best guess is that it is because Crawford uses working hours in the senior year as the dependent variable while Marsh(1991) uses the averaged hours in three grades.

[27] Also, he finds negative effects of total hour worked (or sophomore and junior working hours) on senior outcomes. However, he finds that there is no such negative effects of working in senior year.

be non-linear. Students from lower socio-economic status or with lower academic ability might tend to work less possibly because they have less access to jobs or lower demands for their labor. Also, students from higher socio-economic status or with high academic ability might tend to work less possibly because they have less need to work because their parents are well-off or they want to concentrate on academic activity. Thus, nonlinear specifications might be crucial in identifying how socio-economic status and/or academic ability are related to high school employment.

Second, Marsh's measure of high school employment does not capture accurately the intensity of work efforts by high school students. His 'total hours worked' variable is the weighted mean of hours worked during the last three years of high school.[29] Also, the distinction between working in the senior year and working in other grades seems to be important because most students finish their college entrance preparations in their junior year or early in their senior year, completing standardized tests, etc, SAT tests or finalizing decisions regarding whether to go to college or not. Therefore, more seniors seem to participate in the labor force and work more intensively than juniors. Also, juniors seem to work rather sporadically compared to seniors, evidenced by the fact that many more seniors work than juniors during a given week (Ruhm 1997) even though the

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[28] Even though Marsh presents simple correlation and standardized beta weights in detail, he does not report the OLS regression results in detail, only presenting the percentage of explained variance in hour worked by background variables, sophomore outcomes and hours worked in lower grades.

[29] First, Marsh gives weights to hours worked at the most recent job during senior year according to when they last worked: 1.0 if worked last week; .667 if worked within the past month; .5 if worked within the past three months; .1 if worked since the start of school. For junior and sophomore year, students indicated the average number of hours worked during the period. Then, he averages the number of hours over three years. However, the hours worked during the junior and sophomore year do not represent the averaged hours worked during the whole year. They indicate the hours worked during the period student held jobs. Thus, he gives too much weight to the junior and sophomore year. Ruhm(1997) shows that the hours worked during the junior is much fewer than senior year on the average, while the HS&B Table 3-4 shows that junior year students have worked once almost as much as senior year students.

percentage of students who have ever worked through their whole junior year is almost as high as the percentage of those who have ever worked in their whole senior year (See Table HS&B 3-4). Also, considering that many studies which find the positive effects on later earnings are mostly based on senior year working experience (Ruhm 1997, Meyer and Wise 1982, Stern and Nakata 1989), employment in the senior year needs to receive particular attention.[30]

Marsh only controls for a very few background variables such as sex, race (Black and Hispanics), socio-economic status (based on both parents' education, father's occupation and family income). He does not utilize the labor market indicator file in HS&B in identifying the determinants of high school employment. As Freeman and Wise (1982) point out, the levels of aggregate economic activity or local economic well-being are key determinants of youth employment. Further, while there seem to be clear differences in the determinants across gender, Marsh does not separate male and female students.

In many ways, Ruhm (1997) overcomes the flaws of Marsh's study. Using NLSY data, he explores the effects of high school employment on later earnings, employment and educational attainment. In his investigation, he attempts to identify the determinants of employment (job-holdings and hours worked) to control for selection bias in the wage equations by using the treatment effect and instrument variables method (IV method). Thus, he estimates an OLS equation (2-1) for working hours and a probit model for job-holding (2-2). He concentrates on job-holdings and hours worked during senior year instead of the average hours worked and also includes the mother's and father's education

[30] Marsh also investigates the determinants of hours worked in three grades(sophomore, junior, and senior).

as categorical variables. Also, he includes dummies for areas with high unemployment rates to control for local labor market conditions and also considers other extensive background variables.

According to Ruhm's study (he reports only the results of the probit model for job-holding in the senior year), senior year employment probabilities are relatively low for Blacks and those living in areas with high unemployment rates (more than 12%). Family income has a positive effect on job-holdings. The sign of one standardized test score (AFQT - Armed Forces Qualification Test) is positive but insignificant, and few other variables have significant effects.

However, Ruhm does not control for working in the junior year as a determinant of job-holding during the senior year. Controlling for the work experience in the junior year is important especially when we want to see the selectivity of the working during the senior year in terms of academic ability. It is because, if those students who work during their junior year have lower academic ability and more accesses to jobs, without controlling for the work experience during the junior year, the selectivity of working during the senior year in terms of academic ability might not be capture.

Also, unemployment rates are the only local labor market indicator and 'local' is not specified. Above all, any non-linear forms of test scores specifications are not attempted. Thus, Ruhm fails to capture the plausible non-linear relationship of test scores and high school employment.

Using the National Child Development Study (NCDS) data from England, Dustmann, Rajaj and Ssoest (1996) analyze the determinants of working hours, school

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separately but unfortunately does not report any detailed results, mentioning that he has the similar results.

success and school leaving decision simultaneously, even allowing error terms in three equations to be correlated. Thus, the equation (2-1) is part of a three equation structural model. For both male and female students, regional unemployment rate for school leavers, attending private schools, and being handicapped have significantly negative effects on working hours. The number of younger siblings, whether the mother works, and ability measures all have a positive effect. Also, male students work more if the father's occupation is farmer. Students work less if parents encourage them to go college. Female students work less if their parents have higher skills. Some of these findings are consistent with our findings which we describe later even though the results are based on British data. However, Dustmann et al (1996) do not distinguish working experience by grades and have not attempted any non-linear forms of ability measures in the specifications of working hours.

Using data by the National Center for Research in Vocational Education (NCRVE), Stern et al (1997) also briefly examine the determinants of job-holdings and hours worked in their investigation of the effects of high school employment, especially Co-operative education, which ties work to school as part of vocational education, on later earnings. Logit model for job-holdings in the senior year, and, instead of OLS, Tobit model for hours worked per week in the senior year are exploited.[31] Only a few independent variables, such as sex, ethnicity variable (Black or Hispanics), parents' income, 'both parents' variable which indicates whether a student has both mother and father, parents' education, essay score are included. Stern et al (1997) find that Blacks and Hispanics are less likely to be employed and tend to work less hours. Students whose

[31] Because some students do not work at all, they assume that the distribution of hours worked is truncated.

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parents are high school graduates tend to work more hours. However, this study is so brief that we can not identify the full determinants of high school employment.

Our review shows that previous studies on the determinants of high school employment are very brief compared to its complexity, and the investigation of its determinants were a secondary concern even in these studies. However, as we see in the review of studies on its effects, without understanding the characteristics or determinants of high school employment itself, it is very hard to identify the effects correctly. In the next section, we describe our data, the characteristics of high school employment, and our econometric models.

3. Data, Characteristics of High School Employment, and Strategy

3.1 Data.

The current study uses two different data sets: NLS-72 and the HS&B Senior Group data. NLS-72 is a longitudinal survey that originally sampled 22,652 seniors from the high school class of 1972. It contains extensive family background variables, as well as a standardized test score (NLS test score). We restrict the sample to those who responded to the first and second follow-up surveys (1973, July 1974), and took the NLS test. The sample sizes are 6,763 for males and 7,013 for females respectively.

HS&B is also a longitudinal survey that originally sampled 28,000 seniors and over 30,000 sophomores from 1,100 high schools in 1980. HS&B contains almost the same variables as NLS-72. HS&B has better features for studying the determinants of high school employment because it contains a labor market indicator file, which shows economic activities of areas such as county, SMSA (Standard Metropolitan Statistical

Area), and states. Also, it contains the information on working experience in the junior year. We use the senior sample and restrict it to those who responded to the first and second follow-ups and took the NLS test. The sample sizes are 4,063 for males and 4,966 for females.

With these two data sets, we are able to study differences over time in these two senior groups. Also, with the HS&B sample, we identify the determinants of high school employment of almost the same group as the NLSY sample, which includes those who were 14-19 years old in 1979, and which has been extensively used to study the effects of high school employment on later employment and earnings. Thus, the current study might help us to understand why some studies find positive effects of high school employment of this group on later earnings, or why the results of those studies on the effects of high school experience of this same group on later earnings differs. The sample sizes we use here with these two data sets are around 10,000, which is much larger than the NLSY samples of about 1,000.

In NLS-72, information on high school employment was obtained from responses to the question "on the average over the school year, how many hours per week do you work in a paid or unpaid job?" Then, hours worked were recorded as a categorical variable. In HS&B, students reported how many hours they worked in most recent paid jobs and the hours worked recorded as a categorical variable in their senior year as well as during their junior year. Using this information, 'work,' 'heavy work,' 'moderate work,' and 'working hours' variables are created. 'Work' represents those who have ever worked during their senior year, 'heavy work' represents those who worked more than 15 hours per week for the NLS-72 samples, and 15 hours or more for HS&B samples, 'moderate

work' represent those who work 6-20 hours per week for the NLS-72 sample and 5-21 hours for the HS&B sample. 'Working hours' variable is the midpoint of the categorical variable of hours worked.[32] Using the information on work experience in the junior year in the HS&B senior data, 'work junior' and 'working hours junior' are also created by the same pattern.

The reasons for investigating the determinants of 'heavy work' or 'moderate work' in addition to those of job-holding are as follows. First, since academic activities such as homework, and preparation for classes require much of students' time and efforts during high school, working long hours may not be compatible with such academic duties. Thus, the characteristics of students who work heavily during high school might be different from others. Second, since some studies indicate that students who work moderately have the highest benefits from high school employment, it might be interesting to see

whether those students have distinctive characteristics from others. For example, the quadratic form of hours worked per week in the equations of later earnings as in Ruhm (1997) implies the highest beneficial effects for the moderate work. Also, many studies which investigate the effects of high school employment on educational aspects indicate such beneficial effects as higher educational level (D'Amico 1984, Turner 1994), high academic achievement (Lillydahl 1990), higher future school enrollment rate (Steel 1991).

Except for the information on high school employment, both of these data sets also contain extensive background variables, information on high schools, high school

[32] For example, when a student answers the average working hours per week is between 21 and 25, the

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Table 1-3

Variable Name	
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achievement, and a standardized test score. Means and standard deviations of the variables used in our regression analyses are tabulated in the following Table 1-3-1. From the table, we can tell that in the HS&B sample, the minority groups, especially Blacks and Hispanics are over-represented, which is due to the original sample design. Because these minority groups, on the average, have lower socio-economic status than others, students whose family socio-economic backgrounds are in the bottom quartile are over-represented.[33] Before we explain our regression analysis methods, we summarize the characteristics of high school employment from these two data sets in the following sub-section.

Table 1-3-1 **(NLS-72 and HS&B)**

Variable Name	Definition	Mean and Standard Deviation : NLS-72		Mean and Standard Deviation: HS&B	
		Male (6763)	Female (7013)	Male (4064)	Female (4966)
WORK	0-1 dummy variable that equals to one if student work in senior	.82 (.39)	.70 (.46)	.72 (.45)	.67 (.47)
WORKING HOURS	Number of working hours during high school senior year	14.8 (11.05)	10.4 (10.01)	14.4 (12.4)	11.4 (11.2)
GRADE	Average point of grade during high school. (0-4 scale)	2.03 (1.02)	2.43 (.99)	2.75 (.75)	2.97 (.69)
TEST SCORE	NLS test score	50.9 (8.67)	50.2 (8.65)	49.6 (9.28)	48.3 (8.67)
SES-MEDIUM	0-1 dummy variable that equals one if student's SES is in 2nd and 3rd quartile	.48 (.50)	.48 (.50)	.45 (.50)	.43 (.49)
SES-HIGH	0-1 dummy variable that equals one if student's SES is within 4th quartile	.26 (.44)	.22 (.41)	.21 (.41)	.18 (.38)
BLACK	0-1 dummy variable that equals one if student is black	.09 (.29)	.13 (.34)	.21 (.41)	.25 (.43)
HISPANICS	0-1 dummy variable that equals one if student is hispanic	.04 (.20)	.04 (.20)	.25 (.43)	.24 (.43)
ASIAN	0-1 dummy variable that equals one if student is asian	.01 (.11)	.01 (.10)	.04 (.18)	.03 (.17)
NATIVE AMERICAN	0-1 dummy variable that equals one if student is native american	.01 (.11)	.01 (.10)	.02 (.14)	.01 (.12)

'working hours' is 23.

[33] Since it is highly plausible that high school work experience is related to socio-economic status or race, this over-representation can cause some bias in our regression analysis. To solve this problem, we attempted two methods. First, we run the same regressions only for Whites. Second, we use the weights given in the data sets. Since the results with these methods are not much different, we do not report these results.

SIBLINGS	Number of siblings	2.14 (1.83)	2.25 (1.84)	3.29 (2.80)	3.32 (2.56)
MOMWORK	0-1 dummy that equals to one if mother work when student in high school.	.58 (.49)	.60 (.49)	.70 (.46)	.72 (.45)
ANY DEPENDENT*	0-1 dummy variable that equals one if student has any dependent	.10 (.31)	.09 (.28)	.004 (.064)	.027 (.16)
NO ENGLISH	0-1 dummy variable that equals to one if english is not spoken at home.	.09 (.29)	.09 (.28)	.12 (.32)	.11 (.32)
HIGH SCHOOL ACADEMIC	0-1 dummy variable that equals one if student's high school program is academic	.45 (.50)	.40 (.49)	.40 (.49)	.40 (.49)
HIGH SCHOOL VOCATIONAL	0-1 dummy variable that equals one if student's high school program is vocational	.20 (.40)	.29 (.45)	.23 (.42)	.25 (.43)
SMALL TOWN**	0-1 dummy variable that equals one if student lives in small town during senior	.27 (.44)	.28 (.45)	.	.
URBAN	0-1 dummy variable that equals one if student lives in urban area during senior	.25 (.43)	.27 (.44)	.26 (.44)	.27 (.44)
SUBURBAN	0-1 dummy variable that equals one if student lives in suburban during senior	.24 (.43)	.22 (.41)	.45 (.50)	.45 (.50)
NORTH CENTRAL	0-1 dummy variable that equals one if student lives in north central during senior	.28 (.45)	.26 (.44)	.25 (.43)	.24 (.43)
SOUTH	0-1 dummy variable that equals one if student lives in south during senior year	.32 (.47)	.33 (.47)	.37 (.48)	.38 (.48)
WEST	0-1 dummy variable that equals one if student lives in west during senior year	.18 (.39)	.17 (.37)	.19 (.39)	.19 (.39)

Notes: * In HS&B data, this dummy indicates whether the respondent has any children or not.
** In HS&B data, most small town residents seem to be classified into suburban residents.

3.2. **Characteristics of High School Employment.**

From Table 1-3-2 and Table 1-3-3, 4, 5, 6and 7 we can characterize high school employment in this study as follows: (1) the majority of senior students have worked at least once during their senior year, though female students work much less than male students. Table 1-3-2 shows that in 1972, 81.38% of male and 70.49% of female students have worked either paid jobs or non-paid jobs during their senior year. Table 1-3-3 and 4 show that in 1980, 72.02% of male students and 66.53% of female students have worked paid jobs during their senior year.

(2) Students work longer hours in 1980 than in 1972 if they work. 49.77 % of male students and 33.32 % of female students in this study worked 16 hours or more

during their high school senior year in1972, while in 1980, 69 % of male students and 41.6% of female students worked 15 hours or more. (3) A high turn over rate is expected among high school senior workers. From Table 1-3-5, only 51.3% of male students and 46.7 % of female students worked during a given week (a reference week) while 72.0% of males and 66.5% of worked at least once a year.

(4) Many students work in lower grades also. 71.7 % of male students and 58.7% of female students worked at least once during their junior year (see Table 1-3-4). Considering the fact that senior students work much more than junior or sophomore students during a given week (reference week) from the CPS data,[34] such similar employment probability of male students across two years can indicate a higher turn over rate among juniors than seniors.

(5) From the Table 1-3-6 and 7 we see that jobs students hold during their senior year are mostly low-paying, low-skilled, low quality and private service oriented, and very casual jobs. Most students earned less than $4.00 per hour in 1980. Among workers, 12.3% of male students and 19% of female students worked as "waiter or waitress in a restaurant or drive-in" and 18.4% of male students and 23.4% of female students work as "store clerk or salesperson" and male students tend work more on the farm (6.36%) and as "skilled trade" or "other manual labor" (13.7%), while female students work more on "baby-sitting or child-care" (11.7%) and as "office or clerical" workers (18.4%). These characteristics of senior jobs are consistent with Stern and Nakata's findings with NLSY (1989). They find that "high school students are over-represented in sales and clerical, as

[34] Employment probability for senior students during the CPS reference week from 1968 to 1988 is between 35% and 45% while for junior students is between 24% and 35%. Average working hours per week among

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11 to 15 hou
16 to 20 hou
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26 to 30 hou
More than 3
Total

Table 1-3

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5-14 hours
15-21 hours
22-29 hours
30-34 hours
More than
Total

Table 3-4

None
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22-29 hours
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well as in low-skilled labor, service, and farm jobs" (p197). In most cases, these jobs provide almost no on-the-job training. From these job characteristics, it is hard to expect them to accumulate a high quality of human capital.[35]

In the following sub-section, we explain the econometric methods and specifications of high school employment.

Table 1-3-2: Working Hours Distribution and Average Test Score (NLS-72)

	Male	Ave. Test Score	Female	Ave. Test Score
None	1245 (18.4%)	51.6	2126 (30.3%)	49.6
Less than 6 Hours	730 (10.8%)	52.7	920 (13.1%)	51.3
6 to 10 hours	797 (11.8%)	51.3	931 (13.3%)	50.0
11 to 15 hours	609 (9.%)	52.0	741 (10.6%)	51.8
16 to 20 hours	915 (13.5%)	51.5	900 (12.8%)	51.4
21 to 25 hours	804 (11.9%)	51.1	609 (8.7%)	49.9
26 to 30 hours	607 (9.0%)	49.2	353 (5.0%)	48.5
More than 30 hours	1056 (15.6%)	48.0	433 (6.2%)	47.9
Total	6763	50.9	7013	50.2

Table 1-3-3: Working Hours Distribution and Average Test Score :During Senior Year (HS&B)

	Male	Ave. Test Score	Female	Ave. Test Score
None	1137(27.98%)	48.74	1662(33.47%)	46.47
1-4 hours	240(5.91%)	48.21	444(8.94%)	48.45
5-14 hours	627(15.43%)	51.23	793(15.97%)	49.90
15-21 hours	807(19.86%)	51.04	1077(21.69%)	49.93
22-29 hours	567(13.95%)	51.62	561(11.30%)	49.64
30-34 hours	282(6.94%)	48.64	206(4.15%)	47.73
More than 30 hours	404(9.94%)	47.15	223(4.49%)	46.10
Total	4064	49.647(9.273)	4966	48.338(8.674)

Table 3-4 :Working Hours Distribution and Average Test Score During Junior Year. (HS&B)

	Male	Ave. Test Score	Female	Ave. Test Score
None	1114(27.66%)	51.21	2017(40.91%)	47.81
1-4 hours	323(8.02%)	50.96	487(9.88%)	49.43
5-14 hours	605(15.02%)	50.34	734(14.89%)	49.91
15-21 hours	781(19.39%)	50.00	847(17.18%)	49.33
22-29 hours	515(12.79%)	49.55	412(8.36%)	48.30
30-34 hours	268(6.66%)	46.77	192(3.89)	46.22
More than 30 hours	421(10.45%)	45.35	241(4.89)	44.84
Missing	37	43.58	36	42.86
Total	4064	49.647(9.273	4966	

Note: the percentage is calculated among non-missing observations.

working high school seniors are between 17 and 20 hours while for juniors they are between 14 and 17 hours during the same period.(See Ruhm 1997)

[35] However, around 80 % of them say "job encourages good work habits" In the HS&B senior group data.

Table 1-3-5: Working Experience During Junior and Senior years and Ave. Test Score (HS&B)

	Male		Female	
	Number(%)	Ave. Test Score (Std.)	Number(%)	Ave. Test Score (Std.)
Work Senior Year Only	600 (14.8%)	50.98(9.211)	1061(21.4%)	48.49(8.447)
Work Both Years	2327 (57.3%)	49.75(8.943)	2243(45.2%)	49.654(8.569)
Work Junior Year Only	586 (14.4%)	46.67(9.580)	670(13.5%)	45.804(8.549)
No Work Both Years	551(13.6%)	50.95(9.683)	992(20.0%)	46.91(8.652)
Work Last Week	2083(51.3%)	50.53(8.813)	2317(46.7%)	50.051(8.386)
Work Senior Year	2927(72.0%)	50.00(9.011)	3304(66.5%)	49.28(8.546)
Work Summer	3461(86.0%)	49.68(9.27)	3615(73.2%)	48.36(8.67)
Work Junior Year	2913(71.7%)	49.13(9.157)	2913(58.7%)	48.77(8.715)

Table 1-3-6: Job Characteristics. (HS&B)

Type of Work	Male	Female
Lawn Work or Odd Jobs	118(4.2%)	18(.6%)
Waiter or Waitress	3474(12.3%)	609(19.0%)
Babysitting or Child Care	18(.6%)	375(11.72%)
Farm or Agricultural Work	180(6.4%)	27(.8%)
Factory Work, Unskilled or Semi-skilled	134(4.7%)	64(2.0%)
Skilled-trade	283(10.0%)	31(.97%)
Other Manual Work	389(13.7%)	51(1.6%)
Store Clerk or Salesperson	521(18.4%)	749(23.41%)
Office or Clerical	86(3.0%)	588(18.4%)
Hospital or Health	72(2.5%)	186(5.8%)
Others	678(23.95%)	497(15.53%)
Total	2826	3195

Table 1-3-7: Earnings ($1980) (HS&B)

Hourly Wage on the Job	Male	Female
Less than $1.50	37(1.3%)	221(6.8%)
$1.50 to $1.99	40(1.4%)	141(4.3%)
$2.00 to $2.49	97(3.4%)	185(5.7%)
$2.50 to $2.89	142(4.9%)	197(6.0%)
$2.90 to $3.09	484(16.7%)	497(15.2%)
$3.10 to $3.49	1309(45.2%)	1527(46.8%)
$3.50 to $3.99	341(11.8%)	278(8.5%)
$4.00 per hour or more	445(15.4%)	218(6.7%)
	2895	3264

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3.3. **Strategy**

To identify the determinants of high school employment, two methods are utilized. For the choices of 'work,' for the choice of 'heavy work,' and for the choice of 'moderate work,' we run a binary dependent variable model (probit model). This is the same model for the job-holdings used in the previous studies (Ruhm 1997), and described in the section 2. It is rewritten here for convenience.

$$Y_i^* = XB + e$$

$$Y_i = 1 \text{ if } Y_i^* \text{ is larger than zero}$$

$$= 0 \text{ otherwise.} \qquad (3\text{-}1)$$

For the investigation of the determinants of working hours, we utilize the two-limit tobit models instead of the OLS method because the working hours variables are actually truncated at the longest working hours recorded (30 hours for NLS-72 and 35 hours for HS&B), and also, we can regard them to be truncated at zero working hours. The model for working hours then becomes

$$Y_i^* = X_i B + v_i$$

where Y_i^* is the latent variable, for example, utility from working hours. We denote the working hours observed by Y_i,

$$Y_i = 0 \quad \text{if } Y_i^* \le 0$$

$$= Y_1^* \quad \text{if } 0 \le Y_i^* \le UL$$

$$= UL \text{ if } Y_i^* \le UL \qquad (3\text{-}2)$$

where UL is the upper limit, 30 hours for NLS-72 and 35 hours for HS&B. When the dependent variables are truncated, the estimates of parameters from the usual OLS

regression are inconsistent. Thus, under the assumption that the error term v_i is normally distributed with zero mean, we can consistently estimate the parameters with a tobit model with two limits[36] (see Maddala 1983).

In these regression analyses, males and females are separated because there are big gender differences in high school employment in terms of both job-holdings or working hours as we see in Table 1-3-2 and Table 1-3-3. As mentioned earlier, factors that indicate job availability, ability and family socio-economic background are focused on.

For job availability, we pay attention to local economic conditions, community types, and race. Freeman and Wise (1982) summarize the youth labor market problems: (1) youth employment is more sensitive to cyclical movements; (2) the unemployment rate is high among those who live in areas with high poverty levels; (3) the growth rate of personal income is positively related to youth employment. Thus, we can expect youth employment to be strongly related to levels of economic activity and the economic well-being of the areas they live in. Even though their summaries are related to the general youth employment including both young people in school and out of school, influences of local market conditions on high school employment would be very similar and we can expect lower job-holdings and fewer working hours among high school students who live in areas with lower economic activities (high local unemployment, lower income growth rates) and lower per capita income.

In HS&B, the labor market file provides the information on local (county) economic conditions such as the unemployment rate, employment growth rate, average

[36] We also utilize a tobit model with one limit. However, the results are almost the same.

per capita income, its growth rate in the county, the percentage of people employed within the county, and the mean wage in the manufacturing industries in the area.[37]

However, these county-level economic indicators might not represent all the market conditions. The labor market conditions each individual student faces might be different even within a county. A reservation wage could indicate more specific market conditions each individual student faces. Usually, when the reservation wage is high and all other conditions are the same, the probability of being employed is lower. However, if the reservation wage and employment are influenced by the level of economic activity in the county, the reservation wage will be higher in the areas where there is high demand for high school employment, and could represent the other market conditions which cannot be captured in these county economic indicators. Thus, we test whether the reservation (minimum) wages during high school affect high school employment. In the HS&B survey, Students are asked "What is the lowest hourly wage you would be willing to accept for a job while still in high school" and answered the question as a categorical variable (from below $1.5 to $4.00 or more by every $.5). We make a dummy variable for above $3 categories and a dummy for those who will not work at any wage during high school, and thus, have no reservation wage.

Means and standard deviations of these variables are tabulated in the Table 1-3-8, the standard deviations of the economic indicator variables are large. For instance, the average unemployment rate is 7.5% with standard deviation 2.64 across counties where students live.

[37] Unfortunately, NLS-72 do not provide the information on the local market conditions.

Table 1-3-8.: Summary Statistics of Local Economic Indicators (HSs&B)

Variable Name	Definition	Male	Female
U Rate	county unemployment rate	7.5	7.6
		(2.64)	(2.64)
Employment Growth	county employment growth rate	1.00	1.00
		(3.74)	(3.85)
Income Growth	county income growth rate	10.5	10.5
		(4.22)	(4.22)
County Income	county log average income	9.11	9.11
		(.24)	(.24)
% Employed	percent of people employed in county	42.7	42.8
		(5.9)	(6.0)
Mean Wage	Mean wage per hour in manufacturing industries in SMSA	8.21	8.17
		(1.54)	(1.49)
Reservation Wage	0-1 dummy which is equal to zero if student's reservation is larger than $3.00	.77	.67
		(.42)	(.47)
Will Not Work	0-1 dummy which is equal to zero if student will not work at any wage	.02	.02
		(.12)	(.13)

Community type, such as rural, urban or suburban areas can indicate job availability for students. Considering the fact that most students work in the service sector (see Table 1-3-6), we can expect more jobs available for students who live in urban and suburban areas than for those who live rural areas.

In terms of job-holdings, racial minorities work much less.[38] From the second column of the Table 1-3-10, in 1980 59.0% non-white and 70.7% white students have worked at least once during their junior year. The difference is 11.7%. This racial gap is bigger during their senior year (14.8% difference) and is even bigger for the reference week (18.9% difference). As we see from Table 1-3-11 and 12, these gaps are largest for Blacks. Black males work even less during their senior year than their junior year. Also, in 1972, Blacks' job-holding rate in their senior year is much lower than other races even though the difference is much smaller than in 1980 (see Table 1-3-9).

[38] For those who are employed, racial differences in working hours are much smaller. The average working hours per week for the employed Whites, Blacks, Hispanics and Asians are 19, 18, 19, and 17 in the HS&B sample and 17, 15, 17 and 16 hours in the NLS-72 sample respectively.

Whether race itself indicates job availability is very controversial. If a student from a certain race works less, they might do so simply because they want to work less due to cultural differences. However, there also might exist less demand for Blacks and other minorities either because they have less ability or because employers have a racial bias against them. Minority groups have higher unemployment rates even though their labor force participation rates are much lower. They might even be discouraged to join in the labor force because there is not much demand for them (See Table 1-3-11 and 12).

Table 1-3-9 (NLS-72)

	Whites	Black	Hispanics	Asians
Male	83.0	71.1	78.8	78.1
Female	72.3	57.5	59.7	57.8

Table 1-3-10: Race Difference of Working Experience (HS&B)

	Work in Senior	Work in Junior	Work Last Week
White	76.8	70.7	58.7
Minority	62.0	59.0	39.8

Table 1-3-11: Race Differences in Work Experience (%) Male (HS&B)

Race	Labor Force Part	Unemployment Rate	Work in Senior	Work in Junior	Work Last Week
White (1942)	83.8	12.9	78.1	75.28	59.3
Black (867)	75.7	26.9	63.3	68.51	41.0
Hispanic (1022)	78.6	16.5	71.0	70.16	47.4
Asian (143)	69.2	16.8	51.3	55.9	37.8

Table 1-3-12: Race Differences in Work Experience (%) Female (HS&B)

Race	Labor Force Part	Unemployment Rate	Work in Senior	Work in Junior	Work Last Week
White (2334)	81.7	12.0	75.7	66.8	58.2
Black (1223)	70.6	24.8	54.7	50.1	33.7
Hispanic (1180)	72.3	16.9	61.9	50.4	38.9
Asian (152)	67.8	11.2	61.8	60.5	40.1

With respect to the relationship between the ability measure (standardized test scores) and high school work experience, we focus on the following two points: (i) the relationship between different working experiences and academic ability, especially differences between working in the junior year and working in the senior year. (ii) non-linearity of the relationship of test scores to job-holdings and working hours.

Students took the same test in NLS-72 and HS&B. To measure different types of cognitive skills, the test contain six different categories: vocabulary, reading, math, picture, formula and mosaic area. We use the average test score in the first three areas.

As we see in the review of studies on the effect of high school work experience, the measures or definitions of it are quite different across studies. Those different measures and/or specifications of the work experience in the earnings (or employment) equations seem to derive different results across studies. We suspect that these different measures and specifications might capture the relationship between high school employment and academic ability differently.

The negative effects of high school employment on psychological and educational aspects such as higher drop out rate, higher rates of delinquency, drug and alcohol abuse, and so on, are mostly based on students' working experience in the junior and/or the sophomore year (Greenberger and Steinberg 1980, Marsh 1991, Mortimer and Finch 1986). However, the large positive effects on later earnings and employment are in many cases more related to working experience in the senior year.

Table 1-3-5 shows that those who work only in their senior year have the highest average test scores, while those who work only in their junior year have the lowest average test score. Also the same table indicates that the average test score of those who

are working during the reference week is slightly higher than that of those who have ever worked in their senior year. All these facts together could imply that employment in the senior year(especially, working in the reference week) is more selective toward better students or better workers than in any other grades. Also, the 1-3-9 and Table 1-3-3 indicate that those students who work 6~20 hours have the highest average test scores. Many studies show that the beneficial effects of high school work experience is the largest among those who work moderate hours. However, students who works long hours have the lowest average test scores. We suspect that the quadratic specification of hours worked in the earnings equation as in Ruhm (1997) could capture this selectivity of these working moderate hours instead of the true effects of working experience.

After controlling for other variables, to examine the linear relationship between different work status and academic ability, the probit model for 'work', 'heavy work', 'moderate work' for both the 1972 and 1980 samples are run. Also we run the probit models for 'work' during the reference and 'work' in the junior year for the 1980 samples are run. The test scores in these regressions are specified in the linear form. Thus, only the first order of test scores is included.

Then, we concentrate on the relationship between senior year work experience and academic ability. The tobit models for working hours as well as the probit models for job-holdings are utilized. Including just test scores in independent variables in regression analyses might not be enough to detect the selection bias in terms of ability. When students have the same academic ability, those who have worked in their junior year might have advantages in getting jobs, or in working longer hours over those who do not have previous working. This is because they might have more information on the job

market and might have more access to jobs or because employers might value their previous working experience.

Thus, to see the true selectivity of the high school senior employment in terms of academic ability, controlling for previous working experience might be important in the regression analyses. [39] A dummy variable 'work junior' which represents those who have worked during their junior year or 'working hours junior' which indicates hours worked during the junior year is included in the regressions.[40] By excluding and including this dummy or the hours worked variable in the regression analyses, we want to see how the effect of ability measures on working in the senior year changes before and after controlling for the previous working experience. Then, we can see whether there is any ability selectivity of employment in the senior year. Unfortunately, we have information on working in junior year only with the HS&B data.

We also examine the non-linearity of the relationship of test scores and 'work' or or 'working hours' during the senior year. Previous studies assume only the linear relationship between high school employment and academic ability and find almost no significant relationship between these two variables. However, if the relationship is non-linear, especially quadratic, a linear specification of test scores in the regressions of high school employment might not capture their true relationship.

As briefly mentioned earlier in our review of the previous studies on the determinants of high school employment, the work selection process during high school

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[39] So far, we assume that test scores represent each individual's academic ability without being affected by previous working experience. However, even if we assume that previous working experience affect test scores, we also need to control for previous working experience. Without controlling for previous working experience, negative or no relationship between working in senior and test scores could be the results from

is complicated in terms of academic ability, because high school years are a transition period, and because high school students have to spend at least 35 hours or more on academic activities. Students with low test scores seem to work less probably because they can not find jobs (even if they are less likely to go college, thus more like to work early). Students with high test scores might tend to work probably because they want to invest more human capital in academic areas. Also, from an employer's perspective, those jobs might not require much higher academic ability beyond a certain level. These tendencies can cause a non-linearity effect of test scores on job-holdings or working hours during high school.

Table 1-3-12 and Table 1-3-14 indicate that, except for males in 1972, mean working hours by test score quartiles show a possible non-linear, probably quadratic relationship between working hours and test scores.[41] Also, except in the HS&B female case, the percentages of students who have not held jobs by test score quartiles indicate a possible non-linearity.[42] Students whose test scores are in the 2nd and 3rd quartiles have the highest job-holding rate. From Table 1-3-9 and Table 1-3-3, we can see another aspect of this non-linearity. Students who work moderate hours (5-20 hours) have a higher average test score than others. To capture a non-linear relationship, a quadratic function of test scores or categories of test scores is included in the probit equations for job-holdings and the tobit equations for hours worked.

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the reverse causation because of strong correlation between working in senior year and working in junior year.

[40] We also include the working experience during the summer between the senior year and the junior year.

[41] Even in 1972, the portion of students who have not worked at all implies this nonlinear relationship.

[42] In this case, hours worked show the non-linearity.

Table1- 3-13: Male Working Hours Distribution During Senior Year by Test Score Quartiles: (NLS-72)

	male				female			
	1st Quartil	2nd Quartil	3rd Quartil	4th Quartil	1st Quartil	2nd Quartil	3rd Quartil	4th Quartil
None	18.6	15.5	16.9	22.4	35.2	29.1	26.8	29.8
Less than 6 Hours	8.9	8.0	11.1	15.0	11.7	11.7	14.1	15.4
6 to 10 hours	10.7	11.7	12.0	12.6	14.3	12.3	12.4	14.0
11 to 15 hours	7.2	8.5	10.0	10.1	7.0	10.8	12.3	12.5
16 to 20 hours	11.3	14.1	14.6	14.0	9.4	13.8	14.9	13.5
21 to 25 hours	10.9	12.2	13.2	11.3	8.7	8.9	9.3	7.9
26 to 30 hours	10.3	11.0	9.0	5.8	5.6	6.4	4.7	3.2
More than 30 hours	22.2	18.9	13.3	8.7	8.0	7.1	5.6	3.7
Mean Working Hours	16.1	16.4	14.7	12.1	10.1	11.2	10.8	9.5

Note: all units are % except the mean working hours.

Table 1-3-14: Working Hours Distribution During Senior Year by Test Score Quartiles (HS&B)

	Male				Female			
	1st Quartil	2nd Quartil	3rd Quartil	4th Quartil	1st Quartil	2nd Quartil	3rd Quartil	4th Quartil
None	33.6	25.2	25.5	26.14	42.5	33.7	27.0	25.4
1-4 hours	8.0	5.4	3.9	5.7	9.8	7.2	8.0	10.6
5-14 hours	12.7	14.7	16.3	18.4	13.1	15.6	15.7	21.2
15-21 hours	15.3	19.5	22.17	23.2	16.0	23.6	24.3	26.0
22-29 hours	10.5	16.3	16.0	14.4	8.0	11.7	16.4	10.8
30-34 hours	6.9	9.0	6.7	5.5	4.6	3.9	4.4	3.5
More than 30 hours	13.0	10.2	9.6	6.7	6.0	4.3	4.2	2.6
Mean Working Hours	13.60	15.58	15.20	13.84	9.97	11.65	13.13	11.73

Note: all units are % except the mean working hours.

Family background factors could be important for working during high school because they would affect students' access to jobs though parents' businesses or social contacts, and/or affect students' work ethics (Rees and Gray 1982). However, as seen earlier in our review, previous studies find that few family background factors significantly influence high school employment (Marsh 1991, Ruhm 1997, Dustmann et al 1996). In our investigation of the influences of family background factors, we are particularly interested in their possible non-linear relations to high school employment. Marsh (1991) assumes only a linear relationship between hours worked and socio-

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economic status (SES). Even though other studies include categorical variables for some family background factors in their regression analyses of the determinants of high school employment, they do not investigate the possible non-linearity fully. However, as mentioned earlier, there is a possibility that SES and high school employment are related to each other in a non-linear pattern. Students whose SES is low, have less access to jobs. Students whose SES is high do not need to work because their parents are well off and encourage them to concentrate on academic activities.

Table 1-3-15 and Table 1-3-16 show a possible non-linearity in the relationship between the mean working hours and the percentage of job-holdings except in case of 1980 female case (the first row in Table 1-3-16). Those whose SES is in the 2nd and 3rd quartiles work most in terms of job-holdings and working hours. In order to capture a possible non-linearity of the relationship, we make 3 SES categories and includes the 'middle' and 'top' categories in the regression. For detailed family backgrounds, we include categorical variables for family income, father's education, mother's education and father's occupation.

Table 1-3-15:Working Hours Distribution During Senior Year by SES (NLS-72)

	Male			Female		
	Bottom	Middle	Top	Bottom	Middle	Top
None	19.6	16.5	20.7	34.9	28.0	29.2
Less than 6 Hours	9.1	9.6	14.6	11.3	16.0	16.0
6 to 10 hours	13.2	10.7	12.4	15.2	13.7	13.7
11 to 15 hours	8.0	9.1	9.7	8.6	11.1	11.1
16 to 20 hours	13.3	13.7	13.4	9.9	14.4	14.4
21 to 25 hours	9.4	13.6	11.3	7.4	7.5	7.5
26 to 30 hours	9.4	9.6	7.5	5.2	3.6	3.6
More than 30 hours	18.0	17.3	10.4	7.4	4.5	4.5
Mean Working Hours	14.9	15.8	12.9	9.8	11.1	9.7

Note: 'Bottom' represents the first quartile, 'Middle' represents the second and third quartiles, 'Top' represents the fourth quartile. All units are % except the mean working hours.

Table 1-3-16:Working Hours Distribution During Senior Year by SES (HS&B)

	Male			Female		
	Bottom	Middle	Top	Bottom	Middle	Top
None	31.7	25.3	27.0	40.1	30.3	25.4
1-4 hours	7.1	5.0	5.8	8.9	8.4	10.5
5-14 hours	13.6	16.4	16.5	14.2	16.1	19.9
15-21 hours	17.6	20.1	23.3	20.3	22.9	22.3
22-29 hours	12.8	15.5	12.8	8.0	13.3	14.4
30-34 hours	6.6	7.0	7.5	3.7	4.6	4.2
More than 30 hours	10.6	10.7	7.1	5.0	4.5	3.3
Mean Working Hours	13.7	15.2	14.1	10.2	12.3	12.3

Note: 'Bottom' represents the first quartile, 'Middle' represents the second and third quartiles, 'Top' represents the fourth quartile. All units are % except the mean working hours.

Other included independent variables are dummies for whether the mother works for a paid job during the student's high school years, whether student has his (or her) own children (or dependents in 1972), and whether English is spoken at home; the number of siblings; region categories and high school program categories, such as academic, general, and vocational.

In the following section, we summarize and explain the major results in our regression analyses.

4. Estimation Results.

4-1: Over-time comparisons: In this subsection, we summarize the similarities and differences in the regression results of the probit models and tobit models between the two years (see Table 1-4-1-1 and 2. From now on, we refer to these regressions as the basic regressions). We can observe quite similar influences of background variables on job-holdings and working hours in the senior year in both 1972 and 1980. First, after other factors are controlled for, students whose SES are in the 2nd an 3rd quartile have higher probability of holding a job and work more hours than those whose SES are either

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in the 1st or 4th quartile, except for the 1980 female case. Second, even after other variables including test scores are controlled for, job-holding rates for minorities, especially for Blacks, are much lower than for Whites, and minorities work much fewer hours on the average. Third, male students who are in academic programs work less than students in the general program, while both male and female students in vocational programs work more than those in the general program. Fourth, if the mother works, both male and female students work more in terms of job-holdings and working hours in both years.

There are other similarities. The more siblings students have, the more they work except in the case of males in 1980. Students who have any dependents or any children work more except in the case of female in 1980. There seems to be no linear relationship between GPA and high school work experience.

We can also observe the differences overtime. First, when we put the test scores in the linear form, the relationship has dramatically changed over-time. In 1972, the coefficient of test scores is negative and significant for males in the probit estimation for job-holdings and is zero for females. In the tobit models for working hours, the coefficients are negative and significant for both male and females. In the male case, one standard deviation of test scores decreases more than a one and half working hour. However, in 1980, the coefficients of test scores are positive and significant (except in the tobit of working hours for male.) A increase of one standard deviation of test scores increases almost one working hour. This change indicates that more students with higher academic ability participate in the labor force. Second, students in the 4th quartile SES tend to work more in terms of job-holdings and working hours in 1980 than 1972. The

coefficients of SES-HIGH in the tobit model for working hours are negative in 1972 even though they are not significant. However, in 1980. they are positive for both male and females. In the 1980 female case, female students in the SES-HIGH work 1.6 hours more than those in the bottom SES quartile. More affluent female students work in 1980 than 1972. Third, the effects of the community type seem to have changed. Students who live in urban and suburban areas work more in 1980 than 1972 compared to those students who live in rural areas.

These findings might be explained by the secular rise of materialism among high school students and increases in prices consumption goods for high school students, such as toys or clothes (see Greenberge and Steinberger 1986). In 1972, students in poor families might have worked due to their families' economic demand or students with lower academic ability might have worked during high school because they had decided to go labor market directly after high school graduation. However, in 1982, students even with high academic ability or students from affluent families might have begun to work because they had to spend more money on their consumption. Given a certain demand for high school student workers, higher participation of students from middle class families or students with higher academic ability might have driven out those students in the bottom in terms of academic ability or family backgrounds.

There are other noticeable changes. In 1980, students from homes where English is not spoken work less in terms of both job-holding and hours worked, while there is no such difference in 1972. Students who have dependents seem to work 3 hours more in

Table 1-4-1-1: Probit For Job Holding . (NLS-72 & Table HS&B)

	Probit			
Variables	72 Male (6763)	72 Female (7013)	80 Male (4064)	80 Female (4966)
CONSTANT	1.197***	.148	.374**	-.435**
	(.154)	(.135)	(.186)	(.170)
GRADE	.022	.030	-.055	.032
	(.022)	(.020)	(.035)	(.033)
TEST SCORE	-.007**	-.000	.007**	.011***
	(.003)	(.003)	(.003)	(.003)
SES-MEDIUM*	.137***	.095**	.098*	.099**
	(.048)	(.040)	(.051)	(.044)
SES-HIGH	.065	.036	.005	.162***
	(.058)	(.052)	(.066)	(.062)
BLACK	-.513***	-.374***	-.391***	-.431***
	(.067)	(.056)	(.064)	(.055)
HISPANICS	-.303***	-.325***	-.130*	-.178***
	(.099)	(.085)	(.065)	(.060)
ASIAN	-.250	-.413**	-.518***	-.388***
	(.162)	(.154)	(.120)	(.116)
NATIVE AMERICAN	-.118	-.113	-.472***	-.356**
	(.107)	(.163)	(.146)	(.156)
SIBLINGS	.041***	.051***	-.005	.022**
	(.010)	(.009)	(.010)	(.010)
MOMWORK	.132***	.116***	.148***	.131***
	(.039)	(.034)	(.048)	(.043)
ANY DEPENDENT	.156**	.137**	.247	-.554***
(CHILD)	(.065)	(.060)	(.346)	(.115)
NO ENGLISH	.126*	.013	-.157**	-.219***
	(.069)	(.058)	(.076)	(.069)
HIGH SCHOOL ACADEMIC	-.166***	.044	-.138**	-.036
	(.046)	(.043)	(.055)	(.049)
HIGH SCHOOL	.143***	.138***	.047	.164***
VOCATIONAL	(.054)	(.042)	(.058)	(.050)
SMALL TOWN	-.204***	.069		
	(.055)	(.046)		
URBAN	-.273***	-.003	.035	.198***
	(.055)	(.047)	(.060)	(.053)
SUBURBAN	-.293***	.086*	.078	.175***
	(.057)	(.051)	(.053)	(.047)
NORTH CENTRAL	.083	.191***	.042	.154*
	(.053)	(.047)	(.066)	(.060)
SOUTH	.085*	-.071	.019	-.027
	(.051)	(.045)	(.063)	(.055)
WEST	.119**	.028	.045	.095
	(.059)	(.053)	(.073)	(.065)
R Square	.0347	.0244	.0296	.0502
(χ square)	(223.9)	(210.4)	(142.4)	(317.5)

Notes: (a) Standard errors are in the parentheses. (b) *, **, *** means 'significant' at 10% level, at 5%, and 1% level.

Table 1-4-1-2: Tobit For Working Hours (NLS-72 & Table HS&B)

Variables	72 Male (6763)	72 Female (7013)	80 Male (4064)	80 Female (4966)
CONSTANT	22.762***	5.802***	12.893***	-.372
	(1.650)	(1.552)	(.2.648)	(2.224)
GRADE	-.156	.100	-.637	-.095
	(.235)	(.232)	(.496)	(.437)
TEST SCORE	-.184***	-.059**	.011	.097**
	(.032)	(.031)	(.046)	(.040)
SES-MEDIUM*	1.648***	.874*	1.676**	1.727***
	(.513)	(.462)	(.725)	(.585)
SES-HIGH	-.612	-.607	.002	1.607**
	(.628)	(.598)	(.934)	(.791)
BLACK	-8.365***	-6.572***	-6.746***	-5.558***
	(.771)	(.665)	(.918)	(.740)
HISPANICS	-4.019***	-4.797***	-2.111**	-1.997**
	(1.087)	(1.021)	(.909)	(.782)
ASIAN	-3.169*	-4.077**	-9.383***	-5.249***
	(1.808)	(1.877)	(1.823)	(1.541)
NATIVE AMERICAN	-1.641	-2.766	-4.761**	-1.997**
	(1.846)	(1.858)	(2.195)	(.782)
SIBLINGS	.409***	.711***	-.131	.360***
	(.110)	(.103)	(.152)	(.131)
MOMWORK	1.298***	2.248***	2.852***	1.798***
	(.418)	(.389)	(.687)	(.568)
ANY DEPENDENT	2.842***	2.753***	9.650**	-6.420***
(CHILD)	(.670)	(.681)	(4.745)	(1.677)
NO ENGLISH	.124	.713	-1.194	-2.349**
	(.714)	(.669)	(1.117)	(.946)
HIGH SCHOOL ACADEMIC	-3.008***	.176	-3.548***	-.838
	(.494)	(.494)	(.779)	(.638)
HIGH SCHOOL	2.608***	2.557***	1.479*	2.543***
VOCATIONAL	(.545)	(.478)	(.815)	(.654)
SMALL TOWN	-.798	1.701***		
	(.553)	(.524)		
URBAN	-.146	1.451***	1.510*	3.418***
	(.573)	(.538)	(.851)	(.701)
SUBURBAN	-287	2.228***	2.057***	2.996***
	(.590)	(.571)	(.742)	(.617)
NORTH CENTRAL	1.306**	2.073***	.564	1.690**
	(.567)	(.519)	(.926)	(.756)
SOUTH	2.370***	-.475	1.202	-.140
	(.563)	(.517)	(.891)	(.722)
WEST	.618	-.627	.052	1.422*
	(.640)	(.606)	(1.025)	(.830)
R Square	.0113	.0078	.0076	.0087
(χ square)	(475.6)	(324.1)	(190.6)	(256.5)

Note: see notes in Table 1-4-1-1.

1972. In 1980, male students who have children work 10 hours more than others while female students who have any children work 6 hours less than others. This striking contrast between males and females might be due to the welfare support system for the single mothers in 1980s.

From now on, we concentrate in more detail on factors that indicate job availability, ability and family socio-economic background and only report the coefficients of the related variables in each focus.

4-2: Job availability: (1) Local economic conditions: The effects of various local economic conditions on job-holdings and working hours in the senior year, are tabulated separately in Table 1-4-2-1, 2, 3, and 4. All other control variables in the 'basic' regressions are included in these regressions and the coefficients of them are not reported. The unemployment rate is one of most important factors which determines high school employment. The coefficients of the unemployment rate are significant and negative in most cases. One percent increase of the county unemployment rate reduce .5 to 1% probability of being employed at the mean values of control variables. (Marginal effects are not reported here). Without controlling for other economic indicators, a one percent increase of the county unemployment rate reduces a half hour working hour for males (see column 1 in Table 1-4-2-2) and one third working hour for females (see column 1 in Table 1-4-2-4).

Other indicators which represent the level of local aggregate economic activity are the percentage of employed people within a county, employment growth rate, and per capita income growth rate. The coefficients of these variables are in many cases positive and significant in the regressions of job-holdings and working hours for both male and

female students (column 7 in Table 1-4-2-1, columns 2, 6, and 7 in Table 1-4-2-2, columns 3 and 4 in Table 1-4-2-3, and columns 3, 4, 6, 7, 9 in Table 1-4-2-4).

The level of affluence of the county a student lives in is very important for females. The coefficients of log per capita income are significantly positive in all of the specifications for females except columns 9 in Tables 1-4-2-3 and 4. One unit increase of logged per-capita income increases work time by 4-5 hours for female students. However, for male students, its effects are relatively small when unemployment rate is controlled for.

These tables seem to show some gender differences in influences of these various economic conditions on high school senior employment. When these variables are included all together in the regression, unemployment rates and growth rates of employment in a county, or the percentage of the employed within a county seem to be more important in male students' employment while per capita income and its growth rates seem to be more important in female students' employment (see columns 7 in Tables 1-4-2-1,2,3, and, 4). Because of the correlation between these variables, we can not argue that the gender differences are obvious. However, the gender difference in characteristics of jobs students hold (Table 1-3-6) might be related to this phenomenon because female students' jobs are more strongly related to consumption rather than to production.[43] When income rises, people spend more money on private services and this causes higher demand for student (especially, the female student) labor in the service sector.

[43] Female students' jobs are a little more concentrated in baby-sitting, waitress and sales-person.

However, as mentioned earlier, these county economic indicators might not capture the market conditions each individual faces. When the reservation wage is included as an independent variable, the regression results display a highly positive relationship between employment and reservation wage among high school students. The results are shown in columns (9) in all the Tables 1-4-1,2,3, and, 4. Students with higher than a $3.00 reservation wage work about 5 hours more for females and 7 hours more for males than those who have lower reservation wage. Also the effect of this high reservation wage is to increase the probability of being employed by 8-12% at the mean values of the control variables. (not reported.) Considering the high labor force participation among high school students, we can conclude that those who are willing to work with a lower reservation wage simply can not find jobs or employers who want to hire them. When the reservation wage is controlled for, almost all other labor market variables become insignificant. Also, the effects of reservation wage reduce even the size of community type effects (not reported here). Sweeping away all the effects of other market indicators means strong correlation between local market conditions and reservation wages, and could mean that students would have a higher reservation wage because there is higher demand for them.[44]

However, there could be a compounding effect in the coefficient of the high reservation wage dummy: students can have higher reservations just because they work. This problem might be serious when a reservation wage is related not to market demand but to a student's ability. However, there are evidences which show that reservation

[44] Mean wage in manufacturing industries are not significant even though it is negatively related with high school employment. However, the mean wage hardly represent the high school students wage. Most students earn 2-4 dollars per one hour.

wages represent market demand students face. First, when we include the high reservation wage dummy, the coefficients of test scores in these regressions do not change (not reported) while the coefficients of all other market indicators and region or community types becomes smaller and insignificant. Second, we tabulate the relationship between reservation wages and test scores and the relationship between reservation wages and county economic conditions among Whites in Appendix Table 1.[45] Appendix Table 1 also shows that reservation wages are related to market demand rather than to individual ability. If reservation wages are related to students' ability, students with higher academic ability might demand higher reservation wages. However, there is almost no differences in the average test scores across reservation wage categories. However, appendix Table 1 shows that better county economic conditions are related to higher reservation wages. Thus, it is very plausible that the reservation wages indicate the market demand individual students face.[46]

Table 1-4-2-1: The Effects of Local Economic Conditions on Job-holdings (Probit model) Female: 4046 (HS&B)

Market Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
U Rate	-.032***	-	-	-	-	-	-.015	-	-.014
	(.008)	.031***	.032***	.032***	.028***	.027***	(.010)	.035***	(.011)
		(.009)	(.009)	(.009)	(.009)	(.009)		(.009)	
Employme		.004		.004		.006	.007		.007
nt Growth		(.006)		(.006)		(.006)	(.007)		(.006)
Income			-.001	-.003		-.005	-.003		-.006
Growth			(.006)	(.007)		(.143)	(.007)		(.007)
County					.207*	.239*	.105		.046
Income					(.126)	(.130)	(.143)		(.145)
%							.012**		.011**
Employed							(.005)		(.005)

[45] The reason we restrict the sample to Whites only is because there can be some relationship between race and reservation wage.

[46] Another interesting point in Appendix Table a is that there is no correlation between 'will not work' and test scores, and 'will not work' and county economic conditions. Thus, the choice of 'will not work' seems to be random choices by students.

Mean Wage								.019 (.018)	.007 (.006)
Reservation Wage									.330*** (.052)
Will Not Work									-.876*** (.179)
R Square	.0326	.0326	.0326	.0327	.0331	.0334	.0334	.0328	.0522

Notes: (a) All other regressors in NLS-72 & Table HS&B 4-1-1 are included and the coefficients of them are not reported. (b) see notes in the basic regressions (NLS-72 & Table HS&B 4-1-1 and 2).

Table 1-4-2-2: The Effects of Local Economic Conditions on Hours worked (tobit model) Male: 4064 (HS&B)

Market Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
U Rate	-.503*** (.121)	-.474*** (.122)	-.480*** (.122)	-.461*** (.123)	.428*** (.130)	-.386** (.131)	-.316** (.151)	-.487*** (.126)	-.306** (.149)
Employment Growth		.147* (.084)		.128 (.087)		.147* (.088)	.150* (.088)		.160* (.086)
Income Growth			.120 (.092)	.085 (.095)		3.017* (1.861)	.066 (.098)		.012 (.097)
County Income					2.921* (.1.814)	.052 (.097)	2.217 (2.041)		.939 (2.018)
% Employed							.071 (.075)		.050 (.073)
Mean Wage								-.115 (.251)	
Reservation Wage									6.935*** (.745)
Will Not Work									-11.751* (2.860)
R Square	.0083	.0083	.0084	.0085	.0084	.0086	.0086	.0083	.0137

Note: See notes in Table 1-4-2-1.

Table 1-4-2-3: The Effects of Local Economic Conditions on Job-holdings (Probit model) Female: 4966 (HS&B)

Market Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
U Rate	-.029*** (.008)	.029*** (.008)	-.028*** (.008)	-.028*** (.008)	-.020** (.008)	-.020** (.008)	-.016* (.009)	-.030*** (.008)	-.017* (.010)
Employment Growth		-.002 (.005)		-.005 (.006)			.004 (.005)		.003 (.005)

Income Growth			.010* (.006)	.012** (.006)		-.002 (.005)	-.002 (.005)		-.003 (.005)
County Income					.352*** (.117)	.311** (.122)	.256* (.135)		.202 (.136)
% Employed						.008 (.006)	.009 (.006)		.007 (.006)
Mean Wage								.012 (.017)	
Reservation Wage									.219*** (.042)
Will Not Work									-1.044 (.163)***
R Square	.0525	.0525	.0530	.0531	.0539	.0542	.0543	.0526	.0685

Note: See notes in Table 1-4-2-1.

Table 1-4-2-4: The Effects of Local Economic Conditions on Hours worked (tobit model) Female: 4966 (HS&B)

Market Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
U Rate	-.322*** (.100)	-.319*** (.100)	-.293*** (.100)	-.298*** (.100)	-.177* (.107)	-.173 (.109)	-.087 (.124)	-.323*** (.103)	-.110 (.122)
Employment Growth		.017 (.067)		-.035 (.069)		-.000 (.070)	.001 (.070)		.001 (.069)
Income Growth			.216*** (.076)	.226*** (.078)		.166** (.081)	.185** (.082)		.131* (.081)
County Income					5.488*** (1.535)	4.772*** (1.593)	3.712** (1.759)		2.427 (1.735)
% Employed							.087 (.061)		.052 (.060)
Mean Wage								.008 (.209)	
Reservation Wage									5.209*** (.542)
Will Not Work									-13.630 (2.356)***
R Square	.0090	.0090	.0093	.0093	.0094	.0096	.0097	.0098	.0148

Note: See notes in Table 1-4-2-1.

Appendix Table 1: Reservation Wages, Test Scores and County Economic Conditions among Whites.

	Reservation wage equal to $2.00 or less	Reservation wage above $2.00 and less than $3.00	Reservation Wage between $3.00 and $3.50	Reservation Wage above $3.50	Will not work
Test Scores	53.4	52.8	53.2	52.3	52.3
	(8.67)	(8.09)	(7.99)	(8.59)	(8.97)
County Unemployment Rate	8.06	7.99	7.31	6.95	7.75
	(2.68)	(2.71)	(2.63)	(2.40)	(2.87)
Employment Growth rates	.76	.80	.93	1.29	.78
	(3.36)	(3.74)	(2.94)	(3.26)	(3.47)
Percentage of People employed	41.7	42.12	43.8	44.7	42.4
	(6.18)	(5.97)	(5.83)	(5.87)	(6.42)
Log County Per Capita Income	8.45	8.81	10.26	10.95	9.41
	(4.79)	(4.41)	(4.09)	(3.94)	(4.88)

Tables 1-4-1-1 and 2 show a lower probability of job-holdings and less working hours for racial minorities when they have the same other conditions. From now on, we concentrate on the effects of being minorities on only job-holdings not working hours because the average working hours among job-holders are similar across races (see footnote 36).

The marginal effects of being Black, Hispanic or Asian on job-holdings are tabulated in Table 1-4-2-5 and 6 for each sample. In 1972, after GPA, test scores, SES, community types, regions, and other background variables are controlled for, Blacks, Hispanics and Asians have much lower probability of being employed. Black males and Hispanic males have 14% and 9% lower probability of being employed respectively at the mean values of the independent variables, while Black females, Hispanics females, and Asian females have 14%, 12%, and 15% lower probability. (See columns 1 in Table 1-4-2-5). Instead of SES, detailed family background variables; categorical variables for mother's education, father's education, father's occupation, and family income are added

to the regressors, the results do not change. (see columns 2 in Table 1-4-2-5). It turns out that after other conditions are controlled for, on the average, Black male students work over 6 hours less than White counterpart, Black female students work over 4 hours less than White counterparts, and Hispanic student work 3 or 4 hours less than White students (see the basic regression Table 1-4-1-2).

Many of these trends remain unchanged in 1980 except for Hispanic and Asian males. Table 1-4-2-6 show that also in 1980, under the same conditions as columns 1 in Table 1-4-2-5), Blacks and Asian students have much lower probability of job-holdings. At the mean values of control variables, Black students, Hispanic students and Asian students have 4~20% lower probability of working (see columns 1 in Table 1-4-2-6). These probabilities do not change when more control variables are added. In column 2, the county unemployment, the percentage of people employed within the county, the average per capita income, the employment growth rate, the income growth rate, high reservation dummy, and 'will not work' dummy are added. In column 3, in addition to those variables, detailed family background variables are added and in column 4, a dummy which indicates whether a student has worked during his or her junior year is also added. However, except for the column 4, there are no big changes in the coefficients of 'Blacks', 'Hispanics' and 'Asians'. However, minority status is expected to affect the junior year job-holdings. Under the same conditions, Black male students and Asian male students work 3~4.5 hours less and 4.5~6 hours less than White counterpart respectively and Black and Asian female students work 2.5~3.5 hours less than White counterparts. (see the basic regressions in Table 1-4-1-2).

However, in 1980, the gap in job-holdings between Whites and Hispanic narrows. At the mean values of the control variables, the probability of being employed for Hispanics was 8~12% lower than Whites in 1972, while it is 2~7% lower in 1980. Also, in 1972, Hispanic senior students worked 3-4 hours less than White students. In 1980, the difference becomes around one hour. We do not know whether demand for Hispanics youth has changed or the labor force participation of Hispanic students has changed. However, the narrower race gap of high school employment between Whites and Hispanics in 1980 is consistent with Marsh's finding (1991). Another interesting change is that the coefficients of Asian dummy for males is much lower than in 1972, which means that the job-holding probability for the Asian males in 1972 was lower than in 1980.

Table 1-4-2-5 The Effects of Being a minority on job-holdings (NLS-72)

Races	Male		Female	
	(1)	(2)	(1)	(2)
Blacks	-.157***	-.159***	-.138***	-.136***
	(.023)	(.023)	(.021)	(.022)
Hispanics	-.088***	-.101***	-.120***	-.121***
	(.032)	(.032)	(.033)	(.033)
Asians	-.072	-.075	-.155***	-.152***
	(.051)	(.051)	(.061)	(.061)
R Square	.0347	.0426	.0244	.0271

Notes: (a) In column (1), all other variables in the basic regressions are included. (b) In column (2) detailed family backgrounds instead of SES categories are included. (c) See notes in the basic regressions (Table 1-4-1-1 and 2).

Table 1-4-2-6 (HS&B)

Races	Male				Female			
	(1)	(2)	(3)	(4)	(1)	(2)	(3)	(4)
Blacks	-.138***	-.136***	-.139***	-.116***	-.161***	-.169***	-.163***	-.131***
	(.023)	(.024)	(.024)	(.024)	(.021)	(.022)	(.022)	(.022)

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Hispanics	-.044**	-.037*	-.040*	-.024	-.066***	-.057**	-.055*	-.037*
	(.022)	(.023)	(.023)	(.023)	(.022)	(.023)	(.023)	(.023)
Asians	-.192***	-.198***	-.151***	-.147***	-.148***	-.152***	-.148***	-.154***
	(.047)	(.048)	(.058)	(.049)	(.046)	(.047)	(.047)	(.048)
R Square	.0296	.0523	.0564	.1070	.0502	.0683	.0733	.1109

Notes: (a) In column (1), all other variables in the basic regressions are included. (b) In column (2), in addition, all the economic indicators are included. (c) In column (3), detailed family backgrounds instead of SES categories are included. In column (4), 'work in the junior year' is included. (d) See notes in the basic regressions (Table 1-4-1-1 and 2).

The significance of negative effects of race, especially for Blacks, on job-holdings and working hours does not mean necessarily less job availability for their group. There could be supply side effects if Blacks, Asians and Hispanics could have tendency not to work or not to search as vigorously enough for jobs due to some cultural effects. The supply side effect is likely to be larger among Asians considering relatively low unemployment rate and low labor force participation rate among them (Tables 1-3-10, 11 and 12). However, a twice as high unemployment rate among Blacks than among Whites (see Table 1-3-10, 11 and 12) with much less labor force participation rate (which could be caused by low demand for their labor) indicates lower job availability for them. Also, since other variables (an ability measure, SES, and local economic conditions) are controlled for in the regression analyses, the significant negative effect of being Black implies that jobs are not available for Blacks. When we restricted the sample to those who are in the labor force, we have almost the same results (not reported in Tables), which strongly implies that minorities, especially Blacks, want to have jobs but jobs are not available for them as much as for Whites.

(3) Community type: Another sign of the strong positive correlation between high school employment and job availability is found in the influences of community types on

job-holdings and working hours. Four categories of community type for NLS-72 ('rural,' 'small city town,' 'urban,' and 'suburban') and three categories for HS&B ('rural,' 'urban,' and 'suburban') are used. The category of 'rural' is excluded in the regression analyses. (We do not make separate tables for the community effects. Please see the basic regressions in Table 1-4-1-1 and 2). We expect students who live in urban and suburban areas work more than those who live in rural areas under the same conditions of other factors because students' jobs are concentrated in the private service sector.

In 1972, in the binary dependent model regressions for job-holdings, all the coefficients of community type categories are negative and significant for males, and for females, almost all the coefficients are positive and significant. (see the first and second columns in Table 1-4-1-1). However, in terms of working hours, male students who live in the urban and suburban areas work almost as much as those who live in rural areas. Female students who live in urban and suburban areas work much more than those who live in the rural areas (see the first and second columns in Table 1-4-1-2).

In 1980, when almost the same regressions as in the year 1972 are run, the results are almost the same even after local unemployment rates are controlled for. For male students, categories of 'urban' and 'suburban' are positively related to 'working hour' while they are not related to job-holdings. (see the first columns in Table 1-4-1-1 and 2). For female students, these categories are positively related to both of the two dependent variables (see the second columns in Table 1-4-1-1 and 2) One possible explanation of these results in both 1972 and 1980 is that the male students who live in the rural areas might have more jobs on the farms. However, their working hours might be shorter because farm work must be done during daytime. For females, students who live in urban

and suburban areas work much more than those who live in rural areas because female students do not have many jobs on the farms but have jobs in the service sector which is concentrated in the urban and suburban areas.[47]

Considering all the effects of race, various economic indicators and community types on job-holdings and 'working hours', we can conclude that high school students work because they have more opportunities to work and more jobs available around them and more demand for their labor while almost all students are willing to work.[48] If student workers keep living in these favorable circumstances after high school, their gains in later earnings and employment are not surprising.

4-3: Academic ability: As we mentioned in the previous section, with respect to the relationship between the ability measure (standardized test scores) and working experience during high school, we have focused on the following two points: (i) the relationship between different working experiences and academic ability, especially the differences between working in junior year and working in senior year in their relations to academic ability. (ii) non-linearity of the relationship of test scores to job-holdings and working hours.

(i) The relationship between different working experiences and academic ability: The marginal effects of test scores on the different working status at the mean values of control variables are tabulated in Table 1-4-3-1 and Table 1-4-3-2. In these regressions, test scores are specified in the linear function. As mentioned earlier, the relationship has

[47] However, when all other labor market conditions including the reservation wage dummy and 'will not work' dummy are controlled for, the significance of the coefficients disappears.
[48] Students who will not work at any reservation wage during high school is less than 2% in 1980.

changed over time. In 1972, 'work' and 'work more than 15 hours' are negatively related to test scores. A one standard deviation of test scores decrease the probability of working or being employed by1.5% , the probability of working more than 15 hours by 4% for males. For females, it decreases the probability of working more than 15 hours by 1.7% and has no effects on the probability of working. In 1980, a one standard deviation of test scores increases the probability of working or being employed by 2% for male and 3.5% for female.

However, in both years, test scores are positively related to working moderate hours (6-20 hours for the NLS-72 samples and 5-21 hours for the HS&B samples). In 1972, a one standard deviation of test score increase the probability of working between 6-20 hours by 1.7% for males when the relationship between test score and 'work' or 'heavy work' is negative. In 1980, the positive relationship between test score and 'moderate work' is much stronger than between test score and 'work' or 'heavy work'. When we assume that working hours do not affect academic ability, we can conclude that the students with good academic ability work moderate hours. Then, the positive effects of moderate working hours is not surprising. The selection effects of this moderate work could show up in the quadratic function of working hours as the positive coefficients of working hours and the negative coefficients of the working hours squared.

Table 1-4-3-2 also shows other interesting points. Students who work during the reference week have higher academic ability than those who have worked at least once during the senior year (compare the column 'work' and the column 'work reference week'.) Considering the high turn-over rates among the high school students, measuring the high school work experience by the hours worked during the reference might have a

more serious selectivity problem (See Ruhm 1997). Working in the junior year is negatively related to test scores. Comparing the 'work' column and the 'work junior' column shows the dramatic change in the relationship. Also working during summer time is negatively related to test scores even if the absolute value of the coefficient is much smaller in this case. If we measure the high school work experience by the average hours worked during junior and senior year rather than by the hours worked during only the senior year, we can expect the lower effects of high school working experience on later earnings (See Light 1999 and Hotz 1999).

Table 1-4-3-1: The marginal effects of test score on the different working status in the senior year. (NLS-72)

		Work	Work More than 15 hours	Work 6~20 Hours
	% of Students	81.6	50.1	34.3
M	The Coefficient of Test Scores	-.0017**	-.005***	.0020**
		(.0007)	(.001)	(.0009)
	% of Students	69.7	32.7	36.4
F	The Coefficient of Test Scores	-.0000	-.0020**	.0012
		(.0010)	(.0010)	(.0010)

Note: (a) All other variables in the basic regressions are included and are not reported. (b) See notes in the basic regressions (Table 1-4-1-1 and 2). (c) M: Male sample; F: Female sample

Table 1-4-3-2: The marginal effects of test score on the different working status (HS&B)

		Work	Work more than 14 hours	Work 5-21 hours	Work Reference Week	Work Junior	Work Summer
	% of Students	72.0	50.7	35.3	51.3	71.7	86.0
M	The Coefficient of Test Scores	.0024**	.0012	.0048***	.0039***	-.0052**	-.0018*
		(.0009)	(.0012)	(.0011)	(.0012)	(.0011)	(.0008)
	% of Students	66.6	41.6	37.7	46.7	58.7	73.2
F	The Coefficient of Test Scores	.0040***	.0035***	.0060***	.0048***	-.0018	.0000
		(.0011)	(.0012)	(.0011)	(.0012)	(.0012)	(.0010)

Note: (a) All other variables in the basic regressions are included and are not reported. (b) See notes in the basic regressions (Table 1-4-1-1 and 2). (c) M: Male sample; F: Female sample

Next, we focus on the relationship between academic ability and work experience during the senior year because high school students work most intensively during the senior year[49], and because many studies on the effects of high school employment focus on the working experience during the senior year and find the positive effects. Here, first, we look at how the working experience in the junior year, and summer affect job-holdings and hours worked during the senior year and how controlling for these previous work experiences change the relationship between the work experience and test scores. At the mean values of the control variables, the marginal effects of previous working experience and test scores on job-holdings in the senior year are tabulated in the Table 1-4-3-3 and those effects on working hours in the senior are tabulated in the Table 1-4-3-4. In the column 1 and 2, the same other control variables are included as in the 'basic regressions' Table 1-4-1-1 and 2. In the column 3, in addition, all the economic conditions including the reservation wage are controlled for.

These tables show that students who have worked during either the junior year or summer between the junior year and senior year have stronger tendency to work during their senior year. After controlling for the job-holding experience during summer, students who have worked during their junior year have 19~24 % higher probability of working in their senior year. Students who have worked during the summer have 10~14 % higher probability of working in their senior year. Also, working hours during the senior year are affected by the working hours during the junior year and summer. The coefficients of working hours in the junior year and summer in the tobit models for workings hours in the senior year are in the range between .2~. 4. When the 'work

[49] See footnote 32.

junior' dummy and 'work summer' instead of hours worked during those periods are plugged into the regressors, the results show that those who have worked during the senior year work around 8-9 hours more than those who have not worked and those who have worked during the summer work 6-7 hours more than those who have not worked (the results are not reported.) Another observation we can make from these tables is that when working or working hours in the junior year is controlled for, the already positive coefficients of test scores on 'work' or 'working hours' become bigger, especially for male working hours.[50] It is because the relationship of working during the junior is negatively related as we see in the column 4 in Table 1-4-3-2.

Table 1-4-3-3 Probit for job-holdings during the senior year. (HS&B)

	Male			Female		
	(1)	(2)	(3)	(1)	(2)	(3)
Test Score	.0024**	.0041***	.0039***	.0040***	.0047***	.0042***
	(.0011)	(.0011)	(.0011)	(.0011)	(.0011)	(.0011)
Work Junior		.237***	.228***		.189***	.186***
		(.018)	(.019)		(.015)	(.016)
Work		.136***	.124***		.118***	.105***
Summer		(.024)	(.024)		(.018)	(.018)
R Square	.0296	.0956	.1102	.0501	.1003	.1130
LR Chi Square	142.43	461.72	530.78	317.26	635.04	715.36

Notes: (a) In columns (1) and (2), other control variables in the basic regressions are included. (b) In column (3), in addition to those variables, all the economic indicators in the last column in the Table 1-4-2-6 are included. (c) See notes in the basic regressions (Table 1-4-1-1 and 2).

Table 1-4-3-4 Tobit for working hours during the senior year. (HS&B)

	Male			Female		
	(1)	(2)	(3)	(1)	(2)	(3)
Test Score	.0077	.0931**	.0752**	.0929**	.0991***	.0818**
	(.0462)	(.0430)	(.0428)	(.0403)	(.0376)	(.0375)
Working Hours		.369***	.355***		.305***	.291***
Junior		(.026)	(.026)		(.023)	(.023)
Work Hours		.266***	.245***		.230***	.209***
Summer		(.024)	(.024)		(.018)	
R Square	.0076	.0298	.0335	.0086	.0281	.0314
LR Chi Square	189.52	746.17	839.15	255.88	831.36	930.75

Notes: (a) See the notes Table 1-4-3-3.

[50] Summer work does not seem to be related to test scores. Including or excluding 'work summer' does not change the coefficients of test scores.

(ii) Nonlinear relationship between high school employment and test scores: To examine the non-linearity of the relationship, first, we specify test score in the quadratic function. The coefficients of test scores and test scores squared in the probit model for job-holdings and tobit model for working hours are tabulated in Table 1-4-3-3 for males and Table 1-4-3-4 for females and Table 1-4-3-5 for males and Table 1-4-3-6 for females. In this specification of test scores, the coefficients of test scores are always positive and significant and those of test scores squared always negative and significant (see columns 2 in each tables.) However, the sizes of these coefficients are quite different between two years. The coefficients of test scores in 1982 are much larger than in 1972 while the coefficients of test scores squared in 1982 are much smaller than in 1972, meaning that more students with high academic ability hold jobs and work more hours in 1980.

To examine the nonlinear effects more specifically, we make a categorical variable of test scores with four categories: one category for each test score quartile and the first quartile dummy is dropped and the same regressions are run. The results show that in 1972, students whose test scores are in the 3^{rd} and 4^{th} quartiles work as much as or less than students in the first quartile (see columns 3 in Table 1-4-3-3 and 4). However, in 1980, even students in the 4^{th} test score quartiles work much more than students in the first quartile except for the case of male working hours, and work almost as much as students in the 2^{nd} and 3^{rd} quartiles (see columns 3 in Table 1-4-3-5 and 6). When more categories for test scores are made and the same regressions are run, the results show that

the top 10% of students in the test score distribution work almost as much as the bottom 10% and work less than those who are in the middle (not reported here).

Using the HS&B data, we also examine a non-linearity of the effect of test scores on job-holdings and working hours in the junior year by including test scores and test scores squared, or by including categories of test scores quartiles (the later results are not reported). It turns out that there is not such a non-linear relationship but only a negative linear relationship shown in Table 1-4-3-2. The higher test scores a student has, the lower is his probability of working in his junior year. The lower test scores a student has, the more hours he works in the junior year. If the causal effect runs from test scores to working experience, it can imply that students with lower academic ability work intensively in the earlier grades.[51]

Table 1-4-3-5: Male. (NLS-72)

	Probit for work			Tobit for Working hours		
	(1)	(2)	(3)	(1)	(2)	(3)
Test Score	-.007**	.075***		-.185***	.769***	
	(.003)	(.023)		(.032)	(.250)	
Test Score Squared		-.0008***			-.0094***	
		(.0002)			(.0024)	
2nd Test Quartile			.097*			.149
			(.006)			(.589)
3rd Test Quartile			.058			-1.397***
			(.062)			(.654)
4th Test Quartile			-.100			-3.792***
			(.070)			(.743)
χ square	223.93	236.99	234.04	475.58	490.34	484.51
R Square	.0347	.0367	.0362	.0113	.0116	.0115

Notes: (a) All other control variable are included as in the basic regression and are not reported. (b) The first columns in each regression are the same as in the basic regression and reported here for comparison. (c) See notes in the basic regressions (Table 1-4-1-1 and 2).

[51] If work experience during high school affects test scores, it is hard to interpret these results. This is (i) because the effects of working during the senior year seem to be quite different from those of working during the junior year, and (ii) because the effects of working experience during the senior year in 1980 seem to be different from those in 1972.

Table 1-4-3-6: Female (NLS-72)

	Probit for work			Tobit for Working hours		
	(1)	(2)	(3)	(1)	(2)	(3)
Test Score	-.0001	.0549**		-.0589*	1.067***	
	(.0028)	(.0203)		(.0315)	(.2349)	
Test Score Squared		-.0005**			-.0111***	
		(.0002)			(.0023)	
2nd Test Quartile			.0751			.800
			(.0472)			(.541)
3rd Test Quartile			.1138**			.605
			(.0539)			(.6131)
4th Test Quartile			-.0062			-1.165*
			(.0622)			(.7117)
χ square	210.39	217.82	219.85	324.10	347.51	335.40
R Square	.0244	.0253	.0255	.0078	.0084	.0081

Notes: (a) All other control variable are included as in the basic regression and are not reported. (b) The first columns in each regression are the same as in the basic regression and reported here for comparison. See notes in the basic regressions (Table 1-4-1-1 and 2).

Table 1-4-3-7: Male (HS&B)

	Probit for work			Tobit for Working hours		
	(1)	(2)	(3)	(1)	(2)	(3)
Test Score	.007***	.126***		.008	1.9803***	
	(.003)	(.025)		(.046)	(.3612)	
Test Score Squared		-.0012***			-.020***	
		(.0002)			(.004)	
2nd Test Quartile			.173***			2.391**
			(.065)			(.933)
3rd Test Quartile			.210***			1.997**
			(.070)			(.999)
4th Test Quartile			185.**			.962
			(.079)			(.1.127)
χ square	142.43	165.72	147.81	189.52	219.86	197.95
R Square	.0296	.0344	.0307	.0076	.0088	.0097

Notes: All other control variable are included as in the basic regression and are not reported. (b) The first columns in each regression are the same as in the basic regression and reported here for comparison. See notes in the basic regressions (Table 1-4-1-1 and 2).

Table 1-4-3-8: Female (HS&B)

	Probit for work			Tobit for Working hours		
	(1)	(2)	(3)	(1)	(2)	(3)
Test Score	.011	.088***		.093**	1.849***	
	(.003)	(.024)		(.040)	(.317)	
Test Score Squared		-.0008***			-.018***	
		(.0002)			(.003)	
2nd Test Quartile			.167***			2.864***
			(.053)			(.716)
3rd Test Quartile			.248***			4.009***
			(.060)			(.805)

4th TeSt Quartile			.262*** (.073)			2.599*** (.943)
χ square	317.26	327.49	323.28	255.88	287.06	278.53
R Square	.0501	.0517	.0511	.0086	.0097	.0094

Notes: (a) All other control variable are included as in the basic regression and are not reported. (b) The first columns in each regression are the same as in the basic regression and reported here for comparison. See notes in the basic regressions (Table 1-4-1-1 and 2).

In sum, the relationship between test scores and high school senior employment is very complex. In 1980, students with high academic ability seem to work more than in 1972. Employment in the senior year is more selective in terms of academic ability than employment in any other grades. The relationship between high school employment in the senior year and test scores is non-linear.

Due to this complexity, it is difficult to interpret the positive effects of high school working experience on later earnings and employment after high school. It is difficult to control selection bias in the later earnings equations (or employment equations) and to find the true effects of high school employment on later earnings or employment. However, from the above results, we can draw some implications with respect to controlling for the selection bias. First, we need to distinguish working in the senior year from working experiences in earlier grades. Second, including test scores as independent variables in later earnings equations (or employment equations) is not enough to control for the selection bias regarding test scores because there is not enough linear correlation between high school working hours and test scores. Also, if we want to use the instrumental variable method or treatment effect to control for the selection bias, we need to include non-linear forms of test scores in the first stage regressions (high school employment decision equation or high school working hours equation). This is because

the linear form of test scores in the high school employment equation can not capture the true relationship between high school employment and test scores. Third, we need to consider the period or year when samples are drawn. The regression results might be different depending on the sampling years.

4-4: Family socio-economic status: As mentioned in the subsection 4-1, SES (family socio-economic status) affects job-holdings and working hours during high school in a nonlinear pattern as we expect.[52] In 1972, for males and females, more students from the middle SES hold jobs than those from the bottom and top SES after other variables are controlled for. Students from the top SES hold jobs almost at the same rate as students from the bottom SES (see the first two columns in Table 1-4-1-1). In terms of working hours, students from the middle SES also work the most. However, students whose SES is in the top work almost as much as students whose SES is in the bottom (see the first two columns in Table 1-4-1-2).

In 1980, in terms of job-holdings, the same trends as in 1972 remain only for males (see the last columns in Table 1-4-1-1.) Male students from the middle SES hold jobs the most. However, in the female case, students from top SES hold jobs more than others. In terms of working hours, Male students from the middle SES work most and females from the middle and top SES work the most. (see the last columns in Table 1-4-1-2.)

To see the effects of family background in more detail, we put categorical variables of mother's education, father's education, father's occupation, and family

income as independent variables in the probit and tobit models with other control variables in the basic regressions. The coefficients of these variables are tabulated in Table 1-4-4-1 and Table 1-4-4-2. First, mother's education level seems to be less important than other family background factors. In 1972, female students whose mothers have more than four year college education seem to work less in terms of working hours. However, except that, no coefficients of mother education categorical variables are significant. Second, father's education affects students' working even after father's occupation is controlled for. In 1972, male students whose fathers have more than 4 year college education work less in terms of job-holdings and working hours and male students whose fathers just graduated from high school seem to work the most. However, in 1980, female students whose fathers have more than 4-year college education work the most in both terms of working hours and job holdings. Third, when the father is a farmer, student work most in terms of job-holdings and working hours except for the 1980 female case. Fourth, students whose family incomes are in the middle seem to work the most. The non-linear relationship between high school employment and SES seems to be driven mostly by the family income effects.

Students from the middle SES group tend to work more than students from the bottom and top SES group. However, this non-linear influence of family background is weaker in 1980 than in 1970 because more students from high SES seem to work in 1980. Also, in 1980, it is even much weaker for females than for males because female students with fathers who graduated from college work more than others. Also, this non-linearity

[52] In NLS-72 and HS&B, SES is made out of family income, parents' education, and father's occupation Duncan score. For detailed description, see NLS-72 Data File Users Manual.

tendency of the effects of SES is very evident in the job-holdings and working hours in the junior year (not reported).

Table 1-4-4-1: Family Socio-economic Status (NLS-72)

	Probit for work		Tobit for Working hours	
	Male	Female	Male	Female
Mother Education	.010	-.001	.434	-.145
High School Graduate	(.050)	(.041)	(.525)	(.468)
Mother Education	-.076	-.022	-1.158	-.313
Some College	(.065)	(.054)	(.691)	(.615)
Mother Education	.048	-.081	-.845	-2.109***
More Than Four Year College	(.077)	(.068)	(.823)	(.773)
Father Education	-.053	.110**	-.757	1.113**
High School Graduate	(.058)	(.042)	(.524)	(.483)
Father Education	-.031	.066	-1.044	.323
Some College	(.062)	(.053)	(.648)	(.596)
Father Education	-.171**	.080	-2.964***	.391
More Than Four Year College	(.074)	(.066)	(.788)	(.741)
Professional	.158**	-.025	.078	-.500
	(.072)	(.065)	(.775)	(.740)
Management	.174***	.057	1.214*	.307
	(.062)	(.056)	(.657)	(.631)
Farmer	.396***	.234***	5.787***	2.233***
	(.103)	(.078)	(.945)	(.865)
Sales and Clerical	.163***	.025	.836	.398
	(.067)	(.056)	(.708)	(.655)
Craftsman	.131***	.027	.864*	.157
	(.050)	(.043)	(.525)	(.491)
Family Income($6,000-$9,000 in 1972)	.182***	-.023	1.503**	-.066
	(.068)	(.057)	(.719)	(.653)
Family Income($9,000-$12,000 in 1972)	.091	.032	1.344**	.958
	(.068)	(.060)	(.730)	(.679)
Family Income($12,000-$15,000 in 1972)	.240***	.108	2.884***	1.489**
	(.077)	(.068)	(.798)	(.763)
Family Income(Above $15,000 in 1972)	.041	.003	1.815**	.405
	(.072)	(.065)	(.771)	(.741)
χ square	275.43	233.36	553.34	351.90
R Square	.0426	.0271	.0131	.0085

Notes: (a) all other variables except SES categories are included and not reported. (b) See notes in the basic regressions (Table 1-4-1-1 and 2).

Table 1-4-4-2: Family Socio-economic Status (HS&B)

	Probit for work		Tobit for Working hours	
	Male	Female	Male	Female
Mother Education	-.014	.043	1.022	.903
High School Graduate	(.056)	(.048)	(.794)	(.636)
Mother Education	.076	.024	.897	.580
Some College	(.085)	(.032)	(1.173)	(.922)
Mother Education	.058	-.077	.731	-.312
More Than Four Year College	(.871)	(.078)	(1.228)	(1.005)
Father Education	.072	.099*	.210	.854

High School Graduate	(.060)	(.052)	(.840)	(.670)
Father Education	.038	-.035	-.254	-.089
Some College	(.090)	(.075)	(1.244)	(.983)
Father Education	-.032	..248***	-1.721	2.291**
More Than Four Year College	(.087)	(.082)	(1.210)	(1.029)
Professional	-.113	.115	-1.051	.752
	(.073)	(.077)	(1.637)	(.949)
Management	.071	.067	.706	1.499
	(.082)	(.078)	(1.122)	(.977)
Farmer	.223***	-.120	4.705***	-2.245
	(.123)	(.104)	(1.661)	(1.421)
Sales and Clerical	.090	.055	.351	.108
	(.104)	(.092)	(1.415)	(1.168)
Craftsman	.093	.085	.988	1.735**
	(.067)	(.064)	(.929)	(.815)
Family Income($7,000-$11,999 in 1980)	-.039	.115	.806	1.471
	(.094)	(.075)	(1.366)	(1.026)
Family Income($12,000-$15,999 in 1980)	.108	.135*	3.092**	1.983**
	(.093)	(.077)	(1.377)	(1.040)
Family Income($16,000-$19,999 in 1980)	.067	.134*	2.566*	2.057**
	(.096)	(.079)	(1.374)	(1.055)
Family Income($20,000 to $24,999 in 1980)	.067	.174**	3.322**	2.417*
	(.096)	(.082)	(1.374)	(1.090)
Family Income($25,000 to $37,999 in 1980)	-.028	.076	2.177	1.378
	(.098)	(.084)	(1.408)	(1.116)
Family Income($38,000 or more in 1980	.076	.087	3.079**	1.131
	(.103)	(.092)	(1.456)	(1.206)
χ square	162.32	347.53	215.15	285.34
R Square	.0337	.0549	.0086	.0096

Notes: Notes: (a) all other variables except SES categories are included and not reported. (b) See notes in the basic regressions (Table 1-4-1-1 and 2).

4-5: Other variables: When the mother works when students are in the high school, both male and female students tend to hold jobs more and work more during high school than others (Table 1-4-1-1 and 2). Greenberger and Steinberg (1986) argue that "the employment of individual mother may serve as a model for the employment of her own children and others." (p36) Also, they point out that the adult women's increased involvement in the labor force has changed the day time ecology of the household. Thus, increases in women's labor force participation in more recent years might have caused high school student to work more than before.

The number of siblings affects high school employment positively and in most cases, significantly. However, in 1980, the number of siblings does not affect male student employment and even the sign of the coefficient of the number of siblings becomes negative though it is not significant in most cases.

If students have their own dependents (1972) or children (1980), they work more in terms of job-holdings and hours worked in general. In 1972, having dependents affects significantly and positively the job-holding and hours worked for both male and female students. In 1980, male students with children still work more. However, female students with children hold jobs less and work less hours. We suspect that this change in the impact of having own children on female employment may occur due to the change in the way the welfare system supports single mothers over this period of time.

There is no significant difference in student's employment depending on whether English is spoken at home or not.

Some other variables affect high school employment. One of them is the high school program. High school students in the academic program work less and students in the vocational program work more than those in general program in most cases. Students in academic programs might be encouraged not to wok, while students in vocational programs might be encouraged to work. This relationship implies that school can be a determinant in high school employment.

5. Conclusion.

In the conclusion, we discuss the implications of our findings in the context of previous research on the effects of high school employment on later earnings and employment. First, our review of the studies on the effects of high school employment on later earnings indicates that the measurements of high school work experiences are different across studies, and the regression results from these studies seem to be sensitive to the measurements and specifications of high school work experience in the earnings equations. Our study might explain why different measurements or specifications lead to different results. It seems to be, in a certain degree, related to the complexity of the relationship between high school employment and academic ability. In terms of test scores, employment during the senior year, especially during the reference week, is the most selective. However, job-holdings and working hours during the senior year are non-linearly related to test scores, while job-holdings and working hours during the junior year are negatively and linearly related to test scores. Students with medium academic ability seem to work the most during their senior year. Students with high academic ability seem to work moderate hours if they hold jobs.

From these observations, we can expect that the different measurements of high school work experience might capture students' different abilities by different working experience. If we measure only the work experience during the senior year, we might expect large positive effects of high school work experience on later earnings. Or if we measure work experience in each grades separately, we might expect large positive effects for the work experience in the senior year, and small positive effects for the work experience during other grades. If we measure high school work experience as the

average working experience during the high school years, we expect smaller positive effects of high school employment than when we measure work experience only during the senior year.

Mentioned earlier, Ruhm (1997) distinguishes working hours in the senior year from working hours in the junior year and puts them separately in the quadratic function in earnings equations. The coefficients of the first order term of senior year working hours are positive and significant, while those of the second order term are negative and significant. Also, all the coefficients of the first and second order terms of working hours in the junior year are not significant. The large positive first order coefficients of working hours in the senior year seem to capture the highest average academic abilities of students who work moderate hours during their senior year. We also find that working in the reference is more selective. When Ruhm uses the average working hours per week from the work history file in NLSY, the positive effect is too samller.

Light (1999), who uses the average work experience during the junior and senior years and put them in the linear function in the earnings, finds smaller positive effects than Ruhm (1997). Hotz et al (1999), who regard all working experience as homogeneous regardless of working hours and grades, find no effect when all the selection bias is controlled for.[53]

Second, due to the complexity of the relationship between academic ability and high school employment, it is very difficult to control for the selection bias. Some simple ways to control for selection bias of high school employment in the later earnings or

[53] However, we are not sure that such findings in Light and Hotz et al is directly related to their different measurements of high school employment because they control for working experience after high school and use different econometric methods.

employment equations regarding ability are (1) just including ability measures (test scores) in the later earnings or employment equations, (2) including the inverse Mill's ratio in those equations after a binary dependent variable model of work choice during high school is run (the treatment effects method), or (3) including the estimated high school work experience after the reduced form of the work experience is estimated by a OLS (instrument variables method). However, without thorough and full investigation into how and what factors affects high school employment, these efforts can not guarantee successful control for selection bias.

Just including test scores in later earnings or employment equations can not capture the selection bias of high school employment because there is no linear relationship between high school employment and test scores. It only captures the linear relationship between later earning and test scores. However, when we use the IV method or treatment effect method, we need to include the non-linear forms of test scores in the first stage regressions. By doing so, we are able to capture the non-linear relationship between high school employment and ability measure. Especially, if we use the quadratic form of test scores with IV method, we might be able to identify the high school employment equations because we have an extra variable-test scores squared- in the first stage regressions. It is especially true when we are not able to identify high school employment equations because there is no other variables which are not included in the second stage regressions but still affect high school employment.

Third, in studies which directly investigate the effects of high school employment on later employment, strong evidence of the positive effects on later employment can be

found[54] (Meyer and Wise 1982 and 1984; Ruhm 1997; Carr 1997; Marsh 1991). Also, those studies that find lower or no such positive effects on later earnings always control for working experience after high school graduation (Light 1999 and Hotz et al 1999), which presents also other evidence for a strong correlation between high school employment and working experience after high school. Even if there is no direct positive effect of high school employment on later earnings, there still exists indirect positive effects on later earnings by enhancing the later working experience.

Our current study provides some explanation for why there are such positive effects of high school employment on later employment (and probably later earnings). Students who have more favorable market conditions seem to work more. The demand for student labor seems to be a more decisive factor than the supply of student labor. Students who live in counties with good economic conditions, such as low unemployment rates, high employment growth rates, high per capita income and fast income growth, hold more jobs and work more than others. Even these county economic indicators do not seem to capture the demand that an individual student might face as we see the very large positive effect of a high reservation wage. Students who have more favorable market conditions during high school are more likely to live and work in the similar conditions after high school. Considering the two other factors which can affect job availability, race and community type, these favorable conditions for working high school students might intensify. While many studies control for race, only a few studies try to control for the initial market conditions in which students have lived during their high school years. One way to do so is including the local market conditions of the high school

[54] However, there no studies which investigate the effect of high school employment on later employment

years in the later earnings equations is. Ruhm (1997) includes only the initial local unemployment rates as a categorical variable in the later earnings equations. However, including local unemployment rates is minimally adequate because, as our study suggests, they do not represent appropriately the market demand each individual student faces.

Fourth, the family socio-economic status affects high school employment in a non-linear way. Students whose SES is in the middle work the most. If a student with a high SES works, he or she generally works moderate hours. This makes it very hard to control for selection bias in terms of family backgrounds.

Fifth, Ruhm (1997) summarizes the changes in the characteristics of high school employment over-time. He wrote: "Neither the frequency of student job-holding nor the work hours of employed students have changed much since the late 1960s, with any time trend being dwarfed by cyclical fluctuations" (746-747). We also compare the characteristics of high school employment between the years, 1972 and 1980, and find that there is not much difference in terms of students job-holdings and working hours between these two years. However, we find one big change in the determinants of high school employment over-time, which is that, students with higher academic ability and higher SES worked significantly more in 1980 than in 1972.

This observation might be very important in interpreting the effects of high school employment on later earnings or employment because the positive effects of high school employment seems to have decreased over-time. As mentioned earlier, the positive effects of high school employment seem to be larger for earlier cohorts (NLS-72 cohorts or YTS cohorts) than for later cohorts (the NLSY cohort or the HS&B cohort). In more

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by controlling for the selection bias except Meyer and Wise (1982).

recent cohorts, more students with higher academic ability and higher SES participate in the labor force and work more. Then, without controlling for the selectivity bias, the positive effects of high school experience must be larger in more recent cohorts than in old cohorts. However, existing studies show the opposite possibility. This cohort observation could imply that the changes in the effects of high school employment might depend on the changes in underlying factors, such as changes in the distribution of the different industries or occupations.[55] We need to investigate this issue further.

With various econometric methods, most studies focus on controlling for the unobserved heterogeneity in the investigation of the effects of high school employment. They ignore these complexities of its measurements and determinants. In this study, we summarize the existing studies on the effects of high school employment on later earnings and employment, and explore the possible determinants of high school employment. If the unobservable heterogeneity is related to this observable heterogeneity such as test scores, local economic conditions and family backgrounds, these relationship between high school employment and the observable heterogeneity might help us to identify the underlying relationship between high school employment and later earnings or employment. While Ruhm (1997) and Light (1999) suggest the negative relationship between high school employment and the unobservable heterogeneity, Hotz et al (1999) suggest imply the positive relationship. Our study suggests that there might not be such clear relationship.

However, the implications of our study should be qualified by its own limitations.

[55] The true effects of high school employment might change over time. However, considering the job characteristics high school students hold, it is very hard to think about such possibility.

First, NLS-72 and HS&B do not provide the amount of working experience in detail, and thus, our measure of working experience is still not accurate. For an example, working experience during the junior year in HS&B is very inaccurate because the average working hours during the year are ambiguous. They could represent the average working hours while students hold jobs, or the average working hours during the junior year depending upon how students answer to the question "during the school year before this one, about how many hours per week on the average did you work for pay outside your own home?". The information in NLS-72 is much more ambiguous because working experience includes both paid and non-paid jobs.

Second, if working experience in the senior year influences test scores, identifying the selectivity in high school employment in the senior year becomes more complicated. We do not pursue this issue thoroughly.

However, with these qualifications, our study suggests that when we investigate the effects of high school working experience, we need to pay attention to how to the measurement of the high school work experience, what factors determine it, and how they are related to high school working experience.

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High School Work Experience, College Attendance, and the Choice of College Major

Chapter II

High School Work Experience, College Attendance, and the Choice of College Major

1. Introduction.

As we observed in Chapter 1, the majority of high school students work during high school and about 50 percent of students work more than 10 hours in a week. This work experience during high school has been found to have influential effects on later employment, earnings, occupation and educational attainment (Ruhm 1997, Carr et al 1996, Light 1999). This study explores the relationship between high school employment and an individual's college major as well as college attendance.

Previous studies indicate that working during high school is related to a higher occupational status (Ruhm 1995, 1997, and Mortimer and Finch 1986) as well as to higher earnings later (Ruhm 1997, Carr 1996, Meyer and Wise 1982). However, high school employment seems to be negatively related to post-secondary educational attainment if there is any relationship between high school employment and post-secondary education (Carr et al 1996, Mortimer and Finch 1986.) Even without controlling for the later educational attainment, high school work experience is still positively related to higher occupational attainment (Ruhm 1997).[56] Why do high school student workers obtain higher occupational status and higher earnings later with lower educational attainment? Considering that the jobs which students hold during high school are mostly low-paying, low-skilled, low quality and private service oriented, and very casual jobs, we might not expect student workers to enhance their productivity directly

through this work experience, and we might not expect such work experience to help them to obtain high occupational status later.

We suspect that high school work experience influences students' choices for later education and training, which, in turn, might enhance their productivity and help them to obtain higher occupational status. High school years as well as a few years after high school serve as a very important transition period from school to work or high school to college. During this period, young people make very important choices such as college attendance, their college major, or if they decide to go the job market directly, determining their occupation or job. Choices made during this period, especially about education or training, can have fundamental impacts on their future. If students work during high school, this work experience may have effects on these choices.

Exploring the relationship between high school work experience and individuals' college major choice among college attendees might help understand a possible link between high school work experience and higher occupational status or higher earnings at later time because there are large differences across majors in terms of educational contents, and there are also large differences in the later earnings and occupational status across degrees according to the different college majors. There are no previous studies which empirically investigate the relationship between high school work experience and college major choices.[57]

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[56] Another study also shows a high probability of transition from low-paying job experience to high-paying jobs for young men (Gritz and MaCurdy 1992.)

[57] Even though Greenberg and Steinberg (1986) strongly suggest the possible correlation between the increase in high school employment and the increase in the portion of college students who major in business and engineering, they did not analyze such a relationship with actual data.

In this study, we also explore the relationship between high school work experience and college attendance. By doing so, we might explain in part why high school work experience is positively related to higher later earnings and occupational status, while it is negatively related to post-secondary educational attainment.

We use two comparable high school senior data sets, the National Longitudinal Study of the High School Class of 1972 (NLS-72) for 1972 high school seniors and High School and Beyond (HS&B) for 1980 high school seniors. For each data set we create two separate samples according to respondents' gender because major choices differ greatly between genders. With these data sets, we investigate and compare the effects of high school work experience on the first college major choice as well as on college attendance between 1972 and 1980 and between genders.

First, we investigate the relationship between high school employment and college attendance choices among 'no college', two-year colleges, and four-year colleges by using the multi-nominal logit model (MNL). The dependent variable is students' choices of college attendance during the first fall semester after their high school graduation (October 1972 for NLS-72 samples and October 1980 for HS&B samples). The key independent variables are 'working hours' during high school senior year; 'work,' which indicates whether students worked or not during their senior year; or 'heavy work' which indicates whether students worked 16 or more hours for 1972 samples, and 15 or more hours for 1980 samples. For the HS&B sample, we have two additional variables which indicate high school work experience: 'work junior' which indicates whether students worked or not during their junior year and 'working hours junior.'

We can summarize our findings with the MNL model for the college attendance choice. (1) Work experience, especially heavy work experience is negatively related to college attendance, especially to four-year college attendance. (2) The negative relationship between work experience during the senior year and college attendance is more evident in 1972 than in 1980. However, even in 1980, there is a strong negative relationship between the work experience during the junior year and college attendance for both four-year and two-year college. (3) The negative relationship is stronger among males than females.

In the MNL models for college attendance choice, the coefficients of 'work', 'heavy work' and 'working hours' are in almost all cases negative and significant in the four-year college attendance. In 1972, 'work' is on the average associated with a 3.2 percent fall in the probability of attending four-year college for males only. 'Heavy work' is associated with a 3.4 percent fall for males and a 3.0 percent fall for females , in the probability of attending four-year colleges on average.

However, in 1980, the negative relationship is weaker than in 1972. 'Heavy work' is associated with a 2.3 percent fall in the male students' probability of attending four-year colleges and a 2.1 percent fall in the female students' probability of attending four-year colleges, However, when work experience during the junior year is controlled for, almost all the significance of negative coefficients of 'work' 'heavy work' and 'working hours' in the senior year disappear while 'work junior' and 'working hours junior' are significantly and negatively related to both two-year and four-year college attendance. 'Work junior' is associated with a 1 to 4 percent fall in the probability of attending either two-year or four-year colleges. One interesting finding is that, in the male case, work

experience during in the junior year is more negatively related to two-year college attendance than to four-year college attendance.

Second, we also utilize the probit model, as many previous studies have used the binary dependent framework to see the relationship between high school employment and college attendance (Carr et al 1996, Meyer and Wise 1982, Marsh 1991.) In this framework, the dependent variable is equal to one if a student attends either a two-year or four-year college and otherwise, is equal to zero.

Our main purpose of using the probit model is either to control for or test the possible endogeneity in the relationship between high school work experience and college attendance, because students who plan not to go to college could work more during high school. In the MNL model, testing or controlling for the endogeneity is not easy due to computational difficulty. With the two stage probit method suggested by Lee (1981), we control for the endogeneity related to continuous independent variables with some limitations. We also test endogeneity with the two stage probit model suggested by Rivers and Vuong (1988).[58]

The results from the standard probit model confirm the findings of the previous studies. Working heavily during high school is negatively associated with college attendance. Except for the female case in 1980, 'heavy work' and 'working hours' in the senior year are negative and significant. In 1972, for the male case, 'work' and 'heavy work' are respectively associated with a 5 percent and a 7 percent fall in the probability of attending college at the mean values of other control variables. In the female case, only the 'heavy work' is associated with a 5 percent fall in the probability at the mean values

[58] We could also use the MLE method. We do not attempt the MLE method.

of other control variables. In 1980, 'heavy work' is associated with a 2.5 to 4 percent fall in the probability of attending college for males, depending on the controlling for work experience during the junior year while the coefficients of 'work' are not significant. In the female case, without controlling for work experience in the junior year, there is no such significant relationship.

The results from the two stage probit models are mixed. In 1972, after controlling for the endogeneity, work experience during the senior year affects college attendance positively even though endogeneity test shows there is no significant endogeneity with respect to working hours. However, in 1980, even after controlling for the endogeneity with respect to the relationship between 'working hours' and college attendance, working hours during high school affect college attendance negatively and the endogeneity test also shows that there is no significant endogeneity with respect to working hours.[59]

For the relationship between high school employment and college major choice, first we classify all college enrollees by their study areas- academic field and vocational field, -and apply the standard probit model to this choice. The dependent variable is equal to one if student is in the vocational field and otherwise, is equal to zero.

Our brief investigation shows that, except for the female case in 1972, after controlling for academic ability and other background variables, there is no significant relationship between high school work experience and the choice between vocational field and academic field in both years. In 1972, female students who worked during their

[59] These findings could imply that, in 1972, high school students who decided not go college tend to work longer, while in 1980, students' working hours were irrelevant to students' plans for college attendance. We explain the reasons later.

senior were more likely to choose the vocational field than those who did not work at all, and the longer they worked, the more likely they are to choose the vocational field.

Second, we restrict our samples to college students in the academic field and apply the multi-nominal logit model (MNL) to their specific major choices. Major choice during the first fall semester after high school graduation (October 1972 for NLS-72 samples and October 1980 for HS&B samples) is the dependent variable. We designate six major categories; business, engineering (including computer science and architecture), health science, pre-professional (pre-law or pre-medicine), science (including mathematics) and liberal arts (including other majors).

Our estimates indicate that even after different cognitive skills such as verbal and mathematics skills and courses taken in each subject during high school are controlled for, high school work experience is strongly associated with students' major choices. Students with work experience during their high school senior year are more likely to choose majors which lead to high-paying jobs later. The longer students work during their senior year, the more they are likely to choose business or engineering as a major and they are less likely to choose liberal arts or education. In the MNL model, for the most cases, the coefficients of 'work', 'heavy work' and 'working hours' during the senior year are significantly positive in the log odds ratio between the major choices of business or engineering and the choice of 'liberal arts and other' majors.

This association is stronger in 1980 than in 1972, stronger among males than females, and stronger among Whites than minorities. In 1972, male students who worked during their senior year have a 4.6 percent higher probability of choosing business and a 2.4 percent lower probability of choosing liberal arts or education than those who did not

work at all. Male students with work experience have a 5 percent higher probability of choosing a business major than others. A ten hour increase in working hours reduces the probability of choosing liberal arts by a 2.5 percent and increases the probability of choosing business majors by a 2.4 percent. In the female case, the relationship is much weaker than in the male case. The coefficient of 'work' is not significant in all the major choices. However, 'heavy work' is positively associated with choosing a business major. 'Heavy work' increase the probability of choosing business by a 2 percent and decreases the probability of choosing liberal arts by about a 3 percent.

In 1980, the coefficients of 'work', 'heavy work' and 'working hours' are positive in the choices of business and/or engineering majors for both males and females. In the male case, 'work' is associated with about a 5 to 8 percent fall in the probability of choosing a liberal arts major and about a 5 to 7 percent rise in the probability of choosing a business major.[60] 'Heavy work' is associated with a 5 to 11percent decrease in the probability of choosing a liberal arts major, a 6 to 8 percent increase in the probability of choosing a business major, and a 3 to 10 percent increase in the probability of choosing an engineering major. A ten hour increase in working hours is associated with a 3 to 5 percent decrease in the probability of choosing a liberal arts major and a 2 to 3 percent increase in the probability of choosing a business major and a 1 to 5 percent increase in the probability of choosing an engineering major.

[60] This association between working experience during the senior year and students' tendency to choose business or engineering majors is much stronger among White students. When we restrict the sample to White only for the HS&B samples, 'work' or 'heavy work' are associated with a 7~10 percent increase in the probability of choosing a business major and a 4~5 percent increase in the probability of choosing an engineering major while they are associated with a 8~10 percent decrease in the probability of choosing liberal arts and others majors. Also, we use the weights to accommodate the sampling design in the HS&B sample, and the associations are almost as strong as when we use the White only sample.

In the female case, only the coefficients of 'heavy work' and 'working hours' are positive and significant in the choices of business and engineering. 'Heavy work' is associated with a 3 to 4 percent decrease in the probability of choosing a liberal arts major and a 3 to 4 percent increase in the probability of choosing a business majors and a 2 to 4 percent increase in the in the probability of choosing an engineering major. A ten working hour increases is associated with about a 1 percent decrease in the probability of choosing liberal arts major and a .4 to 1 percent increase in the in the probability of choosing a business major and a 1 to 2 percent increase in the in the probability of choosing an engineering major.[61]

However, this association between high school employment and college major choice does not necessarily mean that work experience influences students' college major choice. For example, if students have a strong tendency to work in the labor market, they might work during high school and choose majors that will facilitate their chances for work in the future. Controlling for this endogeneity is very difficult in the MNL model. Thus, once again, to test whether this association comes from such endogeneity, we utilize the two stage probit models. We regard business and engineering (including computer science and architecture) as 'practical majors.' We also test whether high school working experience causes students to avoid 'the non-technical majors'- liberal arts and education majors- with the same binary dependent framework.

The probit model results confirm the MNL results, showing that high school work experience is significantly and positively associated with choosing business or

[61] Another interesting finding is that in the HS&B female case, 'work junior' is positively associated with choosing liberal arts and negatively associated with choosing business and engineering majors, regardless of

engineering major and are significantly and negatively associated with choosing a 'non-technical major' such as liberal arts, or education.

The results from the two stage probit models for the HS&B male sample indicate that this strong association between high school work experience and college major choice is not caused by a certain characteristics of student workers-such as tendency to work. After controlling for the endogeneity, the coefficients of working hours are still positive and significant in the choice of practical major. Also, the endogeneity test show that there is no such endogeneity in the relationship between high school working hours in the senior year and 'practical college major' choice.

In sum, working during high school is negatively associated with college attendance, especially four-year college attendance. However, among college enrollees in the academic field, high school student workers tend to choose business or engineering majors and avoid liberal arts and education. High school work experience seems to influence student workers to choose such majors over other majors.

In the next section, we briefly review studies that investigate the effects of high school work experience on college attendance, and studies that are related to our current study on the relationship between high school work experience and the choice of college major. In the same section, we also summarize what our data show without controlling for other variables. In section 3, the MNL method and the probit models are described. In section 4, regression results are explained. In section 5, the conclusion of our study is made and further research on the issue is suggested.

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holding work experience during the senior year constant. In the male case, there is no such relationship

2. High School Work Experience, College Attendance and the Choice of College Major.

2-1. High School Work Experience and College Attendance.

Many previous studies which investigate the effects of high school employment on post-secondary education focus on the relationship between high school work experience and college enrollment (or post secondary educational attainment). Most of these studies find lower college enrollment rates among high school student workers, especially among those who have worked heavily during high school. Table 2-2-1-1 summarizes these previous studies.

Using NLS-72, Meyer and Wise (1982) show that, after holding other background variables constant, the hours worked during the senior year are negatively related to college enrollment in the first four years after high school graduation. Meyer and Wise show that those who worked more than 20 hours per week in their senior year are considerably less likely to be in college than those who did not work at all. Using the HS&B sophomore data set, Marsh (1991) also shows that the total hours worked during the senior, junior and sophomore years are negatively related to attending college in 1 to 2 years after high school graduation.[62]

However, among studies which use the NLSY data set, the results of their investigations on the relationship between high school employment and later college

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found between work experience in the junior year and college majors.

[62] However, Marsh's measure of hours worked is not accurate as shown in Chapter 1. Also his variables which indicates college attendance is problematic because he seems to add up the numerical values of the categorical variable which represents college student status at several points in time after high school. In that categorical variable, '0', '1' and '2' indicate respectively that the respondent was not a student, was a part-time student, or was a full-time student at a post-secondary institution at each of four points in time: February 1982, October 1982, October 1983, February 1984.

attendance differ from one another, even though all of them also indicates a negative relationship between heavy work during high school and post-secondary education. [63] Ruhm (1997) shows that only in the female case, working more than 10 hours per week during the senior year is negatively related to grade completed and college graduation. However, Carr et al (1996) show that there is a significant and negative relationship between high school employment, college attendance and college completion, especially for males. Steel (1991) shows that when both the job-holdings and hours worked are entered into the college enrollment equation, job-holding is positively related to future enrollment, while hours worked is negatively related to future enrollment.[64]

Table 2-2-1-1 Review of Previous Studies on the Effects of High School Work Experience on College Attendance.

Authors, Sources	Data, Method, Dependent Variable	Definitions/Specifications of High School Employment	Key Findings
Meyer and Wise (1982)	(1) NLS-72 (2) Probit model simultaneously estimated with weeks worked (or wage) equation. (3) Nonattendance status in college during the first four years. Each year separately.	Hours worked per week categories: 1-5, 6-10, 11-15, 16-20, 21-25, 26 to 30, 31 or more. Hours worked in linear form	Person who worked more than 20 hours per week were considerably less likely to be in college in any of the four years than those who worked less. (10% lower at the mean value of control variables) Persons who worked less than 20 hours per week were also less likely to be in college during the first year after high school than those who did not work at all. The hours worked per week is negatively and significantly related to college attendance.

[63] These studies also show the relationship between high school employment and high school graduation differently. D'Amico (1984) shows that as the percent of weeks that students worked more than 20 hours increases during the junior year, female white students were more likely to drop out. She also shows that as the percent of weeks that student worked 1 to 20 hours increases during the junior year, minority female, white female and white male students were less likely to drop out. The percent of weeks that students worked more than 20 hours during the sophomore year is negatively related to high school graduation only for white males. However, Ruhm(1997) shows that senior work experience is positively related to high school graduation. Carr et al (1996) show that there is no such relationship between high school employment and graduation.

[64] Even though their measure of enrollment is not necessarily the enrollment in colleges, the significant and positive sign of the coefficient of the job-holdings in the enrollment regression seems to show that students who are employed during their senior year have higher academic ability and better family background.

Marsh (1991)	(1) HS&B sophomore data, 1980, 1982, and 1984 interviews. (2) OLS for 'university' *	Total hours worked during the senior, junior and sophomore year. Linear form.	College attendance is negatively related to total hours worked.
DAmico (1984)	(1)NLSY-1979-82 interviews; high school students (in 1979): White male and minority male, White female and minority female are separately sampled. (2) Probit model (3) Drop-out: those whose highest grade completed as of 1982 was less than 11 years and who had not attended school within the last year	The percent weeks worked more than 20 hours/week and 1-20 hours/week during the sophomore year and/or the junior year.; linear forms and each year experience exclusively. Average hours worked per week during the high school year (junior year or sophomore year); Quadratic form, each year experience exclusively.	The percent weeks worked more than 20 hours during the junior year is positively related to drop-out only for female Whites. The percent weeks worked 1-20 hours during the junior year is negatively related to drop-out for minority females, White females and white males. The percent weeks worked more than 20 hours during the sophomore year increased the probability of drop-out only for white males. Slight non-linear relationship (significance problem)
Steel (1991)	(1) NLSY, 1979-81 interviews, 17-18-year olds in 1979. Whites, Hispanics and Blacks are separate. (2) Tobit model (3) Months of enrollment between 1980 and 1981	Both employment status and hours worked per week in 1979 regardless of grades are entered together. Thus, employment status and hours worked can represent the work experience even in college.	For Whites, job-holdings increases future enrollment while hours worked is negatively related to the future enrollment rate.
Ruhm (1997)	(1) NLSY, those who were high school freshmen or sophomores in 1979, remained enrolled in school through their senior year. 588 males and 561 females (2)Probit model and OLS (3) the probability of high school graduation and the probability of finishing 4 or more years of college by 1991; the highest grade completed in 1991.	Hours worked during the reference week during the sophomore year, the junior year and the senior year are separately entered and are specified in the quadratic form. In the cases of the highest grade completed and the probability of finishing 4 or more years of college, only the hours worked during the senior year are entered.	Senior work experience is positively associated with high school graduation rates, while there is no statistically significant relationship between work experience either during the junior year or sophomore year. For females, those who worked more than 10 hours during the senior year have completed less grades and lower college graduation rates. For males, there is no such relationship.
Carr, Wright and Brody (1996)	(1) NLSY. 16-19 in 1979, enrolled in high school as of May 1, 1979 (2) Logistic regression for the probability of high school graduation, 1-3 years of college, 4 or more years of college; OLS for the highest grade completed by 1991.	Hours worked in 1978 divided by 100. Linear form of hours worked.	Hours worked is negatively related to the highest grade completed, especially for males. 100 hours working in 1978 reduced around .03~.04 years of schooling by 1991. No relationship between hours worked and the probability of high school graduation. Significant and negative relationship between hours worked and college attendance, and college completion after controlling for other background variables, particularly for males,.

* Marsh's definition of 'university' is sum of activity variables indicating that the respondent was not a student (0), was a part-time student (1), or was a full-time student (2) at a post-secondary institution at each of four points in time: February 1982, October 1982, October 1983, and February 1984.

These differences in their results seem to be related to the different measurement of high school work experience and different specification of high school work experience in the regression analyses. Ruhm measures hours worked during the reference week in the sophomore, junior and senior year separately as high school work experience and puts them separately in the quadratic form in the regression analyses, while Carr et al measure high school work experience as hours worked in 1978 and put it in a linear form in the regression analyses. Steel measures the average hours worked per week in 1979 as high school experience, and a dummy for the job-holding status and hours worked together as independent variables in the regression analyses.

The general negative relationship between high school employment and college enrollment is usually explained by the assumption that working takes away students' time and efforts from academic activities, and thus, hindering students from attending colleges. However, there is a possibility that students who plan not to go to college work longer and earlier during high school.

Using the NLS-72 and HS&B data sets, we briefly reinvestigate the relationship between high school employment and college attendance because, decisions about college attendance might be closely related to decisions on the major choices, which are our main focus in this study. When we investigate how high school employment is associated with college attendance, we distinguish four-year college attendance from two-year college. All the previous studies on this issue regard these two different types of post-secondary institutions as the same. However, there are distinctive characteristics of two-year and four-year college. Most two-year college majors and courses are skill-oriented and technical. Also, tuition and academic criteria for admission are different from one

another. There is a likely possibility that high school work experience might influence high school seniors' decision about the college type as well as college enrollment because the work experience might change students' views on college education and might influence academic preparation for college.[65]

We tabulate the relationship between working hours during the high school senior year and college attendance (choices) in the Table 2-2-1-2 and 3 and Table 2-2-1-4 and 5. The tables also show some features of the relationship between high school work experience and college attendance. First, in 1972, students who worked heavily during their senior year were much less likely to attend college than those who worked moderately or those who did not work at all (see the first rows of tables).

Table 2-2-1-2: Working Hours and First College Choices : Male (NLS-72)

	None	less than 6 hours	6-10 hours	11-15 hours	16-20 hours	21-25 hours	26-30 hours	More than 30 hours	Total (%)	Total #r
No College (%)	49.3	47.3	53.6	52.7	57.1	61.3	64.9	75.7	57.9	3915
Two-Year College (%)	12.4	12.6	14.3	12.5	13.0	13.8	13.3	8.8	12.4	840
Four-Year College (%)	38.3	40.1	32.1	34.8	30.0	24.9	21.8	15.5	29.7	2008
Total Number	1245	730	797	609	915	804	607	1056		6763

Table 2-2-1-3: Working Hours and First College Choices :Female (NLS-72)

	None	less than 6 hours	6-10 hours	11-15 hours	16-20 hours	21-25 hours	26-30 hours	More than 30 hours	Total %	Total #
No College (%)	60.3	53.0	56.4	57.6	59.9	67.7	70.8	75.1	60.6	4248
Two-Year Collge (%)	10.9	13.2	11.5	11.7	12.6	11.2	9.6	7.9	11.4	796
Four-Year College (%)	28.8	33.8	32.1	30.6	27.6	21.2	19.6	17.1	28.1	1969
Total Number	2126	920	931	741	900	609	353	433		7013

[65] The two-year versus four-year college enrollment decision itself has been a topic in the economics of education (see Rouse 1994, Alexander and Pallas 1987).

Table2-2-1-4: Working Hours and First College Choices: Male (HS&B)

	None	1-4 hours	5-14 hours	15-21 hours	22-29 hours	30-34 hours	More than 35 hours	Total %	Total #
No College (%)	49.1	47.7	40.1	44.7	53.8	56.4	59.9	49.0	1931
Two-Year Collge (%)	16.9	16.2	18.8	17.3	18.3	19.1	15.7	17.5	688
Four-Year College (%)	34.0	36.2	41.1	38.0	27.9	24.5	24.4	33.5	1322
Total Number	374	235	608	779	552	273	394		3941

Table 2-2-1-5: Working Hours and First College Choices: Female (HS&B)

	None	1-4 hours	5-14 hours	15-21 hours	22-29 hours	30-34 hours	More than 35 hours	Total %	Total #
No College (%)	50.5	44.9	38.3	40.7	48.8	51.5	56.4	46.1	2225
Two-Year Collge (%)	16.9	17.0	17.2	19.9	17.3	18.0	22.3	17.9	867
Four-Year College (%)	32.6	38.1	44.5	39.5	33.9	30.5	21.4	36.0	1739
Total Number	1613	430	767	1052	549	200	220		4831

Further, the relationship is almost linear except for the first two time categories.[66] Since working occupies students' time and effort, and may hinder students' academic achievement during high school, this relationship is not surprising. However, this result might occur because students who have decided not to go to college work longer hours while in high school.

Second, we find that this relationship between work experience and college attendance is much weaker in 1980 than 1972, especially for females. The probability that a female student who worked 30-34 hours per week during her high school senior year

[66] In 1972, students who had no work experience were less likely to attend college than those who had worked less than 6 hours among males and those who have worked 1-10 hours among females. However, as we note in the chapter one, those who had no work experience during their high school senior year did not worked because jobs were not available for them because of either poor ability or market conditions.

would attend college is almost as high as that of a female student who did not work at all. In 1980, as we see in chapter 1, more affluent and more academically able students participate in the labor market than in 1972. This weakened negative relationship could have resulted from a negative/positive relationship between working hours and ability, or the negative/positive relationship between working hours and families' socio-economic status.

Third, there remains a strong negative correlation between four year college attendance and working hours. At the same time, there is no such relationship between working hours and two-year college attendance. It is possible that high school students who have worked might choose two-year colleges because many two-year college major fields and courses are skill-oriented and technical.

We also can tell that many of those who have worked during high school go to two-year or four-year colleges. Even among students who have worked more than 30 hours per week, more than 25 percent in 1972 and more than 40 percent in 1980 went to college right after high school graduation. Thus, many college students have some work experience during high school. This work experience could have some relationship with the courses they take and their majors during their first college years.

2-2. High School Work Experience and the Choice of College Major.

Students' college majors serve as one of the determining factors of their future income, occupation, and even future social lives. Previous studies show that college students in general are rational and consider their expected future earnings as one criterion when they choose their college majors (Freeman 1976, Berger 1988).[67] Grogger and Eide (1995), using the same data sets we use in this study, NLS-72 and HS&B, estimate major-specific wage premiums of college graduates relative to earnings of high school graduates. They show that among male college graduates, males who have majored either in business or engineering have the highest returns to their college degrees in 1978, and afterwards, they enjoy the highest earnings growth rates as a function of time and (or) experience relative to earnings of high school graduates.

For female college graduates, science majors, business majors, and engineering majors have the highest earnings. Science majors, business majors, and engineering majors have earned respectively 32, 21, and 17 percent more than high school graduates in 1978, while social science majors, education majors, arts as well as other majors respectively earned, 12, 10, and 12 percent more than high school graduates in the same year. Afterwards, the growth rates of wage premium as a function of time and (or) experience are highest among business and engineering majors.

Other studies also show that individuals choosing more practical and skill oriented fields such as business, engineering or computer science enjoy significant wage premium

[67] However, using the NLS-72 data set, Eide and Waehrer (1998) find that in the female case, the expected wage is a negative determinant for female undergraduate major choice, and the option value of majors related to later graduate school attendance is a positive determinant in major field choice.

over those majoring in less technical fields such as liberal arts and education.(Altonji 1993, Grubb 1993, and Rumberger and Thomas 1993.)

The question is whether work experience during high school is related to college major choice. In particular, our question is whether high school student workers have a stronger tendency than non-workers to choose business or engineering majors. A recent study (Light 1999) shows that high school student workers among non-college bound high school graduates tend to take more vocational courses such as type writing, automobile mechanics, accounting, and health related courses during high school than non-workers. This study also shows that these practical courses are related to higher later earnings. If work experience makes non-college bound high school student workers more sensitive to future earnings and more practical in choosing high school courses, it would make college-bound students more sensitive to future earnings and more practical in choosing their college courses. College courses that students take are bounded to a certain degree by the choice of their major field.

If students' work experience is associated with their taking more practical courses or education, why and how does it makes students more practical? There are several possible explanations for this phenomenon. First, Greenberg and Steinberg (1986) clearly link high school employment to an increase in college students' enrollment in 'lucrative' majors. They argue that working experience makes students more materialistic and thus, college students who have worked during high school tend to choose engineering, computer science and businesse. Greenberg and Steinberg cite this tendency as one of the negative outcomes of high school employment.

> During the same period, college freshmen expressed declined interest in the arts, humanities, and social sciences and increased interest in majors such as engineering, computer science, and business that are likely to lead to more lucrative careers. (The number of students entering college who expected to major in business increased by 80 percent between 1966 and 1981.) In this cultural milieu, it is not surprising that high-school students have flocked to the workplace: in the learning for its own sake or to careers involving service to others, the lure of the paycheck must be very powerful(P 34.)

Second, another possible link between high school employment and practical college major choice might be related to the accumulated knowledge through work experience. If early working experiences increase the knowledge of the world of work (D'Amico 1984) or greater "business knowledge" (Greenberger et al 1982) and thus, student workers know better about what occupations or jobs have more market value, they might choose those occupations or jobs which have more market value. By the same token, if they know better which kinds of skills or education are highly valued in the market, they might choose more practical courses and might major in fields which are more rewarding in the labor market such as business, engineering, computer sciences or health related sciences.

Third, characteristics of jobs students hold during high school are low-skilled and very casual (so called 'dead-end' jobs.) The knowledge of the world of work through such job experience itself might be too limited to help students in choosing such practical college majors. However, work experience in such dead-end jobs might help them understand the hard reality of the world of work and make them not want such kinds of jobs as adults. Thus, when student workers decide to enroll in college, they might choose those majors which generally guarantee well-paid and highly skilled jobs.

All these possible links are related to one another in the sense that they are based on the same assumption that high school work experience might affect an individual's choice of a college major by influencing his or her perceived future earnings, occupation, or job. Thus, it is possible that all these links from work experience to college major choices work together in their influence upon student workers' major choice.

However, the relationship between high school work experience and college major choice might not be causal if students with a certain unobservable characteristic work more during high school and choose such practical majors in colleges. That is, individuals who like to work in the labor market might work more during high school and choose majors that will facilitate their chances for work in the future. Instead that work experience makes high school student workers practical, so students who are already practical work during high school and choose such practical majors in colleges.

There are no previous studies which examine the effects of high school employment on the choice of college major, or the association between these two, using empirical data. However, this question is important if high school work experience influences the choice of college major. (i) As mentioned earlier, the college major can affect future jobs, occupations, earnings, social status, and even life styles in the long run. If we look at the effects of high school employment upon only the short term earnings,[68] it might be misleading and we might ignore other long-term consequences of high school employment on students' future lives. (ii) We can understand one more channel in the link between high school employment and higher later earnings or higher later

[68] Most studies on the effects of high school employment on later earnings have focused on earnings gain in the relatively short term, usually 2-10 years after high school graduation. Even 10 years after high school graduation is short for the college bound students.

occupational status at least for college bound students.[69] (iii) Thus, this research has some implications for government programs involving the school-to-work transition, which mostly aim to increase early job market stability of the young.

First, using the samples of those students who attended college in the fall semester after high school graduation (Oct. 1972 and Oct. 1980), we classify college enrollees by two study areas: vocational field and academic field.[70] We tabulate the relationship between working hours during the senior year and two study areas in Table 2-2-2-1 and 2, and Table 2-2-2-3 and 4. From the tables, we can note several features of the relationship. In 1972, many more female students seemed to take more the vocational field than males, while in 1980 there is no such difference based on gender. Among college enrollees, the percentage of women who enrolled in the vocational field decreases, while the percentage of men who enrolled in vocation field increases over-time. Above all, students who work longer hours are more likely to choose the vocational field and less likely to choose the academic field.

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[69] Many studies which find positive effects of high school employment later earnings do not provide explicit explanations for this positive effects. For example, finding the significant positive effects of senior year working hours on later earnings, Ruhm (1987) argues that his research indicates that "student employment raises future productivity through the skills, knowledge, work habits, and experience provided on-the-job by far more than it detracts form educational human capital investments" (p770). However, he does not provide any evidence for that channel. Two recent studies, Hotz et al (1998) and Light (1999) provide some explanations for these positive effects. Hotz et al (1998) point to individual heterogeneity in the labor market and schooling experience as the reason for the effects while Light suggests the correlation between high school employment and vocational courses taken by students workers as one reason for the effects among non-college bound students.

[70] The National Center for Education Statistics provides field of study codes as a classification of instructional programs. They classified three major fields: (1) conventional academic subdivisions of knowledge training, (2) technological and occupational curriculums leading to associate degrees and other awards below the baccalaureates, and (3) vocational programs. In NLS-72 samples, only 235 among 2334 male college students and 427 among 2262 female students chose vocational majors. In HS&B samples, 252 among 2010 male students and 299 among 2606 female students chose vocation major and 56 male and 106 female student chose technical majors according to NLS-72 and HS&B survey classification. We

Table 2-2-2-1: Working Hours and College Study Field: Male (NLS-72)

	None	less than 6 hours	6-10 hours	11-15 hours	16-20 hours	21-25 hours	26-30 hours	More than 30 hours	Total (%)	Total #
Vocational Field (%)	8.5	8.7	10.7	12.3	12.7	12.7	13.1	10.5	10.8	287
Academic Field (%)	91.5	91.3	89.3	87.7	87.3	87.3	86.9	89.5	89.3	2376
Total Number	575	367	346	277	371	291	198	238		2663

Table 2-2-2-2: Working Hours and College Study Field: Female (NLS-72)

	None	less than 6 hours	6-10 hours	11-15 hours	16-20 hours	21-25 hours	26-30 hours	More than 30 hours	Total (%)	Total #r
Vocational Field (%)	16.7	16.4	21.8	21.2	21.0	24.6	21.0	23.5	19.5	516
Academic Field (%)	83.3	83.6	78.2	78.8	79.0	75.4	79.0	76.5	80.5	2132
Total Number	801	414	390	302	348	191	100	102		2684

Table 2-2-2-3: Working Hours and First College Choices: Male (HS&B)

	None	1-4 hours	5-14 hours	15-21 hours	22-29 hours	30-34 hours	More than 35	Total % hours	Total #
Vocational Field (%)	15.8	16.0	13.4	14.3	20.1	23.2	26.4	16.9	308
Academic Field (%)	84.2	84.0	86.7	85.7	79.9	76.8	73.6	83.1	1520
Total Number	514	89	337	384	244	99	144		1828

Table 2-2-2-4: Working Hours and First College Choices: Female (HS&B)

	None	1-4 hours	5-14 hours	15-21 hours	22-29 hours	30-34 hours	More than 35	Total %	Total #
Vocational Field (%)	19.5	13.6	13.4	15.6	19.2	15.6	23.4	16.9	405
Academic Field (%)	80.5	86.4	86.6	84.4	80.8	84.4	76.6	83.1	1986
Total Number	738	213	432	569	255	90	94		2391

However, the characteristics of each major within the academic field are very different from one another.[71] We further restrict the sample to those who enrolled in the

include vocational majors and technical majors in the vocational field because these majors are basically vocation-oriented majors.

[71] Of course, the characteristics of each major within the vocational field are different from one another. However, the numbers of college students who are in the vocational field in our sample are relatively small

academic fields which usually lead to the bachelor's degree. Students' first chosen college majors are classified into seven big categories; business, liberal arts (including social science), education, engineering (including architecture and computer sciences), health related, pre-professional (pre-law and pre-medicine), and other majors (military science, library, ethnic studies and others).

There are some problems with using the first major choices. First, many college students, especially two-year college students, do not finish their degrees. If college credits or majors without degrees are not valued by the market, investigating the relationship between high school employment and the first major choices is not so meaningful. However, Kane and Rouse (1994) show that the "sheepskin" (degree) effect is small and the returns to credits without degrees, even for two-year college credits, are high regardless of degrees.[72] Second, students change their majors during their college years. Thus, we examine the relationship between college majors four years after high school graduation and working hours, and our results are essentially the same.

There are some advantages to using the first college major in an investigation of the relationship between high school employment and the choice of college major. First, we are able to detect the direct effects of high school working experience on the choice of college major. If we use later college majors, we need to control for many other factors which could influence students' major choice during their college years such as, employment and academic achievement during college. We do not need to worry about those factors if we use the first major choices. Secondly, since many college students,

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and a narrower classification within the vocational field is not easy. We did not attempt to classify the vocational field further.

especially those who have worked a lot during high school, do not finish their degrees, using only major choices with degrees cannot capture the full effects of high school work experience on the choice of major.

The relationship between first major choices among college students in the academic field and working hours during the high school senior year are tabulated in the Table 2-2-2-5 and 6 and Table 2-2-2-7 and 8. First, in both years, regardless of working hours, male students are more likely than female students to choose more practical and lucrative majors, such as business and engineering majors. Second, students tend to choose more such practical majors in 1980 than in 1972 regardless of gender and working hours.

Third, in general students who work long hours tend to choose more such practical majors. Table 2-2-2-5 clearly shows that in 1972, male students who work long hours are more likely to choose business as a major and are less likely to choose liberal arts than those who work less. While 27.9 percent of students who work more than 30 hours choose business majors, only 14.7 percent of students who do not work at all choose business majors. Only 13.3 percent of students who work the longest hours choose liberal arts while 22 percent of students who have not worked at all choose liberal arts.

The female case is strikingly different from the male case. As we see in Table 2-2-2-6 ,in 1972, only less than 20 percent of female students choose business, engineering and health sciences while the majority choose education, liberal arts or other majors. It might be because business women or female engineers were not socially accepted as a standard female job or an occupation at that time and thus, many jobs in business or

[72] We also find that credits in courses such as business, engineering, and science have much higher returns

engineering areas were not available for females. In the early 1970s, teaching may have been regarded as one typical female college graduate job, and many teaching positions may have been available for female college graduates. In sum, in the 1972 female case, there is no distinctive relationship between high school working and the choice of college major while changing dramatically in the 1980s.

In 1980, a much higher percentage of both male and female students choose business and engineering majors than in 1972. In the Table 2-2-2-8, male students who work long hours tend to choose either business, or engineering. About 53 percent, 62 percent, and 59 percent of students in each of the three longest working hour categories choose either a business or engineering major respectively while 49 percent, 49 percent, and 42 percent of students in each of the three shortest working hour categories choose such majors. Also, the last two bottom rows show that students who work longer hours are less likely to choose liberal arts or other majors. In 1980, female students who work long hours during high school tend to choose business and engineering majors and are less likely to choose liberal arts and other majors while these tendencies are less clear than for males.

In sum, students who work long hours tend to choose more practical majors, especially business or engineering, and they avoid education, liberal arts, and other majors, which are less lucrative or less practical.

However, in the health, pre-professional, and science major areas no such clear relationship between working hours during the high school senior year and major choices

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than other credits regardless of degrees obtained even after the sample selection is controlled.

is shown. However, since the percentages of students who choose these majors are relatively small, the importance of these majors for the current study is relatively small.

However, working hours during high school, college attendance, and college major choice are related to academic ability, family backgrounds, and other factors. To see how these relationships are after controlling for all these factors, we utilize two econometric methods: the MNL model and the probit model.

Table 2-2-2-5: Working Hours and Major Choices (%) : Male (NLS-72)

	None	less than 6 hours	6-10 hours	11-15 hours	16-20 hours	21-25 hours	26-30 hours	More than 30 hours	Total #	Total %
Business	15.2	16.1	19.4	24.7	20.1	23.2	22.7	26.3	473	19.9
Engineering	9.5	8.4	11.0	8.2	8.3	11.8	8.1	8.0	220	9.3
Health	10.1	12.5	11.0	10.3	12.7	11.0	15.1	7.5	265	11.2
Pre-professional	3.8	2.1	5.2	1.2	3.7	3.5	2.3	4.7	81	3.4
Science	10.8	12.2	11.3	11.9	9.6	9.8	10.5	8.0	253	10.7
Education	13.9	16.1	11.3	10.3	13.2	12.2	11.1	11.3	304	12.8
Liberal Arts	21.7	19.4	16.2	18.9	17.9	13.0	17.4	15.0	428	18.0
Other Major	15.0	14.6	14.4	14.5	15.4	12.8	19.3	19.3	352	14.8
Total Number	526	335	309	243	324	254	172	213		2376

Notes for Tables 2-2-2-5 : (1) This classification is made for those who are majoring in academic fields which usually lead to four year college degree. (2) Unit is % (percentage) except the total numbers. (3) Science includes Mathematics. (4) Engineering includes Architecture and Computer Sciences.

Table 2-2-2-6: Working Hours and Major Choices (%) : Female (NLS-72)

	None	less than 6	6-10 hours	11-15 hours	16-20 hours	21-25 hours	26-30 hours	More than 30 hours	Total #	Total %
Business	8.4	7.5	5.9	5.9	9.5	4.9	15.2	12.8	169	7.9
Engineering	1.5	1.7	1.3	1.7	.7	1.4	.0	1.3	487	1.4
Health	8.9	11.9	10.2	10.1	9.5	9.7	8.9	14.1	641	10.0
Pre-professional	1.2	2.6	1.3	.8	1.5	.7	.0.	1.3	158	10.8

Science	8.4	7.5	6.9	10.5	4.7	8.3	3.8	2.6	29	7.4
Education	30.3	30.9	27.5	24.8	33.5	35.4	31.7	26.9	213	30.1
Liberal Arts	22.0	22.5	25.3	25.2	20.4	22.2	22.8	24.4	29	22.8
Other Major	19.3	15.3	21.6	21.0	20.4	17.4	17.7	16.7	406	19.1
Total Number	667	346	305	238	275	144	79	78		2132

See notes in Table 2-2-2-5

Table 2-2-2-7: Working Hours and Major Choices (%) : Male (HS&B)

	None	1-4 hours	5-14 hours	15-21 hours	22-29 hours	30-34 hours	More than 30 hours	Total #	Total %
Business	21.0	19.1	21.6	27.4	28.2	39.5	26.4	374	24.6
Engineering	27.7	30.3	20.6	23.7	30.8	22.4	26.4	391	25.7
Health	3.7	.00	3.8	3.3	3.1	.00	3.8	48	3.2
Pre-professional	.7	.00	1.0	0.3	3.1	2.6	1.9	17	1.1
Science	11.1	9.0	10.3	9.7	3.6	6.6	8.5	139	9.1
Education	6.0	10.1	9.9	7.0	4.1	5.3	7.6	107	7.0
Liberal Arts	16.4	19.1	15.1	15.5	11.3	10.5	12.3	226	14.9
Other Major	13.4	12.4	17.5	13.1	15.9	13.2	13.2	218	14.3
Total Number	433	89	292	329	195	76	106	1520	

See notes in Table 2-2-2-5

Table 2-2-2-8 : Working Hours and Major Choices (%): Female (HS&B)

	None	1-4 hours	5-14 hours	15-21 hours	22-29 hours	30-34 hours	More than 30 hours	Total #	Total %
Business	30.0	24.5	23.0	32.3	32.5	29.0	33.3	577	29.1
Engineering	8.6	8.2	6.2	8.8	7.3	10.5	15.3	165	8.3
Health	7.7	7.6	10.7	7.5	5.3	2.6	1.4	150	7.6
Pre-professional	1.9	1.1	2.7	1.7	2.4	1.3	1.4	38	1.9
Science	7.1	8.7	6.2	5.2	3.9	11.8	9.7	130	6.6
Education	13.0	15.8	13.9	12.3	17.0	13.2	11.1	270	13.6

Liberal Arts	16.0	14.1	19.3	16.7	15.5	21.1	13.9	331	16.7
Other Major	15.8	20.1	18.2	15.6	16.0	10.5	13.9	325	16.4
Total Number	594	184	374	480	206	76	72	1986	

See notes in Table 2-2-2-5

3. Econometric Models.

We use the MNL model and probit models to see how high school work experience is related to college major choices after we hold other factors constant. Studies which investigate the determinants of college major choice indicate that expected earnings, expected labor force participation and different kinds of cognitive skills are important in determining major choice (Berger 1988, Polachek 1978, Blakemore and Low 1984, Paglin and Rufolo 1990). However, as mentioned in the foregoing section, early labor market experience might change an individual's perception of future earnings and job amenities or labor force participation, which in turn affects major choice. Using the MNL model and probit models, we also examine the relationship between high school work experience and college attendance choice. Mainly for convenience, we mention the models with respect to only the choice of college major when we describe the models. Only when it is necessary to mention the models with respect to college attendance choices, we do so.

3.1 MNL model.

We assume that individuals choose a major in order to maximize their utility. Let U_{ij} be the level of utility of individual i receives when choosing major j. The level of utility depends on individual characteristics, X_i, like family background, different skills, tastes, community type or regions where student live, and early working experience. Attributes of the college majors, such as an individual's expected future earnings in a particular major, or expected jobs, could be also important determinants for major choice as shown in the previous studies. However, we ignore the attributes of a major's specific characteristics, such as its expected earnings because we are mainly interested in the effects of an individual's early work experience on his or her choice of college major. Thus, we use a MNL model as a special case of McFadden's conditional logit model (CLM) which includes both an individual's characteristics and choices' attributes.[73]

We are particularly interested in whether high school work experience positively affects the probability of choosing business or engineering majors and negatively affects the probability of choosing liberal arts and education majors. Previous studies on the relative earnings associated with different college majors indicate that individuals choosing engineering or business management majors enjoy significant earnings premiums over those majoring in education or the liberal arts (Altonji 1993, Berger 1988, Grogger and Eide 1995, Grubb 1993, Rumberger and Thomas 1993).[74] If individuals with

[73] There are some studies which use this kind of MNL model. For example, Schmidt and Strauss (1975), in their investigations on occupational choices, use only individuals' characteristics such as education, experience, race, and sex,. Omitting choices' attributes might cause some unknown problems. However, the MNL model might be very appropriate in our current investigation because we are mainly concerned with how an individual's particular characteristic-high school work experience affects choosing a certain major.

[74] These connections between college majors and later earnings are pretty clear. However, the effects of expected earnings are not always positive. Even though in general, economic theory predicts the positive

high school work experience choose majors with high earnings premiums, the gain in later earnings of student workers can be explained through such college major choice for college bound individuals.

The main dependent variable is the students' choice of major for the first fall semester after their high school graduation (October 1972 for NLS-72 samples and October 1980 for HS&B samples). As mentioned earlier, we create six college major categories for college students who choose academic areas: (i) business, (ii) engineering (including computer science and architecture), (iii) health science, (iv) pre-professional (pre-law or pre-medicine), (v) science (including mathematics), and (vi) liberal arts (including other majors).

By using the MNL model, we also investigate the relationship between high school work experience and college attendance choice. We create three 'college attendance' categories for the full sample: (i) no college, (ii) two-year college, and (iii) four-year college.

The level of individual utility from choosing major j depends on these observed characteristics and on unobserved heterogeneity as follows:

$$U_{ij} = \beta_{ij} X_i + \varepsilon_{ij} \qquad (3\text{-}1)$$

The probability that an individual makes choice j is given by:

$prob(U_{ij} > U_{ik})$ for all other $k \neq j$.

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correlation between major choice and expected earnings, empirical studies show contrasting results. While Berger (1988) shows the significant and positive effects of expected earnings in each major field on major choices for males, Eide and Waehrer (1998) show the negative relationship between major choices and expected wages for females. This contrasting result implies that not only the expected earnings but also how individuals value the expected earnings are important in the major choice because the general difference of expected earnings across majors is well known and ability and family backgrounds are controlled for,

Let Y_i be a random variable indicating the choice made. We assume that the J disturbances, ε_{ij}, are independent and identically distributed from a Weibull distribution (See Green 1997). Accordingly, we can write the probability that individual chooses major j, as:

$$prob(Y_i = j) = \frac{e^{\beta_j X_i}}{\sum_J e^{\beta_j X_i}} \qquad (3\text{-}2)$$

In order to estimate the parameters of the equation, we normalize the parameters to be equal to zero ($\beta_0 = 0$) for a chosen major, $Y = 0$. We regard liberal arts and 'other' majors together as the comparison group ($Y = 0$) in the specific major choice for college students in the academic field and 'no college' status as the comparison ($Y = 0$) in the choice of college attendance. Then, the probability of choosing major j becomes

$$prob(Y = j) = \frac{e^{\beta_j X_i}}{1 + \sum_{k=1}^{J} e^{\beta_k X_i}} \quad \text{for } j = 1,2,.....j. \quad (3\text{-}3)$$

The relative probability of choosing j alternative to the probability of choosing the base (or comparison) major '0' is

$$prob(Y = j) \,/\, prob(Y = 0) = e^{\beta_j X_j} \qquad (3\text{-}4)$$

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differences in expected earnings for choosing each major across individuals is relatively small or not important (see Berger 1988).

By taking log both sides of the above equation, we can see the relationship of high school work experience to the odds ratio between a certain choice of college major compared and the choice of liberal arts and others. In this MNL model, we can only observe the coefficients of the independent variables for j-1 alternatives.

As mentioned in the introduction, the key independent variables of our current interest are 'work', 'heavy work,' 'working hours' per week during the senior year. In the HS&B, we also have 'work junior' and 'working hours junior' per week. We also use the average working hours per week in the senior and junior years. We expect the signs of these variables to be negative in the choices of two-year college attendance and four-year college attendance. Also, we expect the signs of these variables to be positive in the choices of business or engineering majors.

The coefficients of these variables show the relative effects of working experience on the choice of a certain major compared to majors in the liberal arts and 'others'. For college attendance choice, they show the relative effects of working experience on the choice of two-year or four-year colleges. We expect the positive sign of these work experience variables in more practical major choices, such as business or engineering and the negative sign of them in the choice of two-year or four-year colleges.

However, we have several problems with using this MNL model for our investigation of the effects of high school work experience on the choice of college major. First, the MNL model has the property known as the independence of irrelevant alternatives: the odds ratios (3-4) in the MNL model are the same irrespective of the total number of choices considered (IIA property). This assumption follows from the initial assumption that the disturbances are independent.

Due to the IIA property, using the MNL model might not be appropriate in investigating the choice of college major. This is because if two majors, for example business and engineering, can be perceived as too close or too similar to be an independent alternative by students, this model predicts too high of a joint probability for the selection for two such majors. This problem might be serious in the investigation of the choice of college major for those students in academic areas because some of the seven college majors might be too similar to be distinguishable.

To address part of this problem, we test the hypothesis that a subset of major choice truly is irrelevant by a Hausman's specification test developed by Hausman and McFadden (1984). If the hypothesis is correct, excluding such major choices from the model will not change the parameter estimates systematically and the parameter estimates will be still consistent yet inefficient. If it is not correct, the parameter estimates obtained without these choices will be inconsistent. Test statistics are

$$\chi^2 = (\hat{\beta}_s - \hat{\beta}_f)'[\hat{V}_s - \hat{V}_f]^{-1}(\hat{\beta}_s - \hat{\beta}_f) \qquad (3\text{-}5)$$

where s indicates the estimators after the subset major choices are excluded, f indicates the estimator using the full set of major choice, and $\hat{V}_s$ and $\hat{V}_f$ are the respective estimates of the asymptotic covariance matrices. The test statistics are asymptotically distributed as chi-squared with the degree of independent variables. We report these test statistics for each major choice when we omit each of college majors.

Second, so far we assume that high school work experience influences the choice of college major or the college attendance decision. However, parameter estimates could be biased due to the possible endogeneity problems when there is correlation between error term and high school work experience variables. In the college attendance case, students who decide not to go to college can work more during high school. In the major choice case, as mentioned earlier, if individuals who like to work in the labor market work more in high school and choose majors that will facilitate their chances for work in the future, then the relationship between high school work experience and college majors is not causal. Thus, we have an endogeneity problem in our estimate of the effects of high school work experience on college attendance or the choice of college major. However, in the MNL model, to control for the endogeneity is no easy task due to its computational difficulty. Using the probit model, we seriously address this issue.

3-2. Probit models

We classify the academic majors as either 'practical major' or 'non-technical major.' We regard business and engineering (including computer science and architecture) as 'practical majors' compared to other majors. We regard liberal arts and education as 'the non-technical majors' compared to other majors. With the probit model, we first test whether high school work experience is positively related to 'practical major' choice and whether it is negatively related to 'non-technical major.' For college attendance choice, we regard two-year college and four-year college attendance the same as 'college attendance' and apply the following probit model.

3.2.1. Standard Probit model

First, we utilize a standard probit model. Let y_1^* the utility of an individual choosing 'practical major' or 'non-technical major',

$$y_1^* = X_1\beta_1 + \gamma_1 HW_i + u_1 \qquad (3\text{-}6)$$

$$y_1 = 1(y_1^* > 0) \qquad (3\text{-}7)$$

$$u_1 \sim \text{Normal } (0, 1)$$

where y_1 is equal to '1' if an individual choose practical major such as business or engineering at the first college after high school graduation for 'practical major' choice or for 'non-technical major', y_1 is equal to '1' if an individual choose non-technical major such as liberal arts, education. These decisions are assumed to be affected by working experience during high school. HW_i represents the variable which indicates high school working experience as described in the sub-section 3-1.

3.2.2. Probit models with a continuous endogenous variable.

Our main reason to use the probit model is to address the endogeneity issue in the estimation of the effects of high school work experience on college major choice and/or college attendance. One way is to utilize a two-stage method in the probit model suggested by Lee (1981). It is very similar to the two stage least square method (2SLS) in

the linear regression. First, we can estimate the following reduced form of working hours during high school:[75]

$$HW_i = X_i\pi + Z_i\phi + u_2 \qquad (3\text{-}8)$$

where Z_i represents a vector of instrumental variables for the identification of working hours. (In this case, we also assume that (u_1, u_2) has a zero mean, bivariate normal distribution, and is independent of X_i and Z_i.[76])

Next, we run the probit model by plugging in the estimated working hours instead of the working hours themselves, into the structural equation of college major or attendance choice (3-7). By this method, we can consistently estimate the coefficient of 'working hours' with a scaling factor.[77] This scaling factor is not easy to calculate (see Lee 1981) However, this method has additional drawbacks. The usual standard errors and other test statistics are not valid. It provides no easy method to test for endogeneity either.

An alternative approach is the method suggested by Rivers and Vuong (1988). Under the joint normality assumption of (u_1, u_2), with Var(u_1)=1, we can write

$$u_1 = \theta_1 u_2 + e_1 \qquad (3\text{-}9)$$

where e_1 is a random error and is independent of X_i, Z_i and u_2. By plugging (3-9) into (3-6), we get

$$y_1^* = X_1\beta_1 + \gamma_1 HW_i + \theta_1 u_2 + e_1 \qquad (3\text{-}10)$$

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[75] Since it is more difficult to deal with a dummy endogenous variable than a continuous endogenous variable, we use only the 'working hours' variable here.

[76] Under this assumption, we can drive this two stage method by plugging the equation (3-8) into (3-6).

[77] The scaling factor is the root of the variance of the error term of the equation (3-6) when the working hours term HW_i is replaced by its reduced form.

From (3-10) and (3-7), we can drive the following two stage procedure.[78] First, run the OLS regression of (3-8) and save the residuals. Second, run the probit model, by putting the residuals, instead of the error of (3-8), into the structural equation of college major or the attendance choice equation of (3-10). With this method, we can also consistently estimate the coefficients with a scaling factor.[79] Since the usual probit t-statistic on the residual is valid, we can test the null hypothesis that the working hours HW_i is exogenous.

To find appropriate instruments for the identification of the working hour equation is not easy because many background variables and personal characteristics variables seem to be related to both working hours during high school and college attendance or college major choice.[80] Instrument variables should satisfy two conditions. First of all,

instrumental variables should be sufficiently correlated to working hours during high school after other variables which can affect working hours during are controlled for. We can easily test whether instrument variables are sufficiently related to working hours after other variables are controlled for by running the first stage regression. Second, the instrument variables should be uncorrelated to the error term (u_1) of the equation (3-6)- college attendance or practical major choice. However, there is no way to test whether

[78] For a detailed derivation procedure of this two stage method, see Rivers and Vuong (1988).
[79] The scaling factor is the root of the variance of the error term of the equation (3-6) when the error of the reduced form is added to the equation (3-6).
[80] The endogeneity with respect to working hours in college attendance equation might be different from the endogeneity with respect to working hours in practical major choice equation. The endogeneity in college attendance equation comes from simultaneous decisions of college attendance and working hours during high school while the endogeneity comes from a particular omitted variable, a certain tendency to work.

this condition is satisfied.[81] Thus, we usually assume that instruments are not related to error term by reasonable arguments. [82]

However, among possible candidates as an instrument variable, we do not use those variables which are significantly correlated with college attendance or practical major choice.[83] If the coefficient of an instrument variable in the college attendance or practical major choice is significant, it could be so either due to the correlation between the instrument variable and working hours, or because the instrumental variable affects college attendance or major choice directly. The latter possibility is high when including instruments in college attendance or practical major choice equation does not change the size or significance of the coefficient of working hours in those equations. Even though such variables do not guarantee that we use correct instruments, it does not harm our assumptions about the instrumental variables we use.

First, consider the case of college attendance. Four possible candidates are: test scores squared, the dummy which indicates whether the mother works while a student in high school (let call it 'mother work' dummy), 'high reservation wage' dummy and 'will not work' dummy are possible candidates.[84]

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[81] It is impossible because correlation between the observable and the unobservable can not be examined. However, In the standard 2SLS method, when we have more than one instruments, we can test whether additional instruments are not related to the error term by overidentifying restriction test. However, in the 'two stage probit' model case, we do not have such method.

[82] When we have more than one instruments with 2SLS (Two Stage Least Squares), we can test whether instruments except one are correlated to error term by the over-identifying restriction test. However, it is not known how this test can be done in the case of the probit model.

[83] One of meanings of the second condition for instrumental variable is that instrument variables should be redundant in college attendance or practical major choice. Thus, these variables should not affect college attendance or practical major choice directly.

[84] In the HS&B survey, students are asked "what is the lowest hourly wage you would be willing to accept for a job while still in high school" and answered the question as a categorical variable (from below $1.50 to $4.00 or more by every $.50). We make a dummy variable for above $3 categories and a dummy for those who will not work at any wage during high school, and thus, have no reservation wage. We use 'high reservation wage' dummy as an indicator for demands an individual student face in Chapter 1.

While test scores are expected to be linearly related to college attendance, it is non-linearly related to working hours as we see in Chapter 1. Thus, the second order of test scores (test scores squared) are not related to college attendance but sufficiently related to working hours during high school.[85]

The 'mother work' dummy is significantly related to working hours during the senior year as we see in Chapter 1. The problem is whether it is related to college attendance. It is possible that the working mother could either encourage or discourage their children to go to college. A mother's presence at home might help students to concentrate on academic activity after school, thus encouraging them to attend college. However, the working mother also might encourage students to go college through their experience in the world of work.

As we see in chapter 1, the 'high reservation wage' dummy and 'will not work' dummy are significantly related to high school working hours. However, these variables are also expected to be related to college attendance. Students who are determined to go to college would demand higher reservation wage or would not work at any wage during high school. However, as we see in Chapter 1, students who have a higher reservation seem to work more.

However, if 'high reservation wage' dummy indicates the market demand for a student labor,[86] it could affect college attendance directly. Betts and McFarland (1994) show that labor market conditions affect two-year college enrollment. However, when we

[85] Even though this variable satisfies the conditions of instrument variables, One problem with using this variable as an instrument is its strong correlation with the test scores. We do not know what problem this correlation could cause in our estimation of the coefficients of the endogenous variables. In this sense, using this variable is experimental.

include 'high reservation wage' and 'will not work' dummies in college attendance equation, the coefficients of both variables are not significant at all.[87]

In the case of 'practical major' choice, if we assume that the endogeneity related to working hours during high school comes from an individual's unobservable characteristics, such as tendency to work as mentioned in section 2, instrument variables should not be correlated with the unobservable characteristic, tendency to work and should be redundant in the 'practical' major choice.[88] We can consider local economic indicators such as unemployment rate and employment growth rate, as instruments. We can also consider 'high reservation wage' dummy and 'will not work' dummy.

Local economic indicators, unemployment rate and employment growth rate are sufficiently related to working hours during high school and might not be related to 'practical major' choice. In general, the relationship between 'practical major' and high unemployment rate or low employment growth rate could be either positive or negative. Usually, economic expansion will increase demand for the people who are trained in business or engineering areas, encouraging college students to enroll in these areas. However, high unemployment rates could push college students to enroll in these majors because they might think that majoring in these areas might help them to find jobs later.

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[86] In chapter 1, we claim that students who live in better economic condition have higher reservation wage and reservation wage represents the market demand or economic conditions an individual student faces.

[87] It might be because that we regard two-year and four-year college enrollment together as college attendance while Betts and McFarland uses only community college enrollment as the dependent variable. Also, Betts and McFarland examine the effects of cyclical economic conditions (especially unemployment rate among high school graduates) on community college enrollment while 'reservation wage' indicates demand individual student faces at a point in time.

[88] We can not use test scores squared as an instrument because the test scores and 'business or engineering' major choice might be non-linearly related each other. It is because test scores of college students who choose business or engineering as their majors are expected to be in the middle range of the test scores distribution.

However, we can be sure that these variables are not related to an individual unobservable characteristics, especially tendency to work. We can easily think that an individual's innate tendency to work not to be influenced by local unemployment rate or other economic conditions.

In the cases of 'high reservation wage' dummy and 'will not work' dummy, we can think of two contrasting possibilities. First, these variables, especially the 'will not work' dummy could represent a student' tendency to work.[89] We can regard them as proxy variables for the omitted variable-tendency to work. Then, 'high reservation wage' and 'will not work' dummy are expected to be negatively related to 'practical major' choice. Thus, we first test whether these variables are related to 'practical major' choice and check if the coefficient of working hours changes when we include these variables in the practical major choice equation.

The other possibility is that these variables are not related to individual's tendency to work. 'High reservation wage' dummy can represent economic conditions or market demand each individual faces and 'will not work' dummy can represent just a random choice by individual student.[90] In this case, we can use them as instruments because we can assume that they are not related to error term of the practical major choice equation.

In controlling for endogeneity related to working hours in the practical major choice equation, we concentrate on the HS&B male sample because the association

[89] Even reservation wage can represent individual's willingness to work or tendency to work.
[90] Those students who answered "will not work at any reservation wage during high school' is less than 10 percent among all students. 'Will not work' does not seem to be related to any local economic conditions such as unemployment rate or employment growth rate or test scores or family socio-economic backgrounds.

between high school work experience is the strongest among this group and because we have these possible instruments.

3-3. Data.

The current study uses two different data sets: NLS-72 and the HS&B Senior Group data. NLS-72 is a longitudinal survey that originally sampled 22,652 seniors from the high school class of 1972. It contains extensive family background variables, as well as a standardized test score (NLS test score). We restrict the sample to those who responded to the first and second follow-up surveys (1973, July 1974) and took the NLS test. The full sample sizes are 6,763 for males and 7,013 for females respectively. The sub-sample sizes of those who were enrolled in the academic area in the first semester after high school graduation are 2310 for males and 2040 for females.

HS&B is also a longitudinal survey that originally sampled 28,000 seniors and over 30,000 sophomores from 1,100 high schools in 1980. HS&B contains almost the same variables as NLS-72. HS&B has better features for studying high school employment because it contains a labor market indicator file, which showing economic activities of

areas such as county, SAMA, and states. Also, it contains information on working experience during the junior year. We use the senior sample and restrict it to those who responded to the first and second follow-ups and took the NLS test. The sample sizes are 4,063 for males and 4,966 for females. The sub-sample sizes of those who were enrolled in the academic area in the first semester after high school graduation are 1520 for males and 1986 for females.

In these regression analyses, as the control variables we include family's socio-economic status, race, ability measures, types of high school program, regions of high school, community types students have lived in during their high school years, and some other variables for both college attendance and college major choices. Also, the distances from two-year and four-year colleges are included for college attendance choice. Also, we included local labor conditions for the HS&B samples in the control variables for college attendance.

In the NLS-72 and HS&B, a family's socio-economic status is divided into three categories: 'SES-low,' 'SES-medium' and 'SES-hig.' We exclude the 'SES-low' socio-economic status as the comparison group in the regression analysis. We also include race categories such as 'Black', 'Hispanics', 'Asian', 'Native Indian' and 'others' in the control variables. Thus, the excluded category is 'White'. Other family background variables included are the number of siblings and 'any dependents (or child)' which is one if a student has any dependent (or children). These family background variables might affect individual's need or tastes which could affect an individuals' choices of major. In most major choice studies, these variables are included as some of the important determinants of college major choices. (Davies and Guppy 1997).

Four regional categories, 'North East,' 'North Central,' 'West' and 'South' are made and 'North East' is excluded. Three community type categories such as 'Rural Farming', 'Small Town', 'Urban' and 'Suburban' for 1972 and three categories such as 'Rural Farming', 'Urban' and 'Suburban' for 1980 are made and 'Rural Farming' is excluded. The regions might be related to demand for different college majors in the regions, which could affect college major choices. The types of community students

indicate what adults do for their living in that community and what kinds of role models high school students have. For example, in an affluent suburban areas, more adults who are working as professionals or businessmen live there. By seeing the ways of adults live, students might consider their own future careers and choose appropriate majors following their role models.

In the college attendance choice and the choice of field (vocational or academic), we include the averages of mathematics test scores, reading test scores, and vocabulary test scores. However, in the specific major choice for the students in the academic area, we include three basic skills separately: vocabulary, reading and math. Paglin and Rufolo (1990) find that mathematical ability measured in the Graduate Record Exam (GRE) and the Scholastic Aptitude Test (SAT) math test is an important determinant of field choice for college students. Math and science majors are highly likely to require more mathematical thinking or skill while liberal arts might demand more verbal or linguistic skills. If 'working hours' is related to a certain skill or ability, the positive and significant coefficient of 'working hours' might be superficial and simply represent the relationship between major choices and those skills.

Another factor we need to consider in the estimation of influence of high school working experiences on major choices is high school preparation through courses taken during high school. For those who are well trained in mathematics and science during high school, in college science (including math) and engineering major (engineering, architecture, and computer science) might be appropriate. The number of mathematics or sciences courses taken during high school might be important determinants in choosing such majors. If high school workers tend to take more vocational courses such as

business, or trade or health related courses, and avoid math and science courses, it might force student workers to choose business or occupational oriented majors. Because student workers are not prepared for other majors, their major choice can be limited only to a certain kind of major. Thus, we include the number of high school courses students have taken in each major subject areas; mathematics, sciences, English, business and health- related (or other vocational courses). However, the number of courses taken during high school are coded slightly differently in the NLS-72 and HS&B data sets, so the coefficients are not comparable. We also include the grade point average (GPA) as another aspect of high school preparation.

In the HS&B sample for the college attendance, county unemployment rate, employment growth rate, and log county average income are included as additional control variables. Betts and McFarland (1994) show that 1 percent increases in the unemployment rates are associated with about .4 to .5 percent rises in two-year college enrollment.[91]

Means and standard deviations of independent variables and instrumental variables for college students who are in the academic field, are tabulated in the NLS-72 and Table HS&B 3-3-1.[92] By comparing these summary statistics between two years, we notice one big difference across the samples. Blacks and Hispanics are over-represented in the HS&B sample, and thus the percentage of students within the first quartile of socio-

[91] The reason to include log county average income is to see how the local income level may have any effects on students' college enrollment after his or her own family socio-economic background is controlled for. Excluding and including this variable does not change the coefficients of high school work experience variables in the college attendance choice almost at all. However, it is related to college attendance.
[92] For the full samples, see in chapter 1. For all college students, we do not report here. Summary statistics are very similar to college students in the academic field.

economic status are over-represented. This is because the original sample design includes much more minorities than the population.

If the relationship between high school employment and college major choice differs across race or socio-economic status, this sample design might cause some bias of the estimates of the coefficients. To solve this problem, we use the sample weights provided in the original data set.[93]

Table 2-3-3-1: Summary Statistics for Sub-sample of College Students in Academic Field (NLS-72 and HS&B)

Variable Name	Definition	Mean and Standard Deviation (NLS-72 Samples)		Mean and Standard Deviation (HS&B Samples)	
		Male (2310)	Female (2040)	Male (1520)	Female (1986)
WORKING HOURS	Number of working hours per week during high school senior year	12.4 (10.5)	9.1 (9.3)	13.2 (11.6)	11.5 (10.7)
WORK	0-1 dummy variable that equals one if student work during the senior year	.78 (.42)	.69 (.46)	.72 (.45)	.70 (.46)
HEAVY WORK	0-1 dummy variable that equals one if student work more that 15 hours per week	.41 (.49)	.27 (.44)	.46 (.50)	.42 (.49)
WORK JUNIOR	0-1 dummy variable that equals one if student works junior year			.67 (.47)	.59 (.49)
GRADE	Average point of grade during high school. (0-4 scale)	2.55 (.91)	2.89 (.87)	3.09 (.65)	3.24 (.61)
TEST SCORE	NLS average test score of six test categories	54.2 (6.02)	54.8 (6.28)	54.5 (8.10)	52.4 (8.15)
SES-MEDIUM*	0-1 dummy variable that equals one if student's SES is in 2nd and 3rd quartile	.43 (.50)	.44 (.50)	.45 (.50)	.43 (.50)
SES-HIGH	0-1 dummy variable that equals one if student's SES is within 4th quartile	.44 (.50)	.41 (.50)	.33 (.47)	.29 (.45)
BLACK	0-1 dummy variable that equals one if student is black	.07 (.26)	.12 (.32)	.19 (.41)	.21 (.41)

[93] However, the weights are given in the original sample and in the follow-ups might not be appropriate because the samples we are using are the sub-samples of those. Thus we separate the sample into two groups--White only and minority and run the same regressions. By doing so, we can see if there are any differences between Whites and minorities. We do not report the results from separate groups in Tables.

HISPANIC	0-1 dummy variable that equals one if student is Hispanic	.03 (.18)	.03 (.17)	.20 (.40)	.20 (.40)
ASIAN	0-1 dummy variable that equals one if student is asian	.02 (.14)	.02 (.13)	.06 (.23)	.04 (.20)
NATIVE AMERICAN	0-1 dummy variable that equals one if student is native american	.004 (.064)	..006 (.078)	.011 (.105)	.011 (.105)
SIBLINGS	Number of siblings	2.10 (1.77)	2.14 (1.76)	2.86 (2.47)	2.87 (2.12)
ANY DEPENDENT	0-1 dummy variable that equals one if student has any dependent	.06 (.23)	.04 (.19)	.001 (.036)	.011 (.105)
HIGH SCHOOL ACADEMIC	0-1 dummy variable that equals one if student's high school program is academic	.73 (.44)	.72 (.45)	.64 (.48)	.60 (.49)
HIGH SCHOOL VOCATIONAL	0-1 dummy variable that equals one if student's high school program is vocational	.05 (.23)	..07 (.25)	.08 (.28)	.15 (.33)
SMALL TOWN	0-1 dummy variable that equals one if student lives in small town during senior year	.27 (.45)	.29 (.46)		
URBAN	0-1 dummy variable that equals one if student lives in urban area during senior year	.25 (.44)	.27 (.44)	.27 (.44)	.27 (.44)
SUBURBAN	0-1 dummy variable that equals one if student lives in suburban during senior year	.31 (.46)	.28 (.45)	.50 (.50)	.50 (.50)
NORTH CENTRAL	0-1 dummy variable that equals one if student lives in north central during senior year	.26 (.44)	.23 (.42)	.25 (.43)	.25 (.43)
SOUTH	0-1 dummy variable that equals one if student lives in south during senior year	.31 (.46)	.32 (.47)	.33 (.47)	.33 (.47)
WEST	0-1 dummy variable that equals one if student lives in west during senior year	.19 (.39)	.19 (.39)	.20 (.40)	.20 (.40)
DISTANCE TWO-YEAR	Miles from the nearest two-year college	16.4 (25.6)	17.8 (26.3)	14.9 (25.3)	15.7 (26.4)
DISTANCE FOUR-YEAR	Miles from the nearest four-year college	18.2 (25.6)	17.5 (25.1)	16.0 (22.5)	16.0 (22.6)
VOCABULARY SCORE	NLS vocabulary test score	55.1 (9.53)	55.9 (9.71)	54.00 (9.54)	52.1 (9.26)
READING SCORE	NLS reading test score	55.0 (8.52)	55.7 (8.70)	53.8 (9.66)	52.6 (9.30)
MATH SCORE	NLS math test score	57.1 (8.28)	54.7 (8.69)	55.69 (8.73)	52.2 (8.43)
MATH COURSE	Number of math courses taken during high school	5.1 (1.75)	4.3 (1.81)	5.2 (1.56)	4.6 (1.75)

SCIENCE	Number of science courses taken during	4.7	3.9	4.5	3.9
COURSE	high school	(1.90)	(1.80)	(1.82)	(1.86)
ENGLIGH	Number of English courses taken	6.4	6.4	6.0	6.1
COURSE	during high school	(1.24)	(1.30)	(.92)	(.81)
BUSINESS	Number of business courses taken	1.9	2.7	1.34	2.55
COURSE	during high school	(1.91)	(2.8)	(1.67)	(2.18)
HEALTH	Number of health courses taken during	.1	.5	1.01	.95
COURSE	high school	(.60)	(1.38)	(1.89)	(1.80)
MOM WORK	0-1 dummy variable that equals one if	.60	.60	.68	.72
	the mother work during a student's	(.49)	(.49)	(.47)	(.45)
	mother work during his high school				
	years				
U RATE	County unemployment rate			7.33	7.48
				(2.49)	(2.60)
EMP GROWTH	County employment growth rate			.89	1.02
				(3.8)	(3.4)
LOG INCOME	Log county average income			9.15	9.14
				(.23)	(.24)
HIGH RESERVATIO-N WAGE	0-1 dummy that equals one if reservation wage is larger than $3.00			.78 (.42)	.67 (.47)
WILL NOT WORK	0-1 dummy which is equal to zero if student will not work at any wage			.016 (.127)	.014 (.115)

We also tabulate the summary statistics for SES categories for the full sample and the sub-sample of college students in the academic field in Table 2-3-3-2 and 3. The SES distributions are almost the same over two years for the full samples, while the SES distribution among college students in the academic field shifts much. This is because minority students with the same SES have a stronger tendency to go to college if they have the same conditions. Because of this, using weights for the samples of the college students in the academic field might not be appropriate.

Table 2-3-3-2: SES Distribution for the sub-samples of college students in the academic field (weighted)

Variable Name	Definition	Mean and Standard Deviation (NLS-72 Samples)		Mean and Standard Deviation (HS&B Samples)	
		Male (2310)	Female (2040)	Male (1520)	Female (1986)
SES-MEDIUM*	0-1 dummy variable that equals one if	.44	.45	.46	.43
	student's SES is in 2nd and 3rd quartile	(.50)	(.50)	(.50)	(.50)
SES-HIGH	0-1 dummy variable that equals one if	.45	.42	.41	.37
	student's SES is within 4th quartile	(.50)	(.49)	(.49)	(.48)

Table 2-3-3-3: SES Distribution for full samples (weighted)

Variable Name	Definition	Mean and Standard Deviation (NLS-72 Samples)		Mean and Standard Deviation (HS&B Samples)	
		Male (6763)	Female (7013)	Male (4064)	Female (4966)
SES-MEDIUM*	0-1 dummy variable that equals one if	.50	.50	.51	.51
	student's SES is in 2nd and 3rd quartile	(.50)	(.50)	(.50)	(.50)
SES-HIGH	0-1 dummy variable that equals one if	.28	.23	.27	.22
	student's SES is within 4th quartile	(.45)	(.42)	(.44)	(.42)

4. Estimation Results

4-1. College Attendance Choice

Our estimation results for college attendance choice not only confirm previous studies on the relationship between high school work experience and college attendance but also reveal several other characteristics of the relationship. We can summarize our findings as follows: (1) In 1972, after controlling for family background, academic ability and other factors such as region or community types, work experience- especially heavy work experience during the senior year- is negatively related to college attendance. (2) In 1980, the negative relationship between work experience during the senior year and college attendance is very weak while the negative relationship between the work experience during the junior year and college attendance is very strong. (3) These negative relationships are much stronger in the choice of four-year college attendance

than two-year college attendance. (4) The negative associations between college attendance and high school work experience is stronger among males than females. (4) However, controlling for the endogeneity changes these results dramatically. For the 1972 samples, in the probit models for the college attendance, the coefficients of work hours during the senior year are positive while in 1980, the coefficients are still negative. However, endogeneity tests show that there are not significant endogeneity problems in both years.

4-1-1. The MNL model results

The MNL model results for college attendance choice are tabulated in Table 2-4-1-1 and 2, and Table 2-4-1-5 and 6. For convenience, we only report the coefficients of those variables which represent high school work experience mainly.[94] The coefficients of work experience variables indicates their effects on the log odds ratio between two-year college attendance and 'no college' or between four-year college and 'no college.'

To interpret the logit coefficients, we utilize the method used by Rouse (1994). For the dummy variables such as 'work' or 'heavy work', after the MNL regressions are run, first we calculate the predicted probability of choosing each alternative such as 'two-

[94] The coefficients of other variables have expected signs and significance. For example, the coefficients of test scores, medium and high SES are positive and significant. The coefficients of the number of siblings, 'child dummy' are negative and significant. The coefficient of 'academic program' is positive and significant. The coefficients of unemployment rates do not have always the expected sign and significance. Thus, we report the coefficients of county unemployment rate, county employment rates and county log average income in the following table when the 'working hours' and other variables are controlled for.

	Male		Female	
Variable	Two-year	Four-year	Two-year	Four-year
U rate	-.029	-.008	.014	.039
	(.021)	(.020)	(.019)	(.017)
Emp Grow	.019	-.020	.021*	-.004
	(.014)	(.012)	(.012)	(.011)
Log income	-.122	.187	.469*	.652**
	(.323)	(.279)	(.284)	(.258)

year college' or 'four-year college' when the dummy variable is equal to zero and later we calculate the predicted probability when the dummy variable is equal to one. For 'working hours', first we calculate each individual's predicted probability of choosing each alternative using their original values for 'working hours'. Then, we increase 'working hours' by five or ten hours and then, calculate a new probability of choosing each alternative. Lastly, we report the mean differences in the probabilities in Table 2-4-1-3 and Table 2- 4-1-4.

In 1972, after controlling for other variables, the coefficients of 'work,' 'heavy work,' and 'working hours' are significantly negative in most cases. The coefficients of the working hours categories show that particularly working heavily during the senior year is negatively associated with college attendance (see Table 2- 4-1-2 and 3). This result is consistent with the findings of Meyer and Wise (1982) with the NLS-72 data.

This negative association between high school work experience during the senior year and four-year college attendance is stronger than between the work experience and two-year college attendance. The sizes of coefficients and significance of the work experience variables are much larger in the four-year college choice than two-year college choice (see Table 2- 4-1-1 and 2). For males, 'work,' 'heavy work,' a ten 'working hours,' increase are respectively associated with decreases of 3.2 percent, 3.4 percent, and 1.9 percent in the probability of attending a four-year college while there is no such association with attending a two-year college.

This negative association is stronger among males than females. The sizes of the coefficients are much larger among the male sample (see Table 2- 4-1-1 and 2). Table 2-4-1-3 also shows that, 'heavy work' and a ten 'working hours' increase are respectively

associated with a 3 percent, and a 1.2 percent decrease in the probability of attending a four-year college.

In 1980, the negative association between work experience during the senior year and college attendance is much weaker than in 1972. The coefficients of 'work' during the senior year are not negative in some cases, even though they are not significant. The sizes and significance of the negative coefficients of 'heavy work' and 'working hours' decrease greatly (see Table 2- 4-1-5 and 6). [95] After 'working hours' during the

Table 2-4-1-1: College Attendance Choice: Male 6763 (NLS-72)

Variables	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year
Work	-.121	-.330***						
	(.108)	(.093)						
Heavy work			-.189**	-.393***				
			(.083)	(.073)				
Working hours					-.010**	-.020***		
					(.004)	(.003)		
1-15 hours							-.004	-.127
							(.121)	(.104)
16-20 hours							-.103	-.293***
							(.146)	(.127)
21-30 hours							-.060	-.490***
							(.130)	(.116)
More than 30 hours							-.498***	-.647***
							(.152)	(.136)
-2*log-likelihood		3541.5		3557.1		3564.7		3574.5
Psudo R square	.2797		.2716		.2815			.2823

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level'. (3) Each two columns represents one MNL model results. (4) 'Two-year' and 'Four-year' in the first row represent the log odds ratios: the log[probability (two-year college)/probability (no college)], and the log[probability (four-year college)/probability (no college)]. (5) The coefficients of other variables included are not reported. Other variables are test scores, GPA, family's SES, number of siblings, child dummy, high school program, community types, region, distances from the nearest two-year college and four-year colleges.

[95] When the weighted sample is used to accommodate the over-representation of the minorities in the HS&B samples, the coefficients of these variables are still negative but much smaller and are not significant at 10 percent significance level in most cases. When the samples are separated by two groups, (White only and minorities). Only for minorities, are the coefficients of these variables negative and significant.

Table 2-4-1-2: College Attendance Choice: Female 7013 (NLS-72)

Variables	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year
Work	.020	-.049						
	(.091)	(.078)						
Heavy work			-.136	-.279***				
			(.089)	(.078)				
Working hours					-.008*	-.012***		
					(.004)	(.004)		
1-15 hours							.105	.090
							(.101)	(.086)
16-20 hours							.111	-.092
							(.136)	(.119)
21-30 hours							-.116	-.302**
							(.137)	(.121)
More than 30 hours							-.432**	-.363***
							(.204)	(.170)
-2*log-likelihood		3456.2		3468.7		3467.3		3478.5
PsudoR square		.2716		.2726		.2725		.2733

Note: See notes in Table 2- 4-1-1.

Table 2-4-1-3: Changes in the Mean Probability of Attending Two- or Four-Year College (NLS-72)

Independent Variables	Male		Female	
	Two-Year	Four-Year	Two-Year	Four-year
Work	-.2	-3.2	+.4	-.7
Heavy work	-0.7	-3.4	-.4	-3.0
5 working hours increase	-.01	-1.0	-.2	-.6
10 working hours increase	-.03	-1.9	-.4	-1.2

Note: Units are all %.

junior year is controlled for, the coefficients of 'working hours' during the senior year are not significant at all. Table 2-4-1-3 shows that, only without controlling for the work experience during the junior year, 'heavy work' and a ten 'working hours' increase are respectively associated with around a 2 percent decrease, around a 1 percent in the probability of attending four-year college. When we control for work experience during the junior year, the coefficients of the senior year work experience variables are insignificant.

However, for both male and females, the work experience during the junior year is negatively associated with college attendance. The coefficients of 'work junior' and 'working hours junior' are negative and significant in most cases (see Table 2- 4-1-4, 5, and 6). In the 1980 male case, after controlling for working hours during the senior year, 'work junior' is associated with a 4 percent decrease in the probability of attending a two-year college while there is almost no association with attending a four-year college. In the female case, 'work junior' is associated with a 1.4 percent decrease in the probability of attending two-year colleges and a 2 percent decrease in the probability of attending four-year colleges.

We also use the average working hours per week during the senior and junior years to see the effects of average work intensity during high school on the college attendance choice. Also, coefficients of the average working hours are all negative and significant in both two-year and four-year colleges. A ten hour increase in the average working hours is associated with around a 1.5 percent decrease in the probability of attending either two-year or four-year colleges for males, while for females, it is associated with a 1.7 percent decrease in the probability of attending only four-year colleges.

The weaker negative relationship between high school work experience during the senior year and college attendance, especially among females in 1980, could be related to the relationship between work experience and academic ability or family background. In 1980, students (especially female students) with high academic ability and good family background hold jobs more often and work more hours than in 1972 as we see in Chapter 1.

The coefficients of 'working hour' categories during the senior year show that in 1972 the relationship between working hours and two-year or four-year colleges is strictly negative for both males and females, while in 1980 the relationship is non-linear (see the last columns in Table 2-4-1-1 and 2, and Table 2-4-1-5 and 6). Some can claim the non-linear relationship as evidence for the positive effects of the moderate work during high school on educational aspects.[96] However, the strict negative relationship between working hours and college attendance in 1972 and between working hours in the junior year and college attendance in 1980 makes it difficult to maintain such an argument. Also, in 1980 the coefficients of junior working hour categories show a strict negative relationship between working hours and two-year or four-year college attendance, though the results are not reported. We suspect that the non-linear relationship could capture the fact the students with high academic ability and good family background work moderate hours.

Table 2-4-1-4: Changes in the Mean Probability of Attending Two- or Four-Year Colleges: (HS&B)

Independent Variables	Male		Female	
	Two-Year	Four-Year	Two-Year	Four-year
Work	.	.	.	.
Heavy Work	-1.3	-2.3	.8	-2.1
5 working hours increase	-.3	-.5	.2	-.5
10 working hours increase	-.5	-.9	.3	-1.0
Work Junior*	-3.7	+.7	-1.4	-2.0
5 average working hours increase	-.8	-.7	-.2	-.9
10 average working hours increase	-1.5	-1.4	-.4	-1.7

* after controlling for working hours in the senior year

[96] 'Developmental model' assumes that part-time employment could lead to better performance through the character building effects of working experience (Marsh 1991).

Table 2-4-1-5 College Attendance Choice: Male (3941) (HS&B)

Variables	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year
Work	-.042	.024												
	(.102)	(.100)												
Heavy work			-.185*	-.215**										
			(.096)	(.089)										
Working hours					-.007*	-.009**			-.005	-.008**	-.002	-.006		
					(.004)	(.004)			(.004)	(.004)	(.004)	(.004)		
Average working hours							-.009*	-.014***						
							(.005)	(.004)						
Working hours Junior											-.015***	-.010**		
											(.005)	(.004)		
Work Junior									-.285***	-.061			-.309**	-.103
									(.108)	(.102)			(.109)	(.103)
1-14 hours													.218	.297*
													(.139)	(.129)
15-21 hours													.062	.160
													(.144)	(.133)
22-29 hours													-.079	-.311**
													(.156)	(.151)
More than 30 hours													-.088	-.142
													(.149)	(.144)
-2*log-likelihood		1604.7		1611.4		1611.2		1622.9		1618.4		1628.2		1634.9
Psudo R square		.1995		.2003		.2003		.2017		.2024		.2012		.2032

Notes: (1) See notes in Table 2-4-1-1. (2) In the HS&B samples, we also include county unemployment rates, county employment growth rate, and log county average income. (3) The average working hours are the sum of working hours during the senior and junior years divided by 2.

Table 2-4-1-6: College Attendance Choice: Female (4831) (HS&B)

Variables	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year	Two-Year	Four-Year
Work	.039	.053												
	(.092)	(.085)												
Heavy work			.006	-.119										
			(.087)	(.080)										
Working hours					-.001	-.006*			-.001	-.005	-.002	-.006		
					(.004)	(.004)			(.004)	(.004)	(.004)	(.004)		
Average working hours							-.009*	-.014 **						
							(.005)	(.004)						
Working hours											-.012 ***	-.010 **		
Junior											(.004)	(.004)		
Work junior									-.187 **	-.189 **			-.200 **	-.220 ***
									(.090)	(.082)			(.090)	(.083)
1-14 hours													.097	.238**
													(.118)	(.106)
15-21 hours													.229*	.230**
													(.120)	(.111)
22-29 hours													-.219	-.222*
													(.151)	(.137)
more than 30 hours													-.095	-.172
													(.157)	(.156)
-2*log-likelihood		1845.1		1847.5		1848.2		1855.1		1855.2		1864.1		1876.8
Psudo R square		.1848		.1857		.1852		.1858		.1858		.1867		.1880

Note: See note

4-1-2 Probit results

With the probit models, we control for the endogeneity in the relationship between high school work experience and college attendance, and test whether there is endogeneity in the relationship. In the NLS-72 samples, we concentrate on the effects of the 'working hours' during the senior year on the college attendance (either two-year or four-year colleges) because we do not have information on work experience during the junior year. In the HS&B samples, we concentrate on the effects of the 'average working hours' in the senior and the junior years on college attendance. The results are tabulated in Table 2- 4-1-7 and 8, and Table 2- 4-1-9 and 10. Also the tables show whether the instruments are related to college attendance.

Before we use the IV method, we first control for educational aspirations. Three educational aspiration categories-no college attendance, two-year college attendance, and four-year college attendance are made and no college attendance category is dropped. In both 1972 and 1980, when educational aspirations are controlled for, the sizes of the coefficients of working hours are reduced (see column 2 in the tables). These results indicate that students with lower educational aspirations are likely to work more. However, the signs of all the coefficients of working hours are still negative and significant. Also, just including educational aspiration does not solve the endogeneity problem because educational aspirations also could be affected by work experience. The Instrumental variable method might be better in controlling for such endogeneity.

In the 1972 male case, test scores squared is the only instrument to be used. It is not related to college attendance while 'mother work' dummy is significantly related (see

column 5 in Table 2- 4-1-7.) However, test scores squared are sufficiently related to the working hours as we see in Chapter 1.

After the reduced form of the working hour equation is estimated, first the predicted value of working hours is entered into the college attendance equation (column 3, two stage probit suggested by Lee 1981), and second, the residuals from the reduced form working hour equation and working hours are entered into the college attendance equation (column 4, two stage probit suggested by Rivers and Vuong 1988).

The results are mixed. We find the coefficient of predicted working hours to be positive (see column 3). Also, the coefficient of working hours is positive in column 4 and the coefficient of residuals from the reduced form working hour equation is negative in the college attendance equation (see column 4). Thus, the effects of working hours on college attendance seem to be positive. However, due to the large standard error of the coefficient of the residual, we can not claim that there is a strong endogeneity.

In the female case, we use 'mother work' as the instrument because it is not related to college attendance at all (see column 8 in Table 2- 4-1-8). We have the similar results with the male case. The coefficients of predicted working hours or working hours are positive. Also, the coefficient of the residual is negative yet, not significant at a standard significance level (see columns 3 and 4 in Table 2- 4-1-8.)

When we use 'mother work' and test scored squared together as instruments, the sign of the coefficient of predicted working hours is still negative while the sign of the residual of the working hour equation is negative (see columns 5 and 6 in Table 2- 4-1-8.) However, using test scores as an instrument might be questionable in the female case because test scores squared do not seem to be redundant in the college attendance. When

test scores and test scores squared variables are entered together in the college attendance equation, the significance of test scores disappears (see columns 7 in Table 2-4-1-8.)

For the 1980 case, including the educational aspirations reduces the size of the coefficient of 'working hours' for both males and females (see columns 2 in Table 2- 4-1-9 and 10). However, the results using the IV method are quite different from those in 1972. Here we use the averaged working hours during the senior and junior years instead of separating them.[97]

In the male case, we use the 'high reservation wage' dummy, 'will not work' dummy, and 'mother work' dummy variable as instruments. In column 3 and 4 in Table 2- 4-1-9, we use the first two variables as the instruments, and in columns 5 and 6,we use all three variables. These variables are not related to college attendance (see column 7 and 8 in Table 2-4-1-9). The coefficients of the predicted working hours are still negative (see columns 3 and 5 in Table 2-4-1-9). The signs of the coefficients of the residuals are positive and the sizes of them are very small and standard errors are large. There is no evidence for the endogeneity.

In the female case, the 'will not work' dummy seems to be related to college attendance somewhat even though the coefficient of this variable is not significant at the 10% significance level (see column 7 in Table 2- 4-1-10). However, the 'mother work' dummy is not related to college attendance at all. When we use 'mother work' as the instrument, the results are very similar with the male case. The coefficients of the predicted working hours are still negative (see column 3). The sign of the coefficient of the residual is positive, and its size is very small, and standard error is large.

Even when we use two other variables-the 'high reservation wage' dummy and 'will not work' dummy as instruments, the coefficients of the predicted working hours are still negative (see columns 5). Even though the sign of the coefficient of the residual is negative, its size is very small and its standard error is large. We can claim that there is no evidence for the endogeneity in 1980 in the female case either.

In sum, even though the endogeneity tests in 1972 and 1980 show that there is no strong evidence for any endogeneity related to working hours, the signs of coefficients of working hours, predicted working hours, and residuals from two stage probit models for the NLS-72 samples are opposite to the signs for HS&B samples. The quite contrasting results between two years seem to be reasonable if we consider the fact that in 1980, more students with high academic ability and high SES worked than 1972. In 1972, students who had low academic ability and low SES and thus, might have planed not to go college seem to hold jobs more and work longer hours. It is very plausible that for high school student workers who are not able to go to college or plan not to go to college due to lower academic ability or lower SES, working might help them to go college through savings or good work habits if there is any effects from high school work experience on college attendance. Thus, when we control for the endogeneity, the effects of high school work experience are even positive if any.

However, in 1980, students might have worked regardless of their plans of attending college. Students with better family backgrounds and higher academic ability worked more than in 1972. For those students who plan to go college, working might hinder their academic preparation for colleges.

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[97] As we see in the previous regression results, the significant and negative coefficient of working hours are mostly related to the working hours in the junior year.

However, our attempts to control for the endogeneity or to test whether there is endogeneity are based on the assumption that instrumental variables are not related to the error term in equation (3-6). Because we do not have methods to test this assumption, we can not be sure completely that our results are correct. Individuals' unobservable characteristics could be correlated to instruments. In that case, our results from two stage probit models might be wrong. Particularly using the instrument 'high reservation wage' dummy might not be correct because in Chapter 1, we show that this variable represents market demand that an individual student face and is unrelated to test scores. If such market demand affects anyhow a student's decision on college attendance (Betts and McFarland 1994), the results using this variable might not be correct.

Table 2-4-1-7: Male: Probit for College Attendance (NLS-72)

Variables	(1)	(2)	(3) 2SP	(4) 2SP	(5)	(6)
Working Hours	-.010***	-.007***	.009	.007	-.010***	-.010***
	(.002)	(.002)	(.027)	(.027)	(.002)	(.002)
Residuals				-.017		
				(.027)		
Test scores	.048***	.032***	.050***	.050***	.068**	.067**
	(.004)	(.004)	(.005)	(.005)	(.033)	(.033)
Test scrores squared					-.000	-.000
					(.000)	(.000)
Mom work						-.061*
						(.038)
Eud. Aspiration		1.152***				
Two-year college		(.080)				
Eud. Aspiration		1.723***				
Four-year college		(.066)				
	2836.0	3690.4	2802.8	2836.4	2836.4	2839.1
	(.3080)	(.4009)	(.3044)	(.3081)	(.3081)	(.3084)

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,''**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level'. (3) In the columns 3 and 4, the results are from two stage probit models with test scores squared as the instrument. In column 3, 'working hours' represents the estimated working hours instead of the actual working hours. (4) 'Residual' refers to the residuals from the reduced form working hours equation. (5) In the columns 5 and 6, we include test scores squared and 'mom work' dummy just to show whether these variables are related to college attendance. These variables are not included in the columns 1, 2, 3, and 4. (6) In columns 1, 2, 3, and 4, we include all the control variables in the MNL model

Table 2-4-1-8: Female: Probit for College Attendance
(NLS-72)

Variables	(1)	(2)	(3) 2SP	(4) 2SP	(5) 2SP	(6) 2SP	(7)	(8)
Working Hours	-.007***	-.004***	.008	.009	-.004	-.004	-.007***	-.010***
	(.002)	(.002)	(.023)	(.023)	(.019)	(.019)	(.002)	(.002)
Residuals				-.015		-.003		
				(.023)		(.019)		
test scores	.042***	.031***	.042***	.042***	.042***	.042***	.024	.042**
	(.003)	(.004)	(.004)	(.004)	(.004)	(.004)	(.032)	(.004)
test scrores squared							.000	
							(.000)	
Mom work								.024
								(.037)
Eud. Aspiration Two-year college		1.426***						
		(.071)						
Eud. Aspiration Four-year college		1.936***						
		(.060)						
	2822.3	4098.4	2808.9	2822.7	2810.0	2822.8	2809.2	2822.7
	(.3000)	(.4357)	(.2986)	(.3001)	(.2998)	(.3001)	.2990	(.3001)

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level
and 1% level,' '***' means 'significant at less than 1% level'. (3) In columns 3 and 4, the results are from two stage probit models with 'mom work'
as the instruments. (4) In columns 5 and 6, the results are from two stage probit models with test scores squared and 'mom work' as the instruments.
(5) 'Residual' refers to the residuals from the reduced form working hours equation. (6) In columns 7 and 8, we include test scores squared and 'mom work' dummy just to show whether these variables are related to college attendance. These variables are not included in the column 1, 2, 3, 4, 5 and 6. (7) In columns 1, 2, 3, 4, 5 and 6 we include all the control variables in the MNL model.

Table 2-4-1-9: Males: Probit for College Attendance
(HS&B)

Variables	(1)	(2)	(3) 2SP	(4) 2SP	(5) 2SP	(6) 2SP	(7)2SP	(8)
Working hours	-.010***	-.007***	-.011	-.011	-.014	-.014	-.010***	-.010***
	(.002)	(.003)	(.012)	(.012)	(.011)	(.011)	(.002)	(.002)
Residuals				.001		.005		
				(.013)		(.012)		
High reservation wage							-.005	
							(.056)	
Will not work							-.000	
							(.195)	
Mom work								.024
								(.037)
Educational Aspiration		.729***						
		(.074)						
Two-year college								
Educational Aspiration Four-year college		1.243***						
		(.063)						
	1210.2	1624.8	1192.5	1210.3	1193.3	1210.4	1210.3	1214.0
	(.2216)	(.2975)	(.2183)	(.2216)	(.2185)	(.2216)	(.2216)	(.2217)

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level'. (3) In columns 3 and 4, the results are from two stage probit models with the 'high reservation wage' dummy and 'will not work' dummy as the instruments. (4) In columns 5 and 6, the results are also from two stage probit models with the 'high reservation' dummy, 'will not work' dummy and 'mom work' dummy as the instruments. (5) 'Residual' refers to the residuals from the reduced form working hours equation. (6) In the columns 7 and 8, we include the 'high reservation' dummy, 'will not work' dummy and 'mom work' dummy just to show whether these variables are related to college attendance. These variables are not included in the column 1, 2, 3, 4, 5 and 6. (7) In columns 1, 2, 3, 4, 5, and 6 we include all the control variables in the MNL model.

Table 2-4-1-10: Females: Probit for College Attendance (HS&B)

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Working hours	-.0071*** (.002)	-.0069*** (.003)	-.008 (.011)	-.008 (.011)	-.005 (.044)	-.005 (.044)	-.007*** (.002)	-.007*** (.002)
Residuals				.001 (.012)		-.002 (.045)		
High reservation wage							-.033 (.045)	
Will not work							-.187 (.157)	
Mom work								.002 (.004)
Educational Aspiration Two-year college		.705*** (.060)						
Educational Aspiration Four-year college		1.236*** (.055)						
	1398.8 (.2098)	1915.4 (.2873)	1398.3 (.2084)	1398.8 (.2098)	1388.8 (.2083)	1398.8 (.20998)	1400.5 .2101	.1398.8 .2090

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level'. (3) In the columns 3 and 4, the results are from two stage probit models with the 'high reservation' dummy and 'will not work' dummy as the instruments. (4) In columns 5 and 6, the results are from two stage probit models with the 'high reservation wage' dummy, 'will not work' dummy and 'mom work' dummy as the instruments. (5) 'Residual' refers to the residuals from the reduced form working hours equation. (6) In the columns 7 and 8, we include the 'high reservation wage' dummy, 'will not work' dummy and 'mom work' dummy just to show whether these variables are related to college attendance. These variables are not included in the column 1, 2, 3, 4. (7) In columns 1, 2, 3, 4, we include all the control variables in the MNL model.

4-2 College Major Choice.

Our examination of the relationship between high school work experience and the choice of college major reveals several interesting points: (1) When we first distinguish college majors by the academic field and the vocational field, and run the probit model for the choice of the vocational field, there is no relationship between high school work experience and the choice of study field except for the 1972 female case. (2) When we restrict the sample to those who are in the academic area, and run the MNL model for the six major alternatives mentioned earlier, the association between high school work experience and the choice of college major is very strong. Students who work more during the high school senior year tend to choose business or engineering major and avoid the liberal arts or education majors. (3) This tendency is stronger among the 1980 senior cohort than among the 1972 senior cohort, among males than females, and among Whites than minorities. (4) However, in the 1980 female case, work experience during the junior year has the opposite relationship with college major choice to work experience during the senior year. (5) There is no evidence which supports that students who have a certain unobservable characteristic, such as a tendency to work, work more during the high school senior year and choose engineering or business majors as long as our instruments are correct. The high school work experience seems to influence student workers' college major choices.

4-2-1 Vocational field versus Academic field

We make a dummy variable 'the vocational field' and set 'the vocational field' equal to one if a student choose the vocational field and otherwise to zero. With this

variable as the dependent variable, we run the standard probit model. The results are tabulated in Table 2- 4-2-1 and 2. (The coefficients of other control variables are not reported).

For males, after controlling for the background variables, academic ability and the number of courses of each subject area during high school, there is no significant relationship between high school work experience and 'vocational major' choice during both years. However, there is a big change for females. In 1972, female students who work during their senior year are much more likely to choose a vocational major. The coefficients of 'work', 'heavy work,' and 'working hours' are significantly positive. 'Work', 'heavy work,' and a ten hour increase in 'working hours' are respectively related to increases of 3 percent, 3 percent and .3 percent in choosing the vocational field (but marginal effects are not reported.)

In 1980, there is no such relationship shown even for females. The change in the female case might be explained by the two changes in high school employment and college attendance. First, more able and well-off students participated in the labor force and work in 1980 than 1972. Second, the percentage of females who attended four-year colleges rose from 20 percent in 1972 to 36 percent in 1980.

Table: 2-4-2-1: Probit for Vocational Major Versus Academic Major (NLS-72)

	Male (2585)			Female (2531)		
	(1)	(2)	(3)	(1)	(2)	(3)
Work	.098			.120*		
	(.086)			(.066)		
Heavy work		.113			.107*	
		(.069)			(.061)	
Working hours			.004			.007**
			(.003)			(.003)
Grade	-.045	-.045	-.045	-.093**	-.094**	-.093**
	(.045)	(.045)	(.045)	(.041)	(.041)	(.041)
Test scores	-.008	-.008	-.008	-.021***	-.022***	-.022***
	(.008)	(.008)	(.008)	(.007)	(.007)	(.007)
Math course	.014	.015	.015	.010	.009	.010
	(.024)	(.024)	(.024)	(.020)	(.020)	(.020)
Science course	.026	.025	.025	.099***	.099***	.099***
	(.022)	(.022)	(.022)	(.019)	(.019)	(.019)
English course	-.033	-.033	-.033	-.059**	-.059**	-.059**
	(.030)	(.030)	(.030)	(.025)	(.025)	(.025)
Business course	-.029	-.028	-.028	.035**	.035**	.035**
	(.026)	(.026)	(.026)	(.013)	(.013)	(.013)
Health course	.005	.005	.005	-.026	-.025	-.025
	(.059)	(.059)	(.059)	(.039)	(.039)	(.039)
χ square	33.4	33.4	33.4	116.9	116.9	116.9
R Square	(.0191)	(.0191)	(.0191)	(.0469)	(.0469)	(.0469)

Table: 2-4-2-2: Probit for Vocational Major Versus Academic Major (HS&B)

	Male			Female		
	(1)	(2)	(3)	(1)	(2)	(3)
Work	.001			-.056		
	(.091)			(.072)		
Heavy work		.108			.064	
		(.086)			(.067)	
working hours			.005			.003
			(.003)			(.003)
work junior	-.060	-.087	-.098	-.074	-.104	-.106
	(.087)	(.086)	(.086)	(.069)	(.068)	(.068)
Grade	-.172**	-.172**	-.172**	-.166***	-.166***	-.165***
	(.068)	(.068)	(.068)	(.061)	(.061)	(.061)
Test scores	-.027***	-.027***	-.027***	-.027	-.028	-.028
	(.006)	(.006)	(.006)	(.006)	(.006)	(.006)
Math course	-.009	-.009	-.009	-.014	-.014	-.014
	(.026)	(.026)	(.026)	(.002)	(.002)	(.002)
Science course	-.059***	-.059***	-.059***	.021	.022	.021
	(.024)	(.024)	(.024)	(.019)	(.019)	(.019)
English course	-.001	-.001	-.001	-.046	-.045	-.044
	(.034)	(.034)	(.034)	(.032)	(.032)	(.032)
Business course	-.087***	-.087***	-.087***	-.010	-.012	-.012
	(.024)	(.024)	(.024)	(.016)	(.016)	(.016)
Health course	-.017	-.017	-.017	.001	.002	.002
	(.020)	(.020)	(.020)	(.019)	(.019)	(.019)
χ square	242.4	244.2	244.4	176.7	177.0	177.0
R Square	(.1462)	(.1473)	(.1474)	.0812	.0813	.0814

Notes for Table 2- 4-2-1 and 2: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level.' (4) The coefficients of other variables are not reported.

4-2-2 Major choices among college students in the academic field

The MNL results on the choice of college major among college students in the academic field are tabulated in Table 2- 4-2-3~8 and Table 2- 4-2-9~18. The coefficient of each variable indicates the effects of each variable on the log odds ratio between the choice of a certain major of the six categories (business, engineering, health, pre-professional, science, and education), and the choice of 'liberal arts and others.' We report all the coefficients of all the independent variables only once for each sample in the case where the high school work experience is represented as 'working hours.' In other cases, we report only the coefficients of the high school work experience variables ('work,' 'heavy work,' and 'work junior') because they are the variables of current interest and because the coefficients of other variables hardly change when just changing the work experience variable.

For the interpretation of these coefficients, as we do in the case of college attendance choice, the changes in the mean probability in each major choice in the response to changes in the variables of high school work experience are calculated and tabulated separately (Table 2- 4-4-3 and 5 and Table 2-4-2-13, 16, 9, and 18.)

In the tables where we report the all the coefficients, for each major choice, we also report Hausman test statistics for the IIA hypothesis The test statistics are calculated by comparing the estimates of coefficients of the variables from the full samples and the estimates of the variables when each major choice (and the observation in that major) is dropped. When we include all the independent variables, most Hausman tests are not successful because many of coefficients of the independent variables have large standard errors and are not significant, which does not satisfy the conditions for the test. Thus, we

also use the restricted MNL model where we include only the work experience, test scores in math and vocabulary, the number of courses in math and sciences during high school as the independent variables. The reported test statistics are from these restricted models. Even in this case, Hausman test statistics are often negative. However, there is no evidence that these majors are too close to be alternatives to one another. In the cases where the test statistics are valid, the test statistics are very small and almost all the p values are 100 percent (see Hausman test statistics in Table 2- 4-2-3 and 6, and in the Table 2- 4-2-9 and 14).[98]

The MNL results show several important characteristics of the determinants of the college major choices. First, the effects of many family background variables do not seem to be very important in many major choices and are not consistent across samples compared to students' ability and high school preparation. After ability measures, high school grades, the number of courses taken in each subject during high school, and high school programs are controlled for, the coefficients of family SES, race, number of siblings, and whether students have any children or not are not significant in many major choices. Also, the coefficients of these variables are different between gender and between the two years, 1972 and 1980. Also, the effects of regions and community types seems to be different across samples.

Second, the effects of different cognitive skills are important and consistent across samples. Not only mathematical ability but also vocabulary and reading ability matter in

[98] We also examine whether there are any changes in the coefficients in the MNL model with all independent variables when a major and the observation in that particular major is dropped from the sample. Then there are almost no changes in the coefficients.

the choice of college major, while Paglin and Rufolo (1990) single out only the mathematical ability as one important determinant of the choice of college major in terms of cognitive skills. Students with high vocabulary ability tend to choose 'liberal arts and others' majors rather than business, engineering, or science majors. Both male and female students with high math ability tend to choose science and engineering. Male students with high math ability also tend to choose a business major.

Third, high school preparation is very important in the determination of college majors. Students who have taken more high school mathematics courses tend to choose business, engineering, and science majors. In the 1972 female case, the number of mathematics courses is very important in the various major choices such as business, engineering, and science. The number of science courses is one of the significant positive factors in the choices of engineering, health, and science major for both male and female students, while the number of English courses is one of the significant negative factors in choosing the same such majors. Students who have taken more business courses are more likely to choose a business major.[99]

Fourth, most importantly, even after different kinds of abilities and the numbers of courses taken in different subjects are controlled for, 'working hours' in the senior year turns out to be one of the key determinants for the choice of college majors. Most signs of the coefficients of 'working hours' are positive and significant in the choices of business and engineering. [100] Also the coefficients of other variables of work experience during the senior year, 'work,' and 'heavy work' are almost all positive and significant in

[99] However, we can not exclude a possibility that high school students who are going to choose an engineering or a business major might take more courses in mathematics.

the choices of business or engineering. The positive and significant coefficients of these variables indicate the strong association between the high school work experience and lucrative (practical) major choices even after family background, different cognitive skills, and high school preparation are controlled for. Such an association is more evident in 1980 than in 1972, and among male students than among female students.

In 1972, for males the coefficients of 'working hours' are significant and positive in the choice of business major (see Table 2- 4-2-3) and also the coefficients of 'work' and 'heavy work' are significant and positive in the choice of business major (Table 2-4-2-4). The coefficients of these variables are also positive in the choices of engineering, health, pre-professional, and science, even though only the coefficient of 'work' is significant for only the choice of health. These coefficients imply a positive association between high school work experience and more lucrative or practical major choices, and a negative association between high school work experience and liberal arts or education.

In Table 2- 4-2-5, the changes in the mean probability in each major choice in the response to changes in the variables of high school work experience are reported for 1972 males. 'Work' is on the average associated with increases of around 5 percent and 2 percent in the probability of the choices of business major, and health major respectively and decreases of around 4.5 percent of the choice of liberal arts, and 2.5 percent in the choice of education major respectively. 'Working hours' and 'heavy work' shows similar associations. The more a male student works during his high school senior year, the more likely he is to choose a business major rather than 'liberal arts'.

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[100] In 1980, without controlling these factors, even for females the coefficient of 'working hours' for the choice of business major is positive and significant.

Table 2-4-2-3: Male(2310): MNL Results for Major Choice (NLS-72)

Variables	Business	Engineering	Health	Pre-professional	Science	Education
Constant	-.106	-3.548	-3.262	-6.409	-5.414	1.890
	(.719)	(1.027)	(.960)	(1.476)	(1.065)	(.761)
Working hours	.016***	.007	.010	.010	.006	-.009
	(.006)	(.008)	(.007)	(.012)	(.008)	(.007)
Vocabulary score	-.037**	-.036***	-.035***	-.030*	-.024*	-.023
	(.009)	(.012)	(.011)	(.018)	(.011)	(.010)
Reading score	-.040***	.003	-.017	-.025	.020	-.017
	(.010)	(.014)	(.013)	(.020)	(.014)	(.011)
Math score	.035***	.032**	.015	.007	.026*	-.014
	(.011)	(.016)	(.015)	(.022)	(.016)	(.012)
Math course	.162***	.442***	.237***	.047	.175***	.035
	(.045)	(.068)	(.060)	(.086)	(.063)	(.048)
Science course	-.040	.169***	.358***	-.088	.456***	.009
	(.042)	(.054)	(.051)	(.079)	(.053)	(.046)
English course	-.058	-.282***	-.230***	.049	-.336***	.041
	(.056)	(.079)	(.073)	(.102)	(.077)	(.059)
Business course	.276***	.031	-.033	.570	.054	.067
	(.047)	(.084)	(.078)	(.376)	(.090)	(.056)
Health course	.068	.149	.057	.138	-.090	.096
	(.111)	(.125)	(.136)	(.166)	(.174)	(.111)
Grade	.095	.224*	.397***	.291*	.385***	.060
	(.085)	(.114)	(.109)	(.172)	(.115)	(.91)
SES-medium	.367	-.358	.700**	.319	.293	-.064
	(.217)	(.268)	(.304)	(.466)	(.299)	(.212)
SES-high	.545	-.191	1.033***	.333	.395	-.462*
	(.228)	(.277)	(.315)	(.482)	(.309)	(.235)
Black	-.044	-.689	.462	.671	.337	-.508
	(.267)	(.452)	(.338)	(.499)	(.386)	(.292)
Hispanic	-.067	-.332	.513	.	-.837	-.228
	(.370)	(.522)	(.481)		(.788)	(.375)
Asian	.059	-1.111	.207	.	.575	.333
	(.512)	(.814)	(.558)		(.504)	(.502)
Number of siblings	.013	-.127***	-.024	.061	.011	-.027
	(.036)	(.050)	(.046)	(.064)	(.045)	(.040)
Any dependent	.151	.163	.077	-.531	.019	.329
	(.271)	(.445)	(.378)	(.763)	(.447)	(.278)
High school Academic	-.151	.145	.094	.998**	-.077	-.275*
	(.160)	(.242)	(.222)	(.407)	(.234)	(.171)
High school Vocational	.671**	1.454***	.660	.556	-.515	-.138
	(.287)	(.417)	(.459)	(.834)	(.774)	(.339)
Small town	.813***	.140	.470	.110	.181	.156
	(.171)	(.232)	(.220)	(.367)	(.221)	(.188)
Urban	.578***	.314	.626***	.400	.222	-.332
	(.180)	(.227)	(.216)	(.444)	(.225)	(.212)
Suburban	.732***	.340	.690***	.643***	.240	.146
	(.175)	(.220)	(.211)	(.319)	(.215)	(.194)
North central	-.017	.560**	.813***	.227	.700	.106
	(.187)	(.242)	(.229)	(.384)	(.230)	(.210)
South	-.138	.318	.556**	.624	.241	-.173
	(.177)	(.233)	(.222)	(.437)	(.232)	(.203)
West	-.163	.837***	.495*	.481	.780***	.021
	(.215)	(.265)	(.268)	(.411)	(.256)	(.236)
Hausman Test Statistics #	1.99	-.67	.29	.72	.50	-5.77
R Square				.1073		
(χ square)				(878.8)		

Notes: (1) 'Socio-economic status: low' in social economic status is excluded. Excluded race is 'White'. 'General program' category for high school program. 'North Eastern' is excluded for the region. Excluded community of residence is the 'Rural Farming' category. (2) 'Native American' and 'other' categories for the 'race' are included in the regression and is not reported. (3) '.' indicates that the coefficient has huge standard errors due to the small number of individuals who chose that major.

Table 2-4-2-4: Male: MNL Results for Major Choice (NLS-72)

Variables	Business	Engineering	Health	Pre-professional	Science	Education	χ square (R Square)
Work	.435*** (.159)	.162 (.174)	.381** (.186)	.096 (.281)	.208 (.189)	-.041 (.166)	876.1 (.1070)
Work more than 15 hours	.212* (.128)	.115 (.168)	.202 (.158)	.248 (.248)	.084 (.166)	-.086 (.145)	870.5 (.1063)

Note: see notes in Table 2- 4-2-3

Table 2-4-2-5 : Male Changes in the Mean Probability of Choosing Each Major (NLS-72)

Variables	Liberal Arts and others	Business	Engineering	Health	Pre-professional	Science	Education
Work	-4.6	+4.8	-.8	+2.1	+.2	+.3	-2.4
Heavy work	-2.3	+3.4	+.2	+1.2	+.6	+.1	-1.9
Working hours(+5)	-1.7	+1.1	+.00	+.2	+.1	+.0	-.8
Working hours (+10)	-2.4	+2.1	+.06	+.4	+.2	+.0	-1.6

Note: The numbers are percents.

In the 1972 female case, the association is much weaker. The coefficient of 'working hours' is positive in the choices of business and health majors while it is negative in the choices of engineering, pre-professional, or science. However, none of the coefficients of 'working hours' are significant (see Table 2- 4-2-6). The coefficient of 'work' is positive in the choices of business, engineering, health, and pre-professional while is negative in the choices of science and education majors. None of these variables are statistically significant. The coefficient of 'heavy work' is positive in the choices of business, health while is negative in the choices of engineering, pre-professional and science. Only for the choice of business, is the coefficient of 'heavy work' significant.

Nonetheless, the average changes in the probability of choosing each major show that female students with heavy work experience are more likely to avoid the 'liberal arts and others' and more likely to choose business or health majors than other students (see Table 2- 4-2-8). For example, 'heavy work' is associated with around a 3 percent decrease in the probability of choosing the 'liberal arts and others' and around a 2 percent increase in the probability of choosing either business or health majors.

Table 2-4-2-6 : Female(2040): MNL Results for Major Choice (NLS-72)

Variables	Business	Engineering	Health	Pre-professional	Science	Education
Constant						
	-.398	-3.923	-2.378	-4.017	-7.787	2.626
	(1.048)	(2.434)	(1.002)	(2.340)	(1.340)	(.624)
Working hours	.012	-.013	.013	-.038	-.009	.000
	(.010)	(.024)	(.009)	(.027)	(.011)	(.008)
Vocabulary score	-.016	-.057	-.011	.029	-.013	-.028**
	(.014)	(.030)	(.012)	(.031)	(.015)	(.008)
Reading score	-.044***	.021	.003	.001	.001	-.020**
	(.015)	(.035)	(.014)	(.036)	(.018)	(.009)
Math score	.004	.010	-.015	.129	.056**	-.008
	(.016)	(.038)	(.017)	(.147)	(.021)	(.010)
Math course	.188***	.404***	.228***	.129	.182**	.128***
	(.067)	(.152)	(.062)	(.147)	(.074)	(.040)
Science course	.048	.364***	.371***	.081	.509***	.072*
	(.067)	(.126)	(.032)	(.136)	(.061)	(.039)
English course	-.135*	-.167	-.411	-.086	-.203**	-.018
	(.081)	(.184)	(.077)	(.178)	(.089)	(.046)
Business course	.176***	-.005	.020	-.077	-.115	.000
	(.038)	(.012)	(.048)	(.125)	(.075)	(.029)
Health course	.070	-.830	.006	.145	-.076	-.086
	(.099)	(.824)	(.094)	(.181)	(.106)	(.075)
Grade	.109	.268	.421***	.304	.491***	-.067
	(.132)	(.302)	(.126)	(.302)	(.159)	(.079)
SES-medium	.001	-.627	.139	-.418	-.232	-.287*
	(.284)	(.654)	(.278)	(.648)	(.313)	(.177)
SES-high	.148	.004	.292	-.831	-.337	-.492**
	(.315)	(.663)	(.293)	(.710)	(.333)	(.193)
Black	.167	-.378	.586*	-1.092	.902***	-.789***
	(.323)	(.809)	(.313)	(.897)	(.383)	(.223)
Hispanic	.034	.387	.721	.546	.858	-.338
	(.501)	(1.166)	(.502)	(.905)	(.653)	(.349)
Asian	.220	.450	.736	.	.351	.020
	(.684)	(1.138)	(.523)		(.714)	(.443)
Number of siblings	.018	-.031	.005	.265***	.033	.022
	(.052)	(.124)	(.048)	(.099)	(.057)	(.032)
Any dependent	.507	.	.011	.	-.912	-.079
	(.394)		(.518)		(1.066)	(.299)
High school Academic	-.215	-1.207***	.130	-.396	.190	-.141
	(.241)	(.521)	(.242)	(.536)	(.324)	(.144)
High school Vocational	1.031***	.885	-.499	-.224	-1.153	-.037
	(.311)	(.758)	(.578)	(1.129)	(1.176)	(.260)

Small town	.270	-.316	.227	.424	-.257	.220
	(.246)	(.647)	(.221)	(.655)	(.284)	(.148)
Urban	-.240	.561	-.109	1.048*	-.063	-.107
	(.267)	(.558)	(.233)	(.597)	(.282)	(.157)
Suburban	.103	.569	-.498	1.118*	.532**	.115
	(.275)	(.573)	(.578)	(.623)	(.262)	(.164)
North central	.401	.187	.720***	.414	.683**	.184
	(.327)	(.657)	(.244)	(.671)	(.276)	(.174)
South	.735**	.233	.214	.835	.377	.291
	(.304)	(.555)	(.230)	(.568)	(.263)	(.156)
West	.796**	.343	.630**	-.222	.349	.143
	(326)	(.683)	(.267)	(.743	(.332)	(.189)
	-.45	.18	11.6	-3.2	-2.01	3.69
R Square			.1184			
(χ square)			(710.7)			

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level'. (3) 'Socio-economic status: low' in social economic status is excluded. Excluded race is 'White'. 'General program' category for high school program., 'North Eastern' for the region are excluded. Excluded community of residence is the 'Rural Farming' category. (4) 'Native American' and 'other' categories for the 'race' are included in the regression and is not reported. (5) '.' indicates that the coefficient have huge standard errors due to the small number of individual s who chose that major.

Table 2-4-2-7: Female: MNL Results for Major Choice (NLS-72)

Variables	Business	Engineering	Health	Pre-professional	Science	Education	R Square (χ square)
Work	.033	.055	.246	.060	-.216	-.048	.1186
	(.203)	(.436)	(.184)	(.447)	(.207)	(.121)	(712.1)
Heavy work	.353*	-.335	.271	-628	-.172	.172	.1178
	(.205)	(.519)	(.189)	(.560)	(.238)	(.125)	(.707.1)

Note: See the notes in Table 2-4-2-6.

Table 2-4-2-8: Female: Changes in the Mean Probability of Choosing Each Major (NLS-72)

Variables	Liberal Arts and others	Business	Engineering	Health	Pre-professional	Science	Education
Work	+.1	+.2	-.8	+3.4	+.9	-1.6	-1.3
Work more than 15 hours	-3.3	+1.9	-.4	+2.0	-.7	-1.6	+2.3
Working hours(+5)	-.2	+.4	-.1	+.7	-.04	-.3	-.2
Working hours (+10)	-.4	+.7	-.1	+1.3	-.07	-.7	-.3

Note: The numbers are percents.

For the HS&B samples, the results are tabulated in the Table 2- 4-2-9~13 for males and for females, in the Table 2- 4-2-14~18. Here, 'work,' 'heavy work,' and 'working hours' represent the work experience during the senior year and 'work junior' and 'working hours junior' represent the work experience during the junior year. In general, the association between high school work experience and college major choice

are stronger in 1980 than 1972. In general, the work experience during high school is positively associated with the choices of business or engineering majors and negatively associated with liberal arts and education majors. Also, in the male case, differently from 1972, the work experience is negatively associated with the choice of science major. These associations are much stronger among males than females.

In the 1980 male case, the coefficients of 'work,' 'heavy work,' or 'working hours' in the senior year are almost always significant and positive in the choices of business or engineering in preference to 'liberal arts and others'[101] (see Table 2- 4-2-9 and 10). Table 2-4-2-11 shows that 'work' is associated with a 5 percent decrease in the probability of choosing liberal arts, while associated with about a 5 percent increase in the probability of choosing business. 'Heavy work' is associated with a 5 percent decrease in the probability of choosing liberal arts, and is associated with increases of about 5 percent , 3 percent increases in the probability of choosing business, and engineering respectively. 'Heavy work' is also associated with a 2 percent decrease in the probability of choosing science and education. A ten hour increase in working hours per week during the senior year is associated with a 2.6 percent decrease in the probability of choosing liberal arts and with a 2.2 percent, 1.3 percent increase in the probability of choosing business and the probability of choosing the engineering majors.

When we use the weights to accommodate the over-representation of Blacks and Hispanics, these associations become much stronger. The coefficients of 'working hours,' 'work,' and 'heavy work' are more than doubled (see Table 2- 4-2-12). Table 2- 4-2-13 shows that 'work' is associated with an 8 percent decrease in the probability of choosing

liberal arts, while associated with about a 7 percent increase and a 9 percent increase in the probability of choosing business and the probability of choosing engineering respectively. Also, it is associated with a 5 percent decrease in the probability of choosing science, and is associated with about a 3 decrease in the probability of choosing education. 'Heavy work' is associated with a 11 percent decrease in the probability of choosing liberal arts, and is associated with increases of about 8 percent, and 10 percent in the probability of choosing business, and engineering respectively. 'Heavy work' is also associated with decreases of 3 percent and 4 percent in the probability of choosing science and education respectively. A ten hour increase in working hours per week during the senior year is associated with a 5.6 percent decrease in the probability of choosing liberal arts and with increases of 2.8 percent, and 4.6 percent in the probability of choosing business and engineering majors respectively. These results using weighted data indicates that the association between high school work experience and college major choice is much stronger among Whites than minorities.[102]

However, in all these regressions, the coefficients of 'work junior' are negative in the choices of business or engineering, even though they are not significant after controlling for the work experience during the senior year. 'Work junior' might capture the different characteristics of those who have worked during the senior year. Without controlling for the work experience during the senior year, the coefficients of 'work junior' are positive in the choices of business or engineering (not reported).

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[101] Even though the coefficient of 'working hours' is positive, significant and bigger than those in the choices of business or engineering, the number of students who choose that major is small (just 17) and the meanings of the coefficient is relatively not important.

[102] When the samples are separated in two groups (Whites and minorities) and the same regressions are run, the results are very contrasting (not reported). While there is no significant relationship between high school work experience and college major choice for only minorities, there are strong associations for Whites.

Table 2-4-2-9: Male (1520): MNL Results for Major Choice (HS&B)

Variables	Business	Engineering	Health	Pre-professional	Science	Education
Constant	-.287	-2.979	-6.857	-5.990	-4.810	1.474
	(.809)	(.851)	(1.924)	(2.768)	(1.351)	(1.130)
Working hours	.020***	.015**	.007	.062**	-.001	-.000
	(.007)	(.007)	(.015)	(.024)	(.010)	(.011)
Work junior	-.264	-.200	-.196	.002	-.254	.127
	(.169)	(.166)	(.356)	(.638)	(.228)	(.262)
Grade	.037	.190	.632	-.105	276	-.170
	(.134)	(.137)	(.317)	(.458)	(.199)	(.197)
Vocabulary score	-.024**	-.030***	-.008	.056	-.001	-.053***
	(.010)	(.010)	(.024)	(.038)	(.016)	(.014)
Reading score	-.007	.006	-.015	-.052*	-.005	-.014
	(.010)	(.011)	(.024)	(.029)	(.016)	(.017)
Math score	.002	.022**	.003	-.011	.035***	.010
	(.008)	(.009)	(.017)	(.027)	(.015)	(.012)
Math course	.105*	.379***	-.007	-.213	.225**	.063
	(.054)	(.063)	(.137)	(.198)	(.091)	(.079)
Science course	-.077	.137***	.507***	.396**	.312***	-.010
	(.047)	(.049)	(.135)	(.186)	(.077)	(.071)
English course	.013	-.226***	-.124	-.102	-.376***	.011
	(.080)	(.083)	(.178)	(.257)	(.108)	(.110)
Business course	.312***	-.149**	-.078	.201	-.095	-.029
	(.045)	(.055)	(.120)	(.155)	(.081)	(.075)
Health course	-.184***	-.045	-.039	-.057	-.040	-.158**
	(.044)	(.041)	(.096)	(.139)	(.062)	(.062)
SES low-medium	-.046	.101	.361	.	.041	.055
	(.233)	(.234)	(.512)		(.341)	(.330)
SES high-medium	-.148	.029	-1.534*	.225	-.149	-.064
	(.223)	(.222)	(.824)	(.636)	(.326)	(.321)
SES high	.099	-.155	.869*	-.706	.096	-.299
	(.222)	(.223)	(.479)	(.790)	(.367)	(.339)
Black	.089	.259	-.233	1.140	.021	-.393
	(.224)	(.226)	(.610)	(.723)	(.331)	(.346)
Hispanic	.066	.230	1.270***	.338	.010	-.360
	(.221)	(.223)	(.417)	(.832)	(.321)	(.332)
Asian	.353	1.044***	1.070	.	1.221***	.303
	(.435)	(.371)	(.733)		(.443)	(.540)
Number of siblings	.102**	.094**	.055	.271***	.182***	.048
	(.045)	(.043)	(.104)	(.100)	(.056)	(.065)
High school Academic	-.129	.261	.020	-.934	.082	-.332
	(.184)	(.196)	(.427)	(.655)	(.286)	(.262)
High school Vocational	-.402	.246	-.209	-.220	.108	-.332
	(.293)	(.318)	(.856)	(.815)	(.499)	(.407)
Urban	.577**	.202	.745	.753	.269	-.041
	(.228)	(.226)	(.517)	(.831)	(.297)	(.314)
Suburban	.430**	.128	.645	.689	-.173	-.126
	(.198)	(.194)	(.470)	(.759)	(.267)	(.320)
North central	.482**	.732***	1.210**	.819	.261	1.133***
	(.224)	(.218)	(.516)	(.893)	(.310)	(.396)
South	.576***	.825***	1.458***	.622	.837**	1.003**
	(.218)	(.215)	(.487)	(.845)	(.290)	(.391)
West	.299	.602	.148	.361	.464	1.244***
	(.256)	(.246)	(.617)	(.980)	(.336)	(.419)
Hausman Test	-4.67	9.33	1.39	-.89	.75	-22.7
(p value)		(.9994)				
R Square			.1346			
(χ square)			(662.5)			

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level.' (3) 'Socio-economic status: low' in social economic status is excluded. Excluded race is 'White.' 'General program' category for high school program is excluded. 'North Eastern' is excluded for the region. Excluded community of residence is the 'Rural Farming' category. (4) 'Native American' and 'other' categories for the 'race' are included in the regression and is not reported. Also, the coefficients of 'child' is not reported here. (5) '.' indicates that the coefficient has huge standard errors due to the small number of individuals who chose that major.

Table 2-4-2-10: Male: MNL Results for Major Choice (HS&B)

Variables	Business	Engineering	Health	Pre-professional	Science	Education	χ square (R Square)
Work	.411**	.170	.072	.719	.021	.384	
	(.180)	(.173)	(.371)	(.717)	(.236)	(.271)	
Work junior	-.254	-.165	-.176	.259	-.270	.023	651.4
	(.171)	(.169)	(.361)	(.632)	(.231)	(.264)	(.1324)
Heavy work	.450***	.309**	.015	1.206**	-.079	-.111	
	(.157)	(.156)	(.337)	(.594)	(.210)	(.237)	
Work junior	-.238	-.183	-.152	.162	-.240	.149	661.5
	(.167)	(.164)	(.351)	(.627)	(.224)	(.259)	(.1344)
Working hours	.020***	.016**	.003	.062	-.240	.149	
	(.007)	(.007)	(.015)	(.026)	(.224)	(259)	
Working hours	-.006	-.009	.007	.002	-.012	.009	663.3
junior	(.07)	(.007)	(.015)	(.025)	(.010)	(.010)	(.1348)
Average	.014*	.007	.009	.060	-.012	.007	651.3
working hours	(.008)	(.008)	(.018)	(.026)	(.012)	(.012)	(.1324)

Note: (1) See notes in the Table 2- 4-2-9.

Table 2-4-2-11: Male: Changes in the Mean Probability of Choosing Each Major (HS&B)

Variables	Liberal Arts and Others	Business	Engineering	Health	Pre-professional	Science	Education
Work	-5.0	+4.6	+.2	-.2	+.4	-1.2	+1.3
Heavy work	-5.1	+5.6	+3.2	-.5	+1.0	-2.2	-2.0
Working hours	-1.3	+1.1	+.7	-.04	+.3	-.4	-.3
(5, 10)	-2.6	+2.2	+1.3	-.09	+.7	-.9	-.6
Work junior*	+3.2	-2.8	-1.3	-.1	+.3	-.1	+1.7
Working hours	+.5	-.3	-.6	+.0	-.3	+.5	+.1
junior (5, 10)	+1.0	-.6	-1.2	+.1	-.6	+.9	+.2
Average	-.8	+.8	+.3	-.0	+.3	-.6	+.1
working hours	-1.6	+1.6	+.6	-.1	+.7	-1.2	+.1

Notes: (1) The numbers are percent. (2) The changes in the probability in response to 'work junior' changes are calculated after the work experience in the senior year is controlled for.

Table 2-4-2-12: Male: Weighted MNL Results for Choice of Each Major (HS&B)

Variables	Business	Engineering	Health	Pre-professional	Science	Education	χ square (R Square)
Work	.651**	.687**	.285	1.742	.267	-.203	
	(.214)	(.255)	(.706)	(.901)	(.326)	(.359)	
Work junior	-.248	-.160	-.300	-.702	.243	.353	68760.9
	(.248)	(.237)	(.572)	(.766)	(.308)	(.378)	(.1507)
Heavy work	.802***	.841***	-.398	3.348**	.114	-.237	
	(.225)	(.218)	(.574)	(.100)	(.309)	(.334)	
Work junior	-.228	-.139	-.138	-.820	.144	-.237	76041.5
	(.243)	(.229)	(.564)	(.685)	(.300)	(.334)	(.1582)
Working hours	.036***	.042***	.016	.153	.005	-.016	
	(.010)	(.010)	(.028)	(.041)	(.015)	(.015)	
Working hours junior	-.228	-.139	-.138	-.820	.144	.356	65422.40
	(.243)	(.229)	(.564)	(.685)	(.300)	(.370)	(.1601)

Note: (1) See notes in Table 2- 4-292.

Table 2-4-2-13: Male: Changes in the Mean Probability of Choosing Each Major with Weights (HS&B)

Variables	Liberal Arts and Others	Business	Engineering	Health	Pre-professional	Science	Education
Work	-8.1	+7.0	+8.7	+.1	+1.0	-5.1	-3.3
Heavy Work	-11.1	+8.0	+9.7	-2.3	+2.4	-2.7	-3.9
Working Hours	-2.6	+1.5	+2.4	-.1	+.7	-.7	-1.0
(5, 10)	-5.3	+2.8	+4.6	-.2	+1.7	-1.5	-1.8

Note: (1) The numbers are percents. (2) 'Work junior' is controlled for.

For the case of 1980 females, from Tables 2-4-2-14, 15, 16, 17, and 18, we can observe several characteristics of high school work experience and college major choices. First, even for females, work experience is a key determinant of female students' choices of college major. Second, however, the association is much weaker than in the male case. Third, the negative association between the work experience during the junior year and business or engineering majors is much stronger than for males. Fourth, even in the female case, these associations seem to be much stronger among Whites than minorities.

The coefficient of 'working hours' is positive and significant only in the choice of the engineering major. The coefficients of 'heavy work' are positive and significant in the choices of business and engineering. 'Heavy work' is associated with about a 3 percent decrease in the probability of choosing liberal arts, while is associated with increases of

about 3 percent, and 2 percent in the probability of choosing business, and engineering respectively. A ten hour increase in working hours per week during the senior year is associated with a 1 percent decrease in the probability of choosing liberal arts and with a 1 percent increase in the probability of choosing an engineering major. The coefficients of 'work' in the senior year are not significant in almost all cases.

However, when the weighted data are used, these associations are much stronger. 'Work' is associated with a 3.6 percent decrease in the probability of choosing liberal arts, while is associated with about a 3.4 percent increase in the probability of choosing engineering. 'Heavy work' is associated with a 4 percent decrease in the probability of choosing liberal arts, while associated with increases of about 3.9 percent , and 4.3 percent increases in the probability of choosing business and engineering respectively. 'Heavy work' is also associated with a 2.4 percent decrease in the probability of choosing science. A ten hour increase in working hours per week during the senior year is associated with a 1.4 percent decrease in the probability of choosing liberal arts and with increases of 1.0 percent and 2.1 percent in the probability of choosing business and engineering majors respectively. Again, these results using weighted data indicate that the association between high school work experience and the choice of college major is much stronger among Whites than minorities.[103]

However, in all these regressions, regardless of holding the work experience during the senior year constant, the coefficients 'work junior' are negative and significant in the choices of business or engineering. However, when we include 'working hours

[103] When the sample are separated by two groups (Whites and minorities) and the same regressions are run, the results are once again very contrasting. While for minorities there is no significant relationship between high school work experience and college major choice, there is strong association for Whites.

junior' instead of 'work junior', the coefficients of 'working hours junior' are not significant. We suspect that 'work junior' could represents a certain characteristic of students who work during their junior year.

Table 2-4-2-14: Female (1986): Male: MNL Results for Major Choice (HS&B)

Variables	Business	Engineering	Health	Pre-professional	Science	Education
Constant	.668	-1.612	-2.449	-3.216	-6.080	2.059
	(.698)	(1.206)	(1.113)	(2.112)	(1.283)	(.851)
Working Hours	.005	.017*	-.005	.006	.006	.004
	(.006)	(.009)	(.010)	(.010)	(.010)	(.007)
Working Junior	-.338**	-.422*	-.270	-.176	-.176	-.007
	(.132)	(.194)	(.202)	(.213)	(.213)	(.163)
Grade	.130	.192	.270	.338	.338*	-.150
	(.117)	(.181)	(.184)	(.206)	(.206)	(.138)
Vocabulary	-.034***	-.051***	-.041***	-.016	-.016	-.040***
Score	(.009)	(.013)	(.013)	(.016)	(.016)	(.010)
Reading Score	-.006	.012	.000	-.009	.009	-.009
	(.008)	(.013)	(.013)	(.016)	(.016)	(.010)
Math Score	.006	.041***	-.001	.002	.043**	.004
	(.006)	(.013)	(.009)	(.018)	(.015)	(.008)
Math Course	.126***	.436***	.136*	.096	.105	.058
	(.042)	(.073)	(.070)	(.120)	(.077)	(.051)
Science Course	-.071	.018	.398***	-.180*	.364***	-.017
	(.038)	(.055)	(.065)	(.090)	(.070)	(.046)
English Course	-.096*	-.333***	-.075	-.063	-.198	.013
	(.072)	(.107)	(.121)	(.240)	(.130)	(.091)
Business Course	.318	.069	.054	.018	.056	-.002
	(.032)	(.048)	(.052)	(.240)	(.058)	(.039)
Health Course	.036	.002	.068	-.119	.007	.063
	(.036)	(.057)	(.052)	(.119)	(.064)	(.042)
SES Low-Medium	.049	.022	.441	.572	-.357	-.144
	(.184)	(.267)	(.272)	(.502)	(.317)	(.221)
SES High-Medium	.131	.101	.111	.176	-.399	-.009
	(.187)	(.268)	(.296)	(.559)	(.317)	(.223)
SES High	.072	-.672**	-.199	.327	-.162	-.442*
	(.085)	(.285)	(.294)	(.519)	(.282)	(.223)
Black	-.183	-.090	-.236	.773*	.799***	-.985***
	(.188)	(.280)	(.287)	(.469)	(.306)	(.246)
Hispanic	.080	-.056	.030	.109	.570*	-.290
	(.183)	(.277)	(.285)	(.508)	(.307)	(.218)
Asian	-.091	-.290	.425	.	.341	-1.144**
	(.343)	(.472)	(.443)		(.458)	(.561)
Siblings	.035	.014	-.061	.001	-.023	-.038
	(.038)	(.056)	(.060)	(.112)	(.064)	(.051)
High School	.091	.059	-.011	.640	.061	.109
Academic	(.156)	(.236)	(.242)	(.454)	(.277)	(.182)
High School	.650***	.453	.027	-.238	-.923	-.241
Vocational	(.210)	(.343)	(.384)	(.826)	(.645)	(.291)
Urban	-.047	-.334	-.002	-.156	.257	-.496**
	(.186)	(.280)	(.276)	(.590)	(.310)	(.217)
Suburban	-.032	-.098	-.362	.615	-.001	-.527***
	(.163)	(.235)	(.250)	(.492)	(.282)	(.185)

North Central	-.271	.001	.960***	-1.175	.040	.239
	(.188)	(.286)	(.313)	(.623)	(.294)	(.234)
South	.058	.719**	1.038***	.368	.222	.568***
	(.181)	(.263)	(.367)	(.453)	(.287)	(.226)
West	-.325	.197	.702*	-.137	.451	.235
	(.205)	(.316)	(.358)	(.544)	(.318)	(.253)
Hauman Test	-6.26	1.74	-3.21	-.71	1.95	-48.3
R Square	.1141					
(χ square)	748.8					

Notes: See notes in Table 2-4--2-9.

Table 2-4-2-15: Female: MNL Results for Major Choice (HS&B)

Variables	Business	Engineering	Health	Pre-professional	Science	Education	χ square (R Square)
Work	-.028	.099	.213	.083	-.089	.126	
	(.142)	(210)	(.224)	(.400)	(.230)	(.176)	
Work junior	-.303**	-.360*	-.350*	.126	-.122	-.018	745.7
	(.133)	(.196)	(.204)	(.375)	(.218)	(.163)	(.1136)
Heavy work	.208*	.385**	-.081	-.094	.018	.088	
	(.130)	(.190)	(.206)	(.360)	(.211)	(.157)	
Work junior	-.353**	-.412**	-.282	.168	-.152	-.005	750.3
	(.132)	(.193)	(.200)	(.369)	(.211)	(.161)	(.1143)
Working hours	.005	.019**	-.007	.001	.003	.005	
	(.006)	(.009)	(.010)	(.017)	(.010)	(.008)	
Working hours	-.008	-.017	-.006	.004	.006	-.004	743.6
junior	(.006)	(.010)	(.010)	(.018)	(.010)	(.008)	(.1133)
Ave Working	-.004	.002	-.013	.005	.008	.001	736.4
hours	(.007)	(.011)	(.012)	(.020)	(.012)	(.009)	(.1122)

Note: See notes in Table 2- 4-2-10.

Table 2-4-2-16 : Female: Changes in the Mean Probability of Choosing Each Major (HS&B)

Variables	Liberal Arts and Others	Business	Engineering	Health	Pre-professional	Science	Education
Work	-.8	-1.4	+.5	+1.3	+.1	-.7	+1.2
Heavy work	-2.8	+2.7	+2.3	-1.2	-.4	-.1	-.1
Working hours	-.5	+.2	+.5	-.4	-.0	-.1	+.0
(5, 10)	-1.0	+.4	+1.0	-.8	+.6	-.2	+.0
Work junior	+4.7	-4.6	-1.9	-.8	+.6	+.0	+2.0
Working hours junior (5, 10)	+.6	-.6	-.5	-.1	+.1	+.3	+.0
	+1.2	-1.1	-1.0	-.2	+.2	+.5	+.2
Ave Working hours	+.2	-.4	+.1	+.1	+.1	+.3	+.2
	+.4	-.9	+.2	+.2	+.1	+.6	+.4

Note: See notes in Table 2- 4-2-11

Table 2-4-2-17: Female: Weighted MNL Results for Major Choice (HS&B)

Variables	Business	Engineering	Health	Pre-professional	Science	Education
Work	.130	.648**	.301	.378	-.267	.040
	(.197)	(.325)	(.326)	(.624)	(.355)	(.254)

Work in Junior	-.499**	-.480*	-.063	.227	.000	.094	50946.0
	(.193)	(.289)	(.282)	(.480)	(.295)	(.234)	(.1555)
Heavy Work	.327*	.749**	-.040	-.208	-.096	.046	
	(.189)	(.291)	(.285)	(.493)	(.302)	(.222)	
Work in Junior	-.541**	-.482*	.010	-.385	-.062	.095	45571.1
	(.192)	(.292)	(.276)	(.539)	(.294)	(.234)	(.1569)
Working Hours	.010	.033**	-.004	.004	.004	-.002	
	(.009)	(.014)	(.012)	(.021)	(.016)	(.010)	
Work junior	-.524***	-.500*	.017	.358	-.100	.116	47681.0
	(.193)	(.296)	(.277)	(.505)	(.294)	(.236)	(.1562)

Note: See notes 2-4-2-10.

Table 2-4-2-18: Female: Changes in the Mean Probability of Choosing Each Major with Weights (HS&B)

Variables	Liberal Arts and Others	Business	Engineering	Health	Pre-professional	Science	Education
Work	-3.6	+.4	+3.4	+1.5	+.4	-2.4	-.8
Heavy work	-3.9	+3.9	+4.3	-1.2	-.7	-1.4	-1.2
Working hours	-.7	.6	+1.1	-.3	-.1	+.0	-.5
(5, 10)	-1.4	+1.0	+2.1	-.6	-.2	+.0	-.9

Note: See notes 2- 4-2-11.

From these results of the four samples, male and female in both years (1972 and 1980), we can conclude that among college students who are in the academic field, students who have worked especially long hours during the high school senior year tend to choose college majors which can lead to high paying jobs, such as business or engineering, and to avoid liberal arts and education majors.

However, these associations are much stronger in 1980 than 1972, and among males than females. The stronger association in 1980 than 1972 seems to be related to the changes in the characteristics of student workers observed in Chapter 1. As we see in Chapter one, more students with high academic ability held jobs and worked more often in 1980 than in 1972. In 1972, even if we assume that the high school work experience might make students more practical, it might be difficult for students with low academic ability to choose business or engineering because the courses being taught in these majors

could be much more technical and require higher academic ability than courses being taught in the liberal arts and education.

The weaker association among females might be explained by that for female students the jobs in the health and education fields might be also attractive because many females work in these areas. The coefficients of work experience variables are often significant among the choices of majors such as health and education.

4-2-3 Probit results

By using the probit model, we test whether students with work experience tend to choose a 'practical major.' 'Practical majors' include the majors of business or engineering. Usually, these majors lead to high paying jobs later. However, often, other majors such as health, science, and pre-professional are also very technical or lead to high paying occupations, thus we also test whether students with work experience avoid 'non-technical major.' 'Non-technical majors' includes only liberal arts and education. The results of standard probit model are tabulated in Table 2- 4-2-19 and Table 2- 4-2-17.

The results are consistent with the MNL results. For males, the work experience during the senior year is positively associated with 'practical major' and is negatively associated with 'non-technical major.' Almost all the coefficients of 'work,' 'heavy work,' and 'working hours' during the senior year are positive and significant in the 'practical major choice.' In 1980, at the mean values of other control variables, students who worked during the high school senior year have 5 percent higher probability of choosing 'practical major' than those who do not work at all. Students who work more than 14 hours per week during the high school senior year have a 9 percent higher

probability of choosing 'practical major' than those who work 14 hours or less. A working hour increase per week increases the probability of choosing the 'practical major' by .4 percent (Marginal effects are not reported.)

The coefficients of 'heavy work' and 'working hours' are significantly negative in the 'non-technical major' choice. In 1980, students who work more than 14 hours per week during the high school senior year have 7 percent lower probability of choosing 'non-technical major' than those who work 14 hours or less. A working hour increase per week decreases the probability of choosing the 'practical major' by .3 percent (Marginal effects are not reported.) However, in 1980, the signs of coefficients of the variables which represent the work experience during the junior year are in the opposite direction even though the coefficients are not significant (Table 2- 4-2-17).

For females, signs of the coefficients for those variables are almost the same as in the male case. The coefficients of 'heavy work,' and 'working hours' during the senior year are positive in the 'practical major' and are negative in the 'non-technical major.' However, they are rarely significant. Only the coefficient of 'heavy work' in 1980 is positive and significant in the 'practical major choice.' Female students who work more than 14 hours per week during the high school senior year have about a 6 percent higher probability of choosing 'practical majors' than those who work 14 hours or less. (Marginal effects are not reported.)

Also in 1980, like the male case the signs of coefficients of the variables which represent the work experience during the junior year, are in the opposite direction of the signs of the coefficients of the senior work experience variables. Particularly, the

coefficients of 'work junior' are significant in all cases.[104] Regardless of controlling for the work experience during the senior year, female students who work during their junior year 6 to 7 percent have lower probability of choosing 'practical major' and more than 7 percent higher probability of choosing 'non-technical major.'

Table 2-4-2-19 : Probit models: Practical majors and non-technical majors: Male and female (NLS-72)

	Male		Female	
Variables	Practical Major (business or engineering)	Non-technical Major(liberal arts and education)	Practical Major (business or engineering)	Non-technical Major(liberal arts and education)
	Male		Female	
Work	.156**	-.183***	.032	-.042
	(.071)	(.066)	(.091)	(.068)
Heavy Work	.091*	-.112*	.092	-.027
	(.058)	(.057)	(.094)	(.072)
Working Hours	.007***	-.008***	.016	-.002
	(.003)	(.003)	(.041)	(.003)

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level.' (3) Each cell represent a result from the probit model. (4) Test scores and the number of courses in each subject taken during high school are also included in the control variables. All other variables are included and the coefficients are not reported. (5) R Square and χ square are not reported.

Table 2-4-2-20 : Probit models: Practical majors and non-technical majors: Male and Female (HS&B)

	Independent Variables	Male (1520)		Female (1986)	
		Practical Majors	Non-technical major	Practical Majors	Non-technical major
(1)	Work	.124*	-.088	-.016	.003
		(.077)	(.080)	(.070)	(.068)
	Work junior	-.083	.111	-.160**	.179***
		(.075)	(.078)	(.065)	(.063)
(2)	Heavy work	.234***	-.201***	.151**	-.085
		(.069)	(.072)	(.063)	(.061)
	Work junior	-.101	.132*	-.194***	.197***
		(.073)	(.076)	(.064)	(.062)
(3)	Working hours	.010***	-.009***	.005*	-.003
		(.003)	(.003)	(.003)	(.003)
	Work junior	-.110	.145*	-.188***	.195***
		(.074)	(.077)	(.064)	(.063)

[104] When we put 'heavy work' or 'working hours' during the junior year instead of 'work junior', the coefficients are not significant at all.

(4)	Working hours	.011***	-.009***	.005	-.002
		(.003)	(.003)	(.003)	(.203)
	Working hours junior	-.004	-.005	-.006*	.005
		(.003)	(.003)	(.003)	(.007)
(5)	Working hours	.009***	-.008**	.003	-.001
		(.003)	(.003)	(.003)	(.003)
(6)	Heavy work	.214***	-.174**	.113*	-.047
		(.067)	(.070)	(.062)	(.060)
(7)	Work hours junior	-.001	.002	-.004	.004
		(.003)	(.003)	(.003)	(.003)
(8)	Heavy work junior	.044	-.015	-.080	.074
		(.068)	(.071)	(.065)	(.063)
(9).	Work junior	-.046	.085	.180**	-.164***
		(.071)	(.074)	(.061)	(.062)

Notes: See notes in Table 2-4-2-19.

The main purpose of using the probit model is to control for the possible endogeneity in the relationship between high school work experience and college major choice. We focus on the 1980 male sample because the association between the work experience and college major choice is very strong, and only in 1980, do we have some instruments to identify the working hour equation. Our results indicate that there is no such endogeneity in the relationship.

The results are tabulated in Table 2- 4-2-21. In the first two columns (1) and (1)', we use unemployment rate and growth rates as instruments, in the columns (2) and (2)', we use 'high reservation wage' dummy, and the 'will not work' dummy as instruments. in the columns (3) and (3)', we use all four together as instruments, in the columns (4) and (4)', we use 'high reservation wage' dummy, the 'will not work' dummy, and employment growth rate as instruments.

Before we use these variables as instruments, we test (1) whether these variables are redundant in the probit model for 'practical major' and (2) whether they are

sufficiently correlated with 'working hours' during the senior year.[105] These test results are tabulated in Table 2- 4-2-22 and 23.

First of all, as we mentioned earlier, if the tendency to work cause such association between high school work experience and 'practical major' choice and the 'will not work' dummy represents students' tendency to work, 'will not work' dummy may be negatively related with the 'practical major' choice. The coefficient of the 'will not work' dummy in the column 1 in Table 2- 4-2-22 is not significant at all, showing that there is no such relationship between 'will not work' dummy and 'practical major choice. Even though the coefficient is negative, the very large standard error makes the existence of such a correlation very doubtful. Also, including this variable does not change the coefficient of working hours.

Also, 'high reservation wage' dummy could represent individual student's willingness to work. However, when we include both 'will not work' dummy and 'high reservation wage' dummy together, the coefficients of both variables are not significant and the coefficient of working hours does not change almost at all. These results themselves could be indirect counter evidence for the endogeneity in the relationship between working hours and practical major choice if these variables represent student workers' tendency to work.

However, if the 'will not work' dummy represents an individual student's random choice of working during high school and if 'high reservation wage' dummy represents just market demand, these variables are good instruments to identify the working hours equation. The following appendix table 1 shows such possibilities that among college

[105] In the usual two stage least regression, over-identifying restriction test is generally used. However, in the

students in the academic field, the 'high reservation wage' dummy represents market demand and has nothing to do with individual ability, and 'will not work' dummy is just random choices by high school students, being unrelated to either market demand and individual ability.[106] If reservation wage represents an individual's ability, students with higher reservation wages should have on average higher test scores. However, there is no difference in average test scores across. However, the average economic conditions are much better for student with the highest reservation wages than for student group with the lowest reservation wages. However, both the average test scores and economic conditions for students who 'will not work' at any wage during high school are very similar to the average test scores and economic conditions for the whole college students in the academic field.[107]

Appendix Table 2: Reservation Wages, Test Scores and County Economic Conditions among White College Students in Academic Field.

	Reservation wage equal to $2.00 or less	Reservation wage above $2.00 and less than $3.00	Reservation Wage between $3.00 and $3.50	Reservation Wage above $3.50	Will not work
Test Scores	56.7	56.1	56.4	56.5	57.3
	(7.64)	(7.20)	(6.76)	(7.09)	(7.41)
County Unemployment Rate	8.01	7.92	7.06	6.92	7.03
	(2.86)	(2.71)	(2.50)	(2.33)	(2.43)
Employment Growth rates	.59	.99	.94	1.23	1.02
	(3.57)	(3.13)	(2.72)	(3.26)	(3.73)
Percentage of People employed	42.2	42.3	44.3	45.2	43.7
	(6.61)	(5.75)	(5.66)	(5.00)	(4.64)
Log County Per Capita Income	8.42	8.79	10.56	11.25	10.85
	(4.92)	(4.27)	(3.75)	(3.58)	(4.42)

Note: Standard errors are in parentheses.

two stage probit, we are not sure whether such a method works.

[106] A similar results for the full samples are reported in appendix table in Ch. 1.

'High reservation wage' dummy and the 'will not work' dummy are not related to the choice of college major (see columns 1 and 3 in Table 2-4-2-22.) and can be assumed not to be related to tendency to work, which is the omitted variable that causes the endogeneity.

County unemployment rate and employment growth rate are not related to the choice of college majors (see columns 2 in Table 2-4-2-22). All the coefficients are very insignificant. The problem is whether these variables are sufficiently related to 'working hours' during the senior year. From Chapter 1, we see that, for the full samples, which include all high school graduates, these variables are sufficiently related to 'working hours.' Now we use only college students in the academic field, we need to test whether their relationships are different. Table 2-4-2-23 shows that 'will not work' dummy and 'high reservation wage' dummy are sufficiently related to working hours while county unemployment rate and county employment growth rate are not significantly related to working hours.

Finally, the two stage probit results for practical major choice in Table 2- 4-2-21 show that there is no evidence for the endogeneity we expect. Except for column (1), the coefficients of predicted working hours are still positive (see columns 2, 3, 4) even though we can not tell the significance because of invalid standard errors and the scaling factor of them. Except for the column (1)', the coefficient of residuals from the first stage regression of working hours are all negative and insignificant (see columns 2', 3', 4'.) Thus, if there are any relationship between practical major choice and unobservable

[107] However, we can not claim that appendix table 1 proves that these instruments are not related to the error term in the equation (3-6).

characteristics, the relationship is negative. In that case, our estimates could be downward bias instead of upward bias.

In the cases of column (1) and (1)', since the correlation between 'working hours' and the two instruments; unemployment rate and employment are not significant, such results might occur.

However, once again our forgoing results are based on the assumption that instruments- especially 'high reservation wage' dummy and 'will not work' dummy- are not related to the error term in the equation (3-6). Even if these instruments are not related to a particular omitted variable, tendency to work, we can not exclude the possibilities that these instrumental variables are related to the rest of error term. In the case where the instruments are related to the error term, our attempts to control for the endogeneity or test the endogeneity should be wrong.

Table 2-4-2-21: Male practical major cases: Endogeneity s issue: (HS&B)

	(1)	(1)'	(2)	(2)'	(3)	(3)'	(4)	(4)'
Working hours		-.022 (.019)		.027 (.019)		.022 (.019)		.023 (.019)
Predict working hours	-.022 (.060)		.027 (.019)		.023 (.018)		.023 (.019)	
Residual from 1st reg		.032 (.060)		-.018 (.019)		-.013 (.019)		-.013 (.019)
	99.6 (.0472)	109.4 (.0519)	101.4 (.0481)	109.9 (.0522)	100.9 (.0479)	109.6 (.0520)	100.9 (.0479)	109.6 (.0520)

Notes: (1) Standard errors are in the parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level.' (3) Test scores and the number of courses in each subject taken during high school is also included in the control variables. All other variables in the previous regressions are included and the coefficients are not reported. (4) In columns 1 and 1', county unemployment rate and employment growth rates are used as instruments. In the columns 2 and 2', 'high reservation wage' dummy and 'not work' dummy are used as instruments . In columns 3 and 3', all these variables are used as instruments. In columns 4 and 4', 'high reservation wage' dummy , 'will not work' dummy and county employment growth rate are used as instruments.

Table 2-4-2-22: The probit for the practical choice: Instruments and practical major choice. (HS&B)

	(1)	(2)	(3)	(4)	(5)
Working hours	.010***	.010***	.009***	.009***	.009***
	(.003)	(.003)	(.003)	(.003)	(.003)
Working hours in junior	-.004	-.004	-.005	-.005	-.005
	(.003)	(.003)	(.003)	(.003)	(.003)
Will not work dummy	-.050		.011	.012	.012
	(.261)		(.267)	(.268)	(.268)
Unemployment rates		-.001		.000	
		(.014)		(.014)	
Employment growth		-.006		-.006	-.006
rate		(.009)		(.009)	(.009)
High reservation wage			.081	.081	.081
dummy			(.086)	(.085)	(.085)
	109.2	109.5	110.1	110.5	110.5
	(.0518)	(.0520)	(.0522)	(.0524)	(.0524)

Notes: (1) Standard errors are the parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level'. (3) Test scores and the number of courses in each subject taken during high school is also included in the control variables. All other variables including 'are included in the previous regressions and the coefficients are not reported.

Table 2-4-2-23: OLS for Working Hours During the Senior Year: Instruments and working hours. (HS&B)

	(1)	(2)	(3)	(4)
will not work dummy		-4.271*	-4.263*	-4.290*
		(2.201)	(2.200)	(2.199)
unemployment rates	-.121		-.059	
	(.117)		(.116)	
employment growth rate	.122		.126*	.130*
	(.076)		(.075)	(.075)
High reservation wage		3.696***	3.668***	3.694***
dummy		(.686)	(.687)	(.687)
R square	.1837	.2031	.2049	.2047

Notes: (1) Standard errors are in parentheses. (2) '*' means 'significant between 10% level and 5% level,' '**' means 'significant between 5% level and 1% level,' '***' means 'significant at less than 1% level.'.(3) All other variables such as test scores, test scores squared, GPA, high school program, race, region, community type, 'mother work' dummy, family SES are included.

5. **Conclusion.**

Previous studies on the effects of high school employment on post-secondary education find that the more students work during high school, the less likely they are to attend college and the less likely they are to finish their degrees if they go to college. Using NLS-72 and HS&B, first we reexamine the relationship between high school

employment and college attendance, and second, we explore the relationship between high school work experience on the choice of college major among college attendees.

In the relationship between high school work experience and college attendance, we not only confirm the findings of previous studies but also observe several other characteristics: (1) In general, work experience, especially heavy work experience during the senior year is negatively related to college attendance. However, this relationship has changed over time. In 1972, the work experience during the senior year is negatively related to college attendance. In 1980, the negative relationship between work experience during the senior year and college attendance is weakened, while the negative relationship between the work experience during the junior year and college attendance is very strong. (2) These negative relationships are much stronger in the choice of four-year college attendance rather than two-year college attendance. (3) The negative relationship is stronger among males than females. (4) After controlling for endogeneity, in 1972, the working hours during the senior year affects college attendance positively, while in 1980 the average working hours during high school affects it negatively. However, endogeneity tests do not provide evidences that there are significant endogeneity in the relationship between high school work experience and college attendance. Also, since we can not prove that the instruments we use in two stage probit models are completely valid, we can not completely be sure that these results from two stage probit model are always correct.

Also, we find that high school work experience has strong associations with the choice of college major. Among college students in the academic field, students with much work experience in their high school senior year chose majors associated with higher paying jobs. The longer students work during their senior year, the more they are

likely to choose practical majors such as engineering or business, and the more they are likely to avoid non-technical majors such as liberal arts and education. These tendencies are more apparent among males than females. These tendencies are much stronger in 1982 than 1980. These results are consistent with Light's finding (1999) that among non-college bound male students, those who worked during high school took more vocational courses. Students with work experience tend to choose skill oriented or technical oriented education.

When we control for a possible endogeneity related to the working hours in the probit framework, our results indicate that the work experience seem to influence students' choices of college majors rather than a certain unobservable characteristic (a tendency to work) causes such relationship between high school work experience and the choice of college major. Also, endogeneity test results show no evidence for such endogeneity in the relationship between high school work experience and the choice of college major.

However, as mentioned earlier, we need to admit that our results are based on the assumption that instruments are valid. Since there is no way to test these instruments meet all the requirements as a good instrument, we can not be sure our results from the two stage probit models are completely valid ones.

If these instruments are valid, with our results we can explain, at least partially, the fact that students who worked during high school, especially during their senior year, earn more later or obtain higher occupational status later even though they have generally lower post-secondary educational attainment. If high school work experience leads to higher later earnings and higher later occupational status, it might not be because of high

school work experience itself, but because of the choices of education or training that high school student workers make afterwards.

Students with work experience during high school are more practical in later choices of their education later. High school student workers seem to choose education with higher economic returns and avoid the education with lower economic returns. According to a standard human capital theory, generally individuals will choose the major offering the highest present value of life-time earnings. However, individuals might have different tastes for their future earning streams or different information on the future earnings. Early work experience change either students' perception of the future earnings or information on future earnings.[108]

However, after controlling for work experience in the senior year, students who ever worked during their junior year are more likely to choose liberal arts and education and to avoid business or engineering majors than those students who did not work at all during their junior year. Among females, even without controlling for work experience during in the senior year, those who work during their junior year tend to choose liberal arts or education and avoid the business or engineering major.[109] If early work experience generally makes students more practical in choosing their education, why do working experiences in two different years have different effects? Even though work experience during the senior year is the most common work experience among high school students,

[108] With respect to this issue, Eide and Waehrer's results (1996) provide a very interesting point. They find that the expected earning is negatively related to females' choices of college major. We do not expect females to dislike higher earnings.

[109] However, the coefficients of 'heavy work junior,' or 'working hours junior' in the MNL models for the choices of college major or the probit models for practical major or non-technical major are not significant at all for both males and females, meaning that work intensity during the junior year does not matter.

why do work experiences in two different years have the opposite effects? This question is should be addressed in further research.[110]

However, also further studies should resolve others issues remaining unsolved in this study. First, we do not understand why high school work experience has such effects on the choice of college major. We do not have any information to find out why student workers choose more practical majors and avoid non-technical majors. Is it because work experience makes them know and understand better about the reality of the world of work, and/or which majors or skills are valuable in the market ? Or is it because, as Greenberg and Steinberg claim, work experience (or money making or spending experience) makes them more materialistic or selfish ? Further research is required to understand the effects of high school employment more accurately.

Third, in this study we have not studied the links between major choices and later earnings. Even though studies which use NLS-72 and HS&B data sets show that higher wage premiums for the 'practical major' and lower wage premiums for the 'non-technical major,' all studies classify major field based upon four-year college degree.[111] For the full explanation of higher later earnings and lower post-secondary educational attainment of high school student workers, we need to investigate the links from the major choices to later earnings.

[110] To address this issue, we need to use a MLE method because we have a dummy endogeneous variable in the binary dependent framework.

[111] To see how the working experience affects major field choice in the senior year in college, we use the MNL method to major field choices. The results do not have much differences.

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