Educational Tracking, High School Employment and College Entry in Taiwan

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Abstract:

The purpose of this study is to investigate the interaction of educational tracking and early employment, and the impacts of these interactions on academic achievements for Taiwanese youth. A rich longitudinal youth data - Taiwan Youth Project (TYP) Phase I (2000-2007) in the Taiwan area is used. The results show that early employment during high school years does not have significant impacts on the scores of college entrance examination for students in general track, but increases the probability of entering university of science and technology and labor market. On the contrast, for students in vocational track, the experience of part-time work significantly lower their scores of college entrance examination, and consequently the probability of entering university of science and technology, and substantially increase the probability of entering labor market. Father's education plays an important role in educational tracking behavior and later academic achievement for students in different track.

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1. Introduction

Educational tracking has long been applied to both eastern and western educational system to allocate pupils at some stage of their career between primary and tertiary school to different tracks, which usually differ in the curriculum offered as well as in the average cognitive talent of enrolled students. How the tracking may affect levels and dispersions of academic achievement, and whether the tracking reinforces preexisting inequality in academic achievement among students with different family background become the major concerns for policy makers and social scientists (Gamoran and Mare, 1989; Dustmann, 2004; Bauer and Riphahn, 2006; Hanushek and Wobmann 2006). Meanwhile, working during high school is gradually common among today's youth. Whether employment during high school affect youth's achievement and later labor market productivity becomes another important concerns for both policy makers and social scientists (Griliches, 1980; Ruhm, 1997; light, 1999; Hotz, et.al., 2002; Rothstein, 2007). Would early employment interact with educational tracking to aggrandize or alleviate the inequality of academic achievements? That is, would early employment help less able youth to allocate their time more efficiently, learn about labor market skill, or increase their absenteeism and even worsen their academic achievements? The purpose of this study is to investigate the possibility of the interaction of educational tracking and early employment, and then the impacts of these interactions on academic achievements for Taiwanese youth.

The contribution of this study to the existing literature is three-folded. First of all, a point of departure from previous research in this study is to incorporate the educational tracking with early employment. Theoretically, both educational tracking and employment during high school have two opposing arguments at work. Efficiency provides the main positive argument for tracking, that it is much easier for teachers to teach at lower variance classes. Teachers can focus on the ability level of particular group of students. Peer effect is one of the arguments against tracking. By tracking, the most able students may benefit from being with each other. However, the lower ability students may loose from not having able peer group around. Similarly, early employment has two opposing factors. On one hand, employment while in school

may help youths learn to allocate their time more efficiently, and motivate them to study harder so that they can achieve a higher career goal. On the other hand, youth employment may substitute with their study and diminish their time and energy for study and completing homework, and thus adversely affect their academic achievement. A more able student may have different responses from early employment from a lower ability student does. To examine the interactions between tracking and early employment provides the better understanding in youth's academic achievements.

Secondly, we use a rich longitudinal youth data - Taiwan Youth Project (TYP) Phase I (2000-2007) in the Taiwan area- for this study. There are only few panel studies of youth in the West and most are attached with the more general household survey. TYP, instead, places youth as the central focus and extends to parents. Different from other youth studies which usually are restricted to teen years, TYP examines the transition from early adolescence to young adulthood. TYP panel study is designed to follow adolescent samples from early teenagers into young adulthood. This research design enables us to understand the tracking behavior of youth and the interaction with part-time work during high school years. TYP has the advantage of large sample size, starting with adolescents, and collecting both survey and interview data.

Thirdly, we extend the existing literature from western world to eastern educational system. In Taiwan and in other Chinese societies, academic achievements are often closely associated with personal well-being. Unlike western parents, Chinese parents consider early employment as an alternative activity which may crowd out the normal study time and thus adversely affect children's academic outcomes. Part-time work during high school year is generally not encouraged in Chinese family and educational agents. The impacts of part-time work on academic achievements in a Chinese society (Taiwan), and their interface with tracking system would provide valuable insights.

The next section describes the educational tracking in Taiwanese schooling system. The academic achievements are the main concerns in this study. Two academic outcomes are measured, which are the scores of college entrance examinations and

the college-employment choices. The corresponding estimation models for two academic outcomes are given in Section 3. In Section 4, the youth data from Taiwan Youth Project (TYP), which are used to in this study, are described. Section 5 reports results for the effects of the interactions between educational tracking and early employment. Section 6 discussed some implications of these results.

2. Educational Tracking in Taiwan

The education system in Taiwan is comprised of six years of primary school, three years of junior high, three years of senior high school, four-seven years of college or university, one-four years of a graduate school program, and two-seven years of a doctoral degree program. A nationwide compulsory education has been launched for primary and junior high school students since 1968. After nine years of compulsory education, school tracking system start to allocate fifteen-year-old students to different tracks mainly based on a nationwide entrance examination and self selection. The allocation to different track is therefore nonrandom. The school tracking takes the form of well-defined separate segments in the education process, typically specializing in general and vocational education. For general-education track, junior high school graduates take three years of senior high school. For vocational-education track, junior high school graduates are admitted into either three years of senior vocational school or five years of junior college. The differences between general and vocational education are in the curriculum offered as well as in the average cognitive talent of enrolled students. Vocational education offer courses in areas such as agriculture, industry, business, maritime studies, marine products, medicine, nursing, home economics, drama and art.

Educational tracking is severe in Taiwan. Above the secondary education, both senior high school graduates and senior vocational school graduates can have various college-entry choices and employment choice. For college-entry choices, there are four-year general university, four-year universities of science and technology, and two-year junior college. The admissions to various types of tertiary education depend on the scores of general-college-entrance examinations or two-year and four-year vocational-entrance examinations. Due to the differences in the curriculum offered,

however, the probabilities of switching between general-education track and vocation-education track are relatively low. Table 1 present the college-entry and employment choices of senior high school graduates and senior vocational school graduates of J1 and J3 samples in Taiwan Youth Project (TYP), in which J1 and J3 samples represent 2006 and 2004 secondary school graduates in Taiwan. Table 1 shows that, among senior high school graduates, 74% enter general university, only 10% enter university of science and technology, 13% delay their education by either going to cram school or graduating in later year, and only 2% decide to enter labor market. On contrast, among senior vocational school graduates, only 4.7% enter general university, 57% enter university of science and technology, 17% delay their education by either going to cram school or graduating in later year, and 22% decide to enter labor market. Since the percentage of five-year junior college students are small and their college-entrance and employment choice will be in later year, we concentrate our study on students from senior high school and senior vocational school.

The main purpose of vocational education addresses the interests and needs of students and allows them to receive the relevant occupational training that they would need. Due to the dramatic economic development over the last four decades, especially in 1970s, and 1980s, the demand for tertiary education increases consequently. In order to extend vocational education to higher education level, Taiwanese government set up the first four-year university of science and technology in 1973. Since then, the number of four-year universities of science and technology increase to ninety-three in 2007. Furthermore, the secondary education policy decided to reverse the ratio of students in general-education track v.s. vocational-education track since 1990s by expanding senior high school and shrinking vocational secondary school. Figure 1 shows the historical trend of number of students in general track and in vocational track. The numbers of senior high school students rise significantly, and the number of senior vocational school student and five-year junior college decline dramatically since 1990s. Consequently, the ratio of students in senior high school, in senior vocational school, and in five-year junior college becomes 52：38：10 in 2005.

3. Empirical Model

To investigate the impacts of part-time work in different educational tracking, two later academic outcomes are measured in this study. The first one is the scores of entrance examination for general university and for the university of science and technology. The second academic outcome is college-employment choice. To apply for four-year general university, the score of entrance examination for general university is required. On the contrary, to apply for four-year universities of science and technology, the scores of entrance examination for the university of science and technology are required. The entrance examination for general university comprises five subjects. They are Math, Chinese, English, Natural science, and Social Science. Each subject has maximum fifteen grade points, and the total score points is 75. The entrance examination for the university of science and technology takes three subjects: Math, Chinese, and English. Each subject has maximum 100 points. In order to make the comparison between these two tracks feasible, we rescale the total score points of these two examinations into maximum 100 points.

To examine college-employment choices, four categories of choices are classified. They are general university, university of science and technology, employment, and delayed. The employment category includes graduates who are currently employed either at home or at a firm and who are currently looking for jobs. The delayed group comprises students who are currently not graduated from secondary education or who are entering cram school to prepare for the next year entrance examinations. As shown in Table 1, the large percentage of senior high school graduates enters general university, while the majority of senior vocational school enters the university of science and technology. The estimation models for these two academic outcomes are described as following.

A. Scores of college-entrance examination

The differences between general and vocational education are in the curriculum offered as well as in the average cognitive talent of enrolled students in these two tracks. The scores of college-entrance examinations and the college-employment behaviors of students in different tracks might be correlated with the educational

tracking behavior when the students graduated from junior high school. The impacts of part-time works in these two tracks are expected to be different. The endogenous switching regression is applied. Let D denote the educational tracking behavior of junior high school graduates at the end of grade 9. If a junior high school graduate enters senior high school, D equals to 1. If he/she enters senior vocational school, D equals to 0. Let y_1 and y_0 symbolize the scores of college entrance examinations of senior high and senior vocational school graduates respectively, and E denotes the employment variables during grades 10-12. We observe the scores of senior high school graduates only when he/she is selected into general track. Similarly, we observe the scores of senior vocational school graduates only when he/she is selected into vocational track. Therefore, the estimation model is as following.

$$\text{Educational Tracking} \quad : D_i = \begin{cases} 1 & \text{if} \quad z_i\gamma + u_i \geq 0 \\ 0 & \text{otherwise} \end{cases} \tag{1}$$

$$\begin{cases} \text{Senior high school} \quad : y_{1i} = \alpha_1 E_{1i} + x_{1i}\beta_1 + \varepsilon_{1i}, & \text{if} \quad D_i = 1 \\ \text{Senior vocational school} : y_{0i} = \alpha_0 E_{0i} + x_{0i}\beta_0 + \varepsilon_{0i} & \text{if} \quad D_i = 0 , \end{cases} \tag{2}$$

where $\begin{pmatrix} u \\ \varepsilon_1 \\ \varepsilon_o \end{pmatrix} \sim IIN \begin{pmatrix} \begin{pmatrix} 0 \\ 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \sigma_{u\varepsilon_1} & \sigma_{u\varepsilon_0} \\ \sigma_{u\varepsilon_1} & \sigma_{\varepsilon_1}^2 & \sigma_{\varepsilon_1\varepsilon_0} \\ \sigma_{u\varepsilon_0} & \sigma_{\varepsilon_1\varepsilon_0} & \sigma_{\varepsilon_0}^2 \end{pmatrix} \end{pmatrix}$. The maximum likelihood estimates is obtained by maximizing the likelihood function of this structural model.

B. College-employment choice model

To examine the impacts of part-time work on college-employment choices, we apply multinomial logit estimation model (MNL). To make the estimation feasible, we run MNL separately to students in different track. Assume there are N students, and each one faces J alternatives. Let U_{ij} denotes the satisfaction (utility) of student i by choosing alternative j. Assume high school employment and background will be associated with the satisfaction of alternative choices with the following form:

$$U_{ij} = \alpha E_i + x_i \beta_j + \varepsilon_{ij} \, 。 \qquad\qquad i = 1, \ 2,...N \ , \ j = 0, \ 1, \ 2,..,J \ (3)$$

When alternative j has been chosen by student i, the alternative j must have the maximum satisfaction for student i. Assume ε follow an independently identically extreme-value distribution, Mcfadden(1973) prove that the probability of choosing alternative j will be

$$P_j = \mathrm{Pr}\, ob(Y_i = j) = \frac{\exp(\alpha E_i + x_i \beta_j)}{\sum_{k=0}^{J} \exp(\alpha E_i + x_i \beta_j)} \qquad j = 0, \ 1, \ 2,.....,J$$

$$P_o = prob(Y_i = 0) = \frac{1}{1 + \sum_{k=1}^{J} \exp(\alpha E_i + x_i \beta_j)} \qquad\qquad (4)$$

The marginal effect of each explanatory variable in MNL model is as following:

$$\frac{\partial P_j}{\partial x_i} = P_j \left[\beta_j - \sum_{k=1}^{J} P_k \beta_k \right].$$

The marginal effects represent the partial effects of each explanatory variable on the probability of choosing alternative j. Obviously, the sign and the magnitudes of marginal effects will be different from the coefficient estimates in equation (4).

4. Data and variables
A. data

The data used for this analysis are obtained from a longitudinal survey of Taiwan Youth Project (TYP) Phase I (2000-2007) in the Taiwan area. There are only few panel studies of youth in the West and most are attached with the more general household survey. TYP, instead, places youth as the central focus and extends to parents. Different from other youth studies which usually are restricted to teen years, TYP examines the transition from early adolescence to young adulthood. This research design enables us to understand different developmental concerns in the life course of youth. Taiwan Youth Project (hereafter TYP) aims to study the trajectory of youth growth in Taiwan from the life course perspective. For Phase I (2000-2007), the time frame is set from early adolescence to young adulthood. The linkage between life experiences during adolescence and the subsequent developmental patterns during young adulthood are examined. Hence, TYP is characterized by an analysis of social economic dimensions, and the interplay of family, school and community is

considered most relevant social mechanisms affecting various growth trajectories of Taiwanese youth.

TYP is officially launched in year 2000. First and third year of junior high, or 7th and 9th graders, with an average age of 13 and 15 years old serve as baseline samples (J1 and J3 sample hereafter). When Phase I completes in 2007, both samples will become young adults of 20 and 22 respectively. The transition from early adolescence to young adulthood will be successfully recorded. The reason to sample two cohorts is because the J3 sample is the last cohort under the old comprehensive entrance examination, while J1 sample represents new cohort affected by the educational reform. In order to have representative sample, a multi-stage stratified sampling method is used. Several criteria include urbanization degree (3 strata for Taipei region and 2 strata for Yi-Lan county), proportion of student population in each stratum, mean student number of class in each stratum which result in 41 classes for each of two cohorts (or 2700 students of J1 and J3 samples) in northern Taiwan . One of the parents, student's head master of the class and school principal of junior high are interviewed since the beginning year of 2000. After six waves of surveys, approximately 65% of the original sample in both youth and parent samples is retained.

In order to investigate the associations between the part-time work experience during grades 10-12 and their academic outcomes, we use waves three ~ seven of J1 sample, when the respondents were 15-19 years old over periods of 2002~2006 for this research. We delete individuals who did not respond for at least two years, and those who entered five-year junior college. At last, we obtain 1941 individuals. Among them, we have 1023 senior high school students and 918 senior vocational school students.

B. Variables

Table 2 presents the part-time work experiences for students at grades 10-12 in different educational track. It shows that the students in vocational track experience more part-time work than those in the general educational track. During grades 10-12, 30 percent of senior high school students have ever experienced part-time work, while slightly more half of senior vocational school students have ever experienced. Once

worked, the students in vocational track also work longer period. The average experiencing years are 1.52 out of three years for senior vocational school students. Furthermore, we find that, due to the college entrance examination, high school students tend to work more at grades 10-11. The percentage of part-time work drop dramatically from grade 11 to grade 12 in both educational tracks. Also, students tend to work more during summer or winter vacation period instead of working during semester period. However, senior vocational student tend to augment their employment during semester period at grade 11.

Table 3 presents the basic statistics of two academic outcomes for students in different track by part-time work. When we compare the scores of college entrance examinations between general track students and vocational track students, we find that roughly sixty percent of senior high school graduates are able to achieve 60 points and above in their college entrance examination. Only thirty to forty percent of senior vocational students can earn 60 points and above. When we compare students with part-time work experiences to those without part-time work experiences, the former tend to have lower scores than the latter one, especially for senior vocational school students. In vocational track, students who had experienced part-time work during grades 10-12 have thirty percent of probability to attain 60 points and above. The probability will increase to forty percent if he/she did not work at all. For college-employment choices, part-time work seems to play different role for students in general track and those in vocational track. For students in general track, the total percentage of entering either general university or university of science and technology are roughly the same for students with part-time work and without part-time work. Students with part-time work tend to enter the university of science and technology. Contrast to general track, part-time work seems to lower the percentage of either general university or university of science and technology, and to raise the probability of entering labor market.

Table 4 presents the mean statistics of family background for work and non-work students in different tracks. It shows that senior high school students have higher both father's and mother's years of schooling, higher family income at grade 9 and grade 12 than senior vocational students. Students had experienced part-time work tend to

come from families with lower parental education and lower family income.

5. Results

The basic statistics shown in section 4 reveals that educational tracking in Taiwan introduces selection in the educational process. Students in general track perform better in their college entrance examinations, have higher percentage of college entry, and have higher parental education and family income than students in vocational track. Meanwhile, students experienced part-time work during high school year perform worse in their college entrance examinations, have lower percentage of college entry, and have lower parental education and family income than students without part-time work. Would educational tracking interact with part-time work to enhance or lessen the inequality of academic outcomes of Taiwanese teens? Two academic achievements have been examined.

A. Scores of college entrance examination

Table 5 presents the coefficient estimates of endogenous switching regression model, in which we observe the scores of senior high school graduates only when he/she is selected into general track. Similarly, we observe the scores of senior vocational school graduates only when he/she is selected into vocational track. The endogenous switching regression model takes into account the correlation between the tracking behavior and the academic outcomes for secondary school graduates in different track. The first equation in Table 5 is the tracking equation. It shows that urban and father's education plays important roles in tracking behavior. Living in Taipei city at grade 9 has significantly higher probability of entering general track than living in Taipei county or Yi-Lan county. There is no significant difference in the probability of entering general track for junior high graduates living in Taipei county and Yi-Lan county. Father's education has substantial positive influence on tracking behavior. Gender and family income do not play a role in the probability of entering general track.

The second equation is the scores equation for senior high school graduates. It shows that the length and the timing of part-time work during high school years have no significant impacts on the college entrance examinations for senior high school

graduates. Again, both living in Taipei city and father education significantly and positively influence the scores of senior high school graduates. Living in Taipei city substantially increases the scores of college entrance examination by roughly 2 points. Increasing father's education by one year raises the scores by 0.9 points. Family income and parental marriage at grade 12 have no roles in influencing college entrance scores for senior high school graduates.

The Third equation is the scores equation for senior vocational school graduates. It shows that part-time work during high school years have significant impacts on the college entrance examinations for senior vocational school graduates. On average, when vocational school students have ever worked during grades 10-12, their scores significantly drop 5.8 points in their college entrance examination after controlling for family background. In particular, having part-time work at grade 12 would substantially lower their scores by 11.9 points. Increasing one more year of employment would decrease the scores by 4.6 point for senior vocational school student. Family background variables play no significant roles in influencing college entrance scores for senior vocational school graduates.

The estimates of variance -correlation coefficient of this structural model shows that the correlation between tracking behavior and the performance of college entrance examination can not be ignored.

B. College-employment choices

The second academic outcome to be examined is college-employment choices among secondary school graduates. Table 6 and Table 7 present the marginal-effect estimates of multinomial logit regression model. Four choices are categorized. They are entering general university, entering university of science and technology, entering labor market, and delayed. The employment category includes graduates who are currently employed either at home or at a firm and who are currently looking for jobs. The delayed group comprises students who are currently not graduated from secondary education or who are entering cram school to prepare for the next year entrance examinations.

Table 6 reveals that the duration of employment during high school significantly lowers the probability of entering general university for senior high school students.

Increasing one more year of employment would lower the probability of entering general university by 0.042. Father's education has significant and positive impacts on the probability of entering general university. Senior high school males tend to have lower probability to entering general university. For senior vocational school graduates, high school employment does not significantly affect their probability of entering general university. Family income and father education also plays insignificant roles. However, parental living arrangement do significantly influence senior vocational school student to enter general university. If his/her family is intact at grade 12, the probability of entering general university will increase 0.32.

For the choice of entering university of science and technology, the experience of part-time work during high school year do play significant but opposite role among senior high school students and senior vocational school students. Ever work and the length of work during high school year significantly increase the probability of entering university of science and technology for senior high school students, but substantially lower the probability for senior vocational students. The probability of entering university of science and technology for senior vocational school student would go down 0.108 when he/she has ever experienced employment during high school years. Living in Taipei city has significantly lower probability of entering university of science and technology for senior vocational school student than living in Taipei county or Yi-Lan county. Senior high school males tend to have higher probability of entering university of science and technology than female. Father's education has substantial but opposite effects on the probability of entering university of science and technology among senior high school students and senior vocational school students. Higher father education would lower the probability of entering university of science and technology among senior high school students, but raise the probability of entering university of science and technology among senior vocational school students. Family income does not play a role in the probability of entering university of science and technology.

For choice of entering labor market, the experience of part-time work during high school year significantly lift up the probability of entering labor market for senior high school students and senior vocational school students, especially for

vocational track. Increasing one more year of employment during high school year would raise the probability of entering labor market by 0.01 for senior high school students, and by 0.046 for vocational track students. Father's education has discouraged effects on the probability of entering labor market. Living in Taipei city increases the probability of delaying education. Having large number of cram schools in Taipei city may be the main reason.

Furthermore, Table 7 explores the impact of the timing of high school employment on college-employment choices for students in different tracks. It discloses that employment experiences at grade 11 and grade 12 for senior high school students significantly decrease their probability of entering general university. The probability of entering general university for senior high school students would drop 0.11 and 0.32 when he/she employed at grade 11 and grade 12 respectively. Part-time work during semester at grade 10 and part-time work during vocational period at grade 11 significantly worsen the changes of entering general university for senior high school students. The impacts of family background are the same as the ones in Table 6.

For the choice of entering university of science and technology and entering labor market, the experience of part-time work during high school year do play significant among senior high school students and senior vocational school students. Working at grade 11 tends to increase the probability of entering university of science and technology for senior high school students. However, Working at grade 12 tends to increase the probability of entering labor market for senior high school students. Meanwhile, working experience at grade 10 and grade 12 substantially increase the probability for senior vocational students to enter labor market, but lower the probability of entering university of science and technology.

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Table 1. College-employment choices for graduates in different tracking   unit: %

	General University	University Of Science and Technology	Employment	Delayed
Senior high school graduates	74.72	9.8	2.48	13.01
Senior vocational school graduates	4.73	56.87	21.53	16.87

Data sources: J1 and J3 sample of Taiwan Youth Project
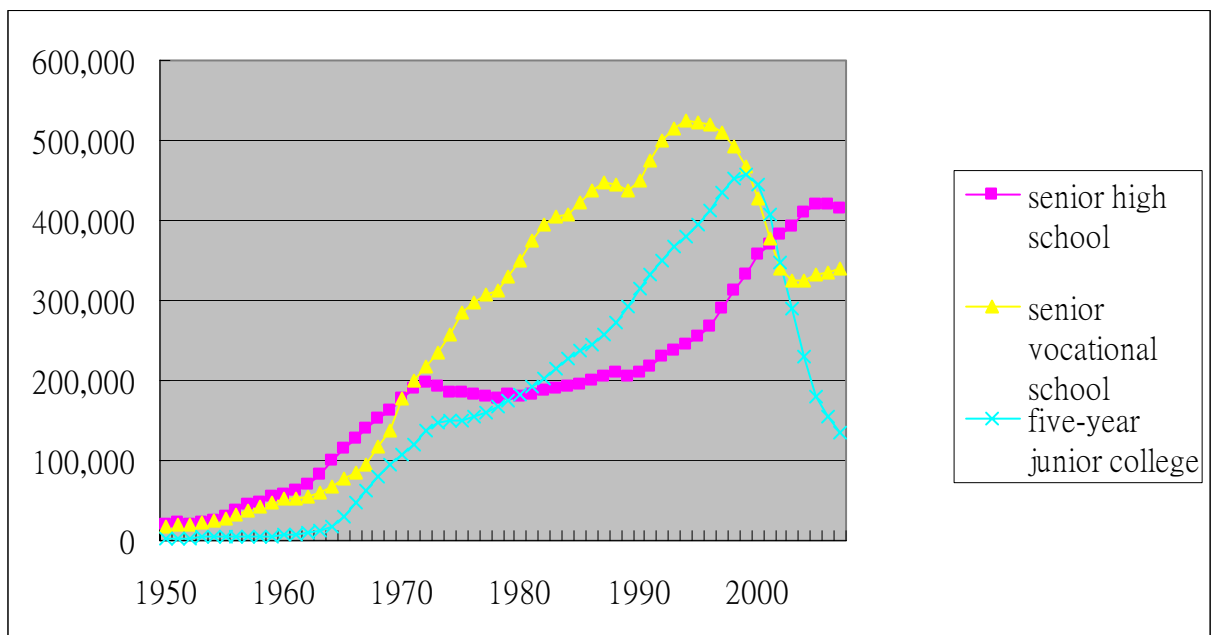
Figure 1. The historical trend of number of students in senior high school, senior vocational school and 5-year junior college in Taiwan

Table 2. Part-time work experiences for students in different tracks

	Senior high school	Senior vocational school
Worked part-time during grades 10-12 (=1)	0.30	0.53
Number of years working part-time	1.27	1.52
Work part-time at grade 10 (=1)	0.24	0.38
Work during semester(=1)	0.04	0.12
Work during summer or winter vacations(=1)	0.23	0.34
Work part-time at grade 11(=1)	0.11	0.27
Work during semester(=1)	0.04	0.16
Work during summer or winter vacations(=1)	0.09	0.20
Work part-time at grade 12(=1)	0.02	0.16
Number of observations	1023	918

Table 3. Academic outcomes for the graduates in different track by part-time work

A. Scores of college entrance examinations

	Senior high school graduates		Senior vocation school graduates	
	Part-time work	No part-time work	Part-time work	No part-time work
Less than 20 points	0.0	0.0	2.2	0.0
20~39 points	4.1	2.2	27.0	24.1
40~59 points	36.8	33.4	40.4	34.3
60~79 points	47.5	48.9	27.0	37.0
More than 80 points	11.6	15.5	3.4	4.6
Number of observations	242	593	89	108

B. College-employment choices   unit: %

	Senior high school graduates		Senior vocation school graduates	
	Part-time work	No part-time work	Part-time work	No part-time work
General university	73.1	78.2	2.6	4.6
University of Science and Technology	13.4	8.9	56.7	67.7
Employment	4.9	1.9	25.2	16.1
Delayed	8.6	11.0	15.5	11.5
Number of observations	268	628	381	347

Table 4. Mean statistics

	Senior high school graduates		Senior vocation school graduates	
	Part-time work	No part-time work	Part-time work	No part-time work
Gender (male=1)	0.42	0.53	0.50	0.56
Father died at grade 9(=1)	0.96	0.98	0.97	0.97
Father died at grade 12(=1)	0.95	0.98	0.95	0.97
Father' age at grade 9	46.02	46.65	45.72	45.78
Mother' age at grade 9	43.57	44.18	43.01	43.07
Family is intact at grade 9 (=1)	0.86	0.91	0.85	0.90
Parents separate or divorce at grade 9 (=1)	0.08	0.07	0.11	0.07
Family is intact at grade 12 (=1)	0.84	0.90	0.83	0.89
Parents separate or divorce at grade 12 (=1)	0.08	0.07	0.11	0.08
Father' s years of schooling	11.50	12.40	9.89	10.38
Mother' s years of schooling	10.95	11.70	9.53	9.76
Family income at grade 9 (NT$ 10 thousand)	6.85	7.81	5.53	6.27
Family income at grade 12 (NT$ 10 thousand)	6.90	7.86	5.57	6.13

Table 5. Coefficient estimates of educational tracking and scores of college entrance examinations (endogenous switching regression)

	Tracking equation (D)			
	Model 1	Model 2	Model 3	Model 4
Lived in Taipei city at grade 9	0.406***	0.405***	0.404***	0.407***
	(0.114)	(0.114)	(0.115)	(0.115)
Lived in Yi-Lan county at Grade 9	0.180	0.180	0.180	0.181
	(0.118)	(0.118)	(0.119)	(0.122)
Student gender(male=1)	0.014	0.014	0.014	0.016
	(0.095)	(0.095)	(0.095)	(0.096)
Father's years of schooling	0.062***	0.061***	0.061***	0.062***
	(0.015)	(0.015)	(0.015)	(0.015)
Family income at grade 9	0.019	0.020	0.020	0.018
	(0.014)	(0.014)	(0.014)	(0.014)
Family is intact at grade 9 (=1)	0.133	-0.130	-0.127	-0.130
	(0.145)	(0.146)	(0.147)	(0.148)
Scores equation of college entrance exam for senior high school graduates (y_1)				
	Model 1	Model 2	Model 3	Model 4
Worked part-time during grades 10-12 (=1)	-1.378			
	(1.014)			
Number of years working part-time		-1.025		
		(0.679)		
Worked part-time at grades 10 (=1)			-0.246	
			(1.164)	
Worked part-time grades 11 (=1)			-2.131	
			(1.464)	
Worked part-time at grades 12 (=1)			-1.494	
			(2.864)	
Worked part-time during semester at grades 10 (=1)				-0.288
				(3.162)
Worked part-time during semester at grades 11(=1)				-1.909
				(2.584)
Worked part-time during vacation at grades 10(=1)				-0.079
				(1.187)
Worked part-time during vacation at grades 11 (=1)				-1.144
				(1.604)
Lived in Taipei city at grade 9	2.144*	2.194*	2.280*	2.249*
	(1.221)	(1.218)	(1.215)	(1.225)

Lived in Yi-Lan county at Grade 9	1.127	1.133	1.140	1.156
	(1.316)	(1.319)	(1.324)	(1.329)
Student gender(male=1)	0.846	0.831	0.865	0.895
	(0.970)	(0.972)	(0.979)	(0.981)
Father's years of schooling	0.934***	0.941***	0.947***	0.949***
	(0.157)	(0.156)	(0.156)	(0.156)
Family income at grade 12	0.004	0.008	0.007	0.006
	(0.155)	(0.155)	(0.156)	(0.155)
Family is intact at grade 12 (=1)	-0.600	-0.718	-0.776	-0.721
	(1.623)	(1.628)	(1.631)	(1.635)

Scores equation of college entrance exam for senior vocational school graduates (y_0)

	Model 1	Model 2	Model 3	Model 4
Worked part-time during grades 10-12 (=1)	-5.581**			
	(2.640)			
Number of years working part-time		-4.614***		
		(1.777)		
Worked part-time at grades 10 (=1)			-0.992	
			(2.843)	
Worked part-time grades 11 (=1)			-4.301	
			(3.253)	
Worked part-time at grades 12 (=1)			-11.917**	
			(5.542)	
Worked part-time during semester at grades 10 (=1)				-3.117
				(4.912)
Worked part-time during semester at grades 11(=1)				-5.383
				(4.116)
Worked part-time during vacation at grades 10(=1)				-0.922
				(3.034)
Worked part-time during vacation at grades 11 (=1)				-2.343
				(4.298)
Lived in Taipei city at grade 9	4.518	4.822	5.878	4.354
	(7.332)	(7.016)	(6.788)	(7.817)
Lived in Yi-Lan county at Grade 9	2.383	1.947	2.004	1.984
	(4.668)	(4.567)	(4.514)	(4.703)
Student gender(male=1)	2.659	2.437	2.522	2.584
	(2.821)	(2.822)	(2.818)	(2.843)
Father's years of schooling	0.596	0.593	0.642	0.534

	(0.963)	(0.897)	(0.853)	(1.013)
Family income at grade 9	0.387	0.306	0.273	0.373
	(0.422)	(0.415)	(0.408)	(0.424)
Family is intact at grade 9 (=1)	-0.650	-1.236	-1.345	-0.179
	(4.472)	(4.358)	(4.482)	(4.636)
Variance Parameter				
	Model 1	Model 2	Model 3	Model 4
SIGMA(0)	18.488***	18.602***	18.571***	18.454***
	(5.813)	(5.863)	(5.858)	(6.072)
RHO(0,μ)	0.418	0.461	0.483	0.408
	(0.810)	(0.718)	(0.667)	(0.867)
SIGMA(1)	14.068***	14.121***	14.167***	14.143***
	(0.798)	(0.788)	(0.777)	(0.790)
RHO(1,μ)	0.616***	0.630***	0.642***	0.634***
	(0.166)	(0.158)	(0.150)	(0.156)

Table 6. Marginal-effect estimates of college-employment choices for graduates in different track I (MNL model)

	Senior high school		Senior vocational school	
	Model 1	Model 2	Model 1	Model 2
(1) Entering general university:				
Employment factors:				
Worked part-time during	-0.031		-0.002	
grades 10-12 (=1)	(0.031)		(0.002)	
Number of years working		-0.042**		-0.002
part-time		(0.021)		(0.001)
Geographic factors:				
Lived in Taipei city at	0.017	0.016	0.004	0.004
grade 9 (=1)	(0.032)	(0.032)	(0.003)	(0.003)
Lived in Yi-Lan county at	0.008	0.006	-0.002	-0.002
grade 9 (=1)	(0.037)	(0.037)	(0.002)	(0.002)
Family background:				
Gender (=1)	-0.064**	-0.067**	-0.002	-0.002
	(0.028)	(0.028)	(0.002)	(0.002)
Father's years of schooling	0.012***	0.012***	0.001	0.001
	(0.004)	(0.004)	(0.000)	(0.000)
Family income	0.006	0.006	0.000	0.000
(NT$10 thousand)	(0.005)	(0.005)	(0.000)	(0.000)
Family is intact at grade 12	0.022	0.014	0.032***	0.032***
	(0.046)	(0.045)	0.008	(0.008)
(2) Entering university of science and technology:				
Employment factors:				
Worked part-time during	0.039*		-0.108***	
grades 10-12 (=1)	(0.023)		(0.036)	
Number of years working		0.036***		-0.071***
part-time		(0.013)		(0.020)
Geographic factors:				
Lived in Taipei city at	-0.019	-0.019	-0.095**	-0.098**
grade 9 (=1)	(0.021)	(0.021)	(0.046)	(0.047)
Lived in Yi-Lan county at	-0.020	-0.019	0.069	0.058
grade 9 (=1)	(0.022)	(0.022)	(0.043)	(0.044)
Family background:				
Gender (=1)	0.043**	0.044**	-0.003	-0.010
	(0.019)	(0.019)	(0.036)	(0.037)

Father's years of schooling	-0.010***	-0.010***	0.013**	0.013**
	(0.003)	(0.003)	(0.006)	(0.006)
Family income	-0.003	-0.003	0.003	0.002
(NT$10 thousand)	(0.003)	(0.003)	(0.007)	(0.007)
Family is intact at grade 12	0.049**	0.054***	0.037	0.034
	(0.021)	(0.020)	(0.062)	(0.062)

(3) Entering labor market:

Employment factors:

Worked part-time during	0.018		0.070**	
grades 10-12 (=1)	(0.011)		(0.031)	
Number of years working		0.010**		0.046***
part-time		(0.005)		(0.016)

Geographic factors:

Lived in Taipei city at	-0.007	-0.007	0.006	0.009
grade 9 (=1)	(0.009)	(0.009)	(0.038)	(0.039)
Lived in Yi-Lan county at	0.001	0.001	-0.041	-0.033
grade 9 (=1)	(0.010)	(0.010)	(0.035)	(0.035)

Family background:

Gender (=1)	0.014	0.014	-0.004	0.000
	(0.009)	(0.009)	(0.031)	(0.031)
Father's years of schooling	-0.003**	-0.003**	-0.017***	-0.017***
	(0.001)	(0.001)	(0.005)	(0.005)
Family income	-0.001	-0.001	-0.007	-0.007
(NT$10 thousand)	(0.001)	(0.001)	(0.006)	(0.006)
Family is intact at grade 12	-0.006	-0.003	-0.085	-0.083
	(0.014)	(0.012)	(0.055)	(0.055)

(4) Delayed

Employment factors:

Worked part-time during	-0.026		0.040	
grades 10-12 (=1)	(0.022)		(0.026)	
Number of years working		-0.005		0.027*
part-time		(0.016)		(0.014)

Geographic factors:

Lived in Taipei city at	0.010	0.010	0.084**	0.086**
grade 9 (=1)	(0.024)	(0.025)	(0.036)	(0.036)
Lived in Yi-Lan county at	0.011	0.012	-0.026	-0.023
grade 9 (=1)	(0.030)	(0.030)	(0.033)	(0.033)

Family background:

Gender (=1)	0.007	0.009	0.009	0.012
	(0.021)	(0.021)	(0.026)	(0.026)
Father's years of schooling	0.000	0.001	0.003	0.003
	(0.003)	(0.003)	(0.004)	(0.004)
Family income	-0.002	-0.002	0.005	0.005
(NT$10 thousand)	(0.003)	(0.003)	(0.005)	(0.005)
Family is intact at grade 12	-0.065	-0.064	0.016	0.018
	(0.041)	(0.041)	(0.040)	(0.040)

Table 7. Marginal-effect estimates of college-employment choices for graduates in different track II (MNL model)

	Senior high school		Senior vocational school	
	Model 3	Model 4	Model 3	Model 4
(1) Entering general university:				
Employment factors:				
Worked part-time at grade 10	0.032		-0.002	
(=1)	(0.032)		(0.002)	
Worked part-time at grade 11	-0.110**		-0.001	
(=1)	(0.053)		(0.002)	
Worked part-time at grade 12	-0.318***		-0.002	
(=1)	(0.119)		(0.002)	
Worked part-time during		-0.175*		-0.002
semester at grade 10(=1)		(0.106)		(0.003)
Worked part-time during		-0.093		-0.004**
semester at grade 11(=1)		(0.092)		(0.002)
Worked part-time during		0.045		-0.002
vacation at grade 10(=1)		(0.032)		(0.002)
Worked part-time during		-0.119**		0.002
vacation at grade 11(=1)		(0.058)		(0.003)
Geographic factors:				
Lived in Taipei city at	0.017	0.014	0.004	0.004
grade 9 (=1)	(0.032)	(0.032)	(0.003)	(0.003)
Lived in Yi-Lan county at	0.003	0.003	-0.002	-0.002
grade 9 (=1)	(0.037)	(0.037)	(0.002)	(0.002)
Family background:				
Gender (=1)	-0.060**	-0.065**	-0.002	-0.002
	(0.028)	(0.028)	(0.002)	(0.002)
Father's years of schooling	0.012***	0.012***	0.001	0.000
	(0.004)	(0.004)	(0.000)	(0.000)
Family income	0.006	0.006	0.000	0.000
(NT$10 thousand)	(0.005)	(0.004)	(0.000)	(0.000)
Family is intact at grade 12	0.001	0.006	0.032***	0.028***
	(0.045)	(0.045)	(0.008)	(0.008)
(2) Entering university of science and technology:				
Employment factors:				

Worked part-time at grade 10 (=1)	-0.005 (0.022)		-0.016 (0.040)	
Worked part-time at grade 11 (=1)	0.100** (0.043)		-0.024 (0.043)	
Worked part-time at grade 12 (=1)	0.100 (0.081)		-0.242*** (0.053)	
Worked part-time during semester at grade 10(=1)		-0.029 (0.039)		-0.115* (0.067)
Worked part-time during semester at grade 11(=1)		0.159* (0.088)		-0.101* (0.057)
Worked part-time during vacation at grade 10(=1)		0.006 (0.024)		-0.010 (0.042)
Worked part-time during vacation at grade 11(=1)		0.041 (0.040)		0.002 (0.050)
Geographic factors:				
Lived in Taipei city at grade 9 (=1)	-0.021 (0.021)	-0.019 (0.021)	-0.087* (0.047)	-0.100** (0.046)
Lived in Yi-Lan county at grade 9 (=1)	-0.017 (0.022)	-0.017 (0.023)	0.058 (0.044)	0.046 (0.044)
Family background:				
Gender (=1)	0.042** (0.019)	0.040** (0.019)	-0.002 (0.037)	-0.006 (0.036)
Father's years of schooling	-0.010*** (0.003)	-0.010*** (0.003)	0.013** (0.006)	0.014** (0.006)
Family income (NT$10 thousand)	-0.003 (0.003)	-0.003 (0.003)	0.002 (0.007)	0.003 (0.007)
Family is intact at grade 12	0.057*** (0.019)	0.056*** (0.020)	0.021 (0.062)	0.035 (0.062)

(3) Entering labor market:

Employment factors:				
Worked part-time at grade 10	0.006 (0.011)		0.069** (0.035)	
Worked part-time at grade 11	-0.004 (0.011)		-0.013 (0.035)	
Worked part-time at grade 12	0.135* (0.082)		0.097** (0.047)	
Worked part-time during semester at grade 10		0.104 (0.072)		0.098 (0.060)

Worked part-time during semester at grade 11		-0.017***		0.086*
		(0.006)		(0.052)
Worked part-time during vacation at grade 10		0.004		0.072**
		(0.010)		(0.037)
Worked part-time during vacation at grade 11		0.015		-0.079**
		(0.019)		(0.036)
Geographic factors:				
Lived in Taipei city at grade 9 (=1)	-0.006	-0.006	0.003	0.008
	(0.009)	(0.009)	(0.039)	(0.039)
Lived in Yi-Lan county at grade 9 (=1)	0.001	0.000	-0.034	-0.022
	(0.010)	(0.010)	(0.036)	(0.037)
Family background:				
Gender (=1)	0.011	0.016*	-0.002	-0.001
	(0.009)	(0.009)	(0.031)	(0.031)
Father's years of schooling	-0.003**	-0.003***	-0.017***	-0.017***
	(0.001)	(0.001)	(0.005)	(0.005)
Family income (NT$10 thousand)	-0.001	-0.001	-0.007	-0.007
	(0.002)	(0.001)	(0.006)	(0.006)
Family is intact at grade 12	0.000	-0.003	-0.079	-0.082
	(0.011)	(0.012)	(0.055)	(0.055)

(4) Delayed

Employment factors:				
Worked part-time at grade 10	-0.034		-0.051**	
	(0.023)		(0.026)	
Worked part-time at grade 11	0.014		0.037	
	(0.037)		(0.032)	
Worked part-time at grade 12	0.083		0.147***	
	(0.091)		(0.047)	
Worked part-time during semester at grade 10		0.101		0.019
		(0.092)		(0.048)
Worked part-time during semester at grade 11		-0.049		0.019
		(0.038)		(0.041)
Worked part-time during vacation at grade 10		-0.055**		-0.060**
		(0.021)		(0.027)
Worked part-time during vacation at grade 11		0.064		0.075*
		(0.048)		(0.043)
Geographic factors:				
Lived in Taipei city at	0.010	0.010	0.080**	0.089**

grade 9 (=1)	(0.025)	(0.024)	(0.036)	(0.037)
Lived in Yi-Lan county at	0.014	0.013	-0.022	-0.022
grade 9 (=1)	(0.030)	(0.030)	(0.032)	(0.033)
Family background:				
Gender (=1)	0.007	0.010	0.007	0.009
	(0.021)	(0.021)	(0.026)	(0.026)
Father's years of schooling	0.001	0.000	0.004	0.003
	(0.003)	(0.003)	(0.004)	(0.004)
Family income	-0.002	-0.001	0.005	0.005
(NT$10 thousand)	(0.003)	(0.003)	(0.005)	(0.005)
Family is intact at grade 12	-0.058	-0.059	0.026	0.019
	(0.040)	(0.040)	(0.037)	(0.040)