

Educational Wage Differentials in Korea

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In Korea, the number of new college graduates relative to new high school graduates increased by 159 percent between 1980 and 1985, mainly due to a series of government policies which expanded the college student quota. This enormous rise in the relative supply provides an ideal case for identifying its effect on educational wage differentials. Using the data from *The Occupational Wage Survey*, this paper documents the changes in educational wage structures in Korea from 1971 to 1986. These changes are analyzed using a market clearing model and an alternative non-wage adjustment model. (JEL Classification: J31, E24)

I. Introduction

There has been a vast literature on the economic determinants of educational wage differentials. One of the main issues in the literature has been to identify and quantify the changes in educational wage premiums due to demand or supply factors. For example, Freeman (1978) showed that the drop in the relative income of college workers in the 1970s in the U.S. was largely due to the increase in college enrollment in the 1960s. Bound and Johnson (1986) and Murphy and Welch (1991) found that foreign trade competition contributed to the rise in the relative earnings of U.S. college workers in the 1980s. Distinguishing these factors is not an easy task since we do not usually observe rapid exogenous changes in these driving variables. International comparisons of educational wage differentials (Freeman 1981; Katz and Revenga 1989) provide an alternative way to distinguish various

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hypotheses which cannot be easily identified with American time series information alone.

This paper examines educational wage differentials in Korea. Because of her unique pattern of labor supply changes, Korea provides an ideal case for analyzing educational wage differentials. In Korea, the ministry of education has regulated the quota of college students in consideration of quality of college education, urban concentration, changes in industrial structures, etc. For the reasons explained in section II, there were drastic increases in the quota in 1978 and 1981. In 1978, the number of first year students in junior colleges (two year programs) increased by 1,306 percent (from 5,701 in 1977 to 80,187) and those in colleges and universities (four year programs) increased by 37 percent (from 96,734 to 132,692). Another sharp increases occurred in 1981 and the increases were 34 percent and 49 percent respectively.

Compared with changes in other countries, this shift in supply is striking. In the international comparison study by Freeman (1981), the largest changes in the relative supply of college graduates to high school graduates over a 5 year period were approximately 50 percent in the U.S. and Japan.¹ In Korea, the largest change in relative supply over a 5 year period was 159 percent from 1980 to 1985. This enormous and exogenous rise in the supply of highly educated youth in Korea provides an ideal case for identifying the effect of relative supply on educational wage differentials.

Using the data from published tables and a few survey tapes of *The Occupational Wage Survey* from 1971 to 1986, this paper first documents the changes in educational wage structures in Korea. These changes are then analyzed using a simple demand and supply model which is a variant of Katz and Murphy (1992) as well as an alternative non-wage adjustment model. Some of our findings are:

(1) The relative earnings of the least educated workers (middle school graduates or under) have increased against others throughout the period. The increase is largely due to a decrease of their relative supply.

(2) The earnings of college workers relative to high school workers increased in the first half of the 1970s. For males, the trend is reversed starting from the late 1970s, whereas for females, the college wage pre-

¹In the U.S., the ratio of 25-34 year old college to high school graduates rose from .38 in 1970 to .57 in 1976, and in Japan the number of new college graduates relative to high school graduates increased from .24 to .37 between 1970 and 1975.

mium continued to increase until 1987. Though the supply changes of male and female college workers in the 1980s are quite similar, a rapid expansion in service industries contributed to an increase in the relative demand for female college workers.

(3) The distribution of workers by educational attainment across occupations has changed significantly. Deterioration or upgrading of occupational choice alone can explain almost half of the changes in observed relative wages.

The remainder of the paper is organized as follows. Section II provides a brief history of the changes in educational policy in Korea. Section III documents the changes in wage structures. A simple demand and supply framework is introduced in section IV to explain the quantitative dimensions of the changing economic status of college workers. Evidence for the non-wage adjustment hypothesis is examined in section V. Section VI concludes.

II. Changes in Educational Policy in Korea

Korea has experienced three phases of higher education policy changes since 1950. In the 1950s, the government supported the expansion of colleges and universities, regarding higher education as a major vehicle to economic development and a panacea to social problems. Together with the high demand for college education and the Confucian values which hold the pursuit of knowledge in high regard, this led to a rapid expansion of college and university systems. Korea's economic infrastructure and technology at that time, however, were too underdeveloped to fully absorb the highly educated graduates. Faced with severe unemployment of college graduates and the declining quality of college education, the ministry of education responded by reducing the student quota and tightening the facility requirement of colleges and universities starting from the mid 1960s. Other factors such as preventing urban concentration of population and tightening the control of university students who had been a major source of political opposition also contributed to this policy of tight controls and reduced quota.

In the late 1970s when the baby boom generation² started to graduate from high school, the shortage in colleges and universities resulted in heated competition for higher education. Most students who failed

²The baby boom in Korea was from the late 1950s to the early 1960s.

in entrance examinations spent one or more years for retrial. The cost of private tutoring for college entrance examinations soared ridiculously. Faced with the excess demand and the concomitant social problem, the ministry reversed its earlier policy and began to expand the quota from 1978. For fear of excess supply in relation to industrial structure, however, the government decided to expand mostly two year junior college programs with only a modest increase in the quota for the 4 year colleges and universities.

Compared with 1977, the number of the first year students in junior colleges in 1978 increased by 1,306 percent from 5,701 to 80,187. The corresponding figure for colleges and universities was 37 percent from 96,732 to 132,692.³ Qualitative aspects of junior college education also changed. Before the expansion, teacher's colleges had accounted for more than 50 percent of the junior college system. But most of the expansion in 1978 was in vocational colleges. The share of teacher's colleges dropped to less than 5 percent after the expansion. In contrast, the expansion of colleges and universities was qualitatively homogeneous.

Another sharp increase in the quota occurred in 1981 since the great upsurge in 1978 was not enough to meet the "educational zeal" and the excess competition for college education. After the coup in 1980, President Chun's government announced the expansion of higher education opportunities in a series of policies designed to legitimize his government. In 1981, the number of the first year students in 4 year colleges and universities increased by 49 percent from 162,296 to 238,788, and those in junior colleges increased by 34 percent from 88,071 to 117,833. This enormous and rapid exogenous rise in the supply of highly educated youth in Korea in the 1980s provides an ideal case for identifying the effect of relative supply on educational wage differentials.

III. Changes in Wage Structure

This section examines the changes in the structure of wages in Korea from 1971 to 1986. Our data are mainly from the published tables in various issues of *Jigjong-Byul Inkum Siltae Chosa Bogoso* (Report on

³The average growth rates of the entrants to junior colleges and 4 year colleges including universities between 1971 and 1977 were -3 percent and 9.4 percent respectively.

Occupational Wage Survey). These data are compiled from surveys of employees in about 3,000 nongovernment establishments with ten or more regular workers. The surveys are taken in April of each year. In addition to the published tables, sub-sample tapes are available to us for the years 1971, 1972, 1976, 1980, 1983, and 1986. The tapes include 193,020, 30,441, 27,970, 25,705, 587,152, and 580,990 individuals, respectively. Since the number of observations in the tapes, especially 1972, 1976, and 1980, is not large, the tapes are used only when the published tables cannot provide necessary information to avoid possible small sample bias. The wage measure in our analysis is total compensation computed as the sum of monthly payments (regular and overtime) and one-twelfth of the annual bonus payments.

It should be noted beforehand that *The Report on Occupational Wage Survey* has a sampling bias towards manufacturing industries. In 1986, for example, the employees in the manufacturing sector constituted 62 percent of total individuals in this data even though the corresponding figure in the census data is 32 percent. Under-represented industries include retails and services. Since we find a significant dispersion of wage differentials (experience based or educational based) across industries, the calculated wage measures potentially have a large sampling bias in representing national averages. Given the structure of survey design, the workers who are self employed or employed in small business are more likely to be under-represented and the calculated measures should be interpreted with this in mind.

Table 1 presents changes in real wages for various education-gender-experience groups for the 1971-86 periods and for the sub-period, 1971-76, 1976-80, and 1980-86. To supplement Table 1, we plot the annual variations of some of the educational, gender, and experience wage differentials in Figure 1 to 4. The first three rows in Table 1 show that real wages increased approximately 250 percent in 15 years. This amounts to a 6.2 percent annual growth rate. Between 1971 and 1986, the average annual growth rate of real GNP in Korea was 7.7 percent.

The second panel in Table 1 describes the changes in real wages by educational attainment. Throughout the whole period, the least educated group (11 or less years of education) gained against other groups. The wages of college graduates (16 or more years of education) relative to high school graduates (12 years of education) increased substantially (26%) during 1971-76⁴, but the trend is reversed from the late 1970s

⁴The data for junior college graduates are available separately from college

TABLE 1
CHANGES IN REAL WAGES, 1971-86

	1971-76	1976-80	1980-86	1971-86
All	27.2	33.8	32.4	93.4
Males	32.5	33.8	26.7	93.0
Females	34.3	31.5	38.0	103.8
Education & Experience (Males and Females)				
Middle School or under	20.8	40.5	33.05	94.8
Less than 1 year	28.6	50.3	20.2	99.1
1-4 years	21.0	37.3	20.7	79.0
10 years or over	10.1	38.2	14.6	62.9
High School	20.1	25.4	21.5	67.0
Less than 1 year	31.0	23.0	3.0	57.0
1-4 years	20.9	24.2	6.5	51.6
10 years or over	13.3	32.0	14.9	60.2
Junior College	N.A	26.1	8.9	35.0†
Less than 1 year	N.A	25.4	-1.7	23.7
1-4 years	N.A	26.5	-0.8	25.7
10 years or over	N.A	35.1	7.4	42.5
College or over	40.3*	24.8	18.7	89.6
Less than 1 year	32.9*	14.1	-12.3	41.7
1-4 years	41.5*	21.6	3.1	72.6
10 years or over	26.4*	23.6	16.6	72.1
Education & Experience (Males)				
Middle School or under	22.0	43.6	28.7	94.3
Less than 1 year	24.0	56.6	17.1	97.7
1-4 years	20.4	42.2	16.9	79.7
10 years or over	11.5	37.8	16.2	65.5
High School	24.2	29.0	22.3	75.5
Less than 1 year	38.4	23.1	2.8	64.3
1-4 years	24.5	23.1	12.5	60.1
10 years or over	13.3	32.1	15.1	60.5
Junior College	N.A	25.2	7.9	33.1
Less than 1 year	N.A	21.4	-5.1	16.3
1-4 years	N.A	24.5	-3.8	20.7
10 years or over	N.A	33.9	7.4	41.3
College or over	41.5*	25.3	18.8	90.5
Less than 1 year	35.4*	14.9	-13.9	41.3
1-4 years	44.2*	22.1	2.9	74.2
10 years or over	27.7*	23.6	17.0	72.2

TABLE 1
(CONTINUED)

	1971-76	1976-80	1980-86	1971-86
Education & Experience (Females)				
Middle School or under	39.5	32.6	32.3	104.4
Less than 1 year	29.9	42.6	28.0	100.5
1-4 years	29.3	29.9	27.7	86.9
10 years or over	12.6	31.5	28.1	72.2
High School	14.2	21.6	24.3	60.1
Less than 1 year	12.3	28.9	15.3	56.5
1-4 years	17.5	19.5	17.3	54.3
10 years or over	21.6	25.1	19.4	66.1
Junior College	N.A	27.4	20.5	47.9†
Less than 1 year	N.A	37.2	12.9	50.1†
1-4 years	N.A	30.9	14.9	45.8†
10 years or over	N.A	37.5	12.5	50.0†
College or over	29.4*	13.1	32.8	87.2
Less than 1 year	7.0*	18.7	19.1	52.2
1-4 years	23.2*	12.1	25.3	69.8
10 years or over	26.3*	19.0	11.3	70.0

Source: Published tables in various issues of *Report on Occupational Wage Survey*.

Note: 1. Consumer price index (1980=100) is used in calculating real wages. All figures in the table are log changes multiplied by 100.

2. *: The data for junior college graduates are available separately after 1974. These figures are for junior college and college graduates.

†: These figures are the changes between 1976 and 1986.

(-3.4% from 1976 to 1986). However, this decline of the college wage premium in the 1980s disguises the different patterns across gender and experience groups. As shown in Table 1 and Figure 1, for males, the college wage premium over high school graduates decreased by 7.3 percent during 1976-86. For females, it decreased by 8.5 percent during 1976-80, but increased by 8.5 percent during 1980-86. This gender difference suggests strong segmentation between the male and female labor markets.⁵

graduates only after 1974. The figures for college graduates between 1971 and 1976 include junior college graduates. However, since the number of junior college graduates in that period is relatively small, the discussion is not wide off the mark.

⁵In figure 1, note the large decline of the college wage premium for females as well as males in 1988. One may argue that the expansion of the college system

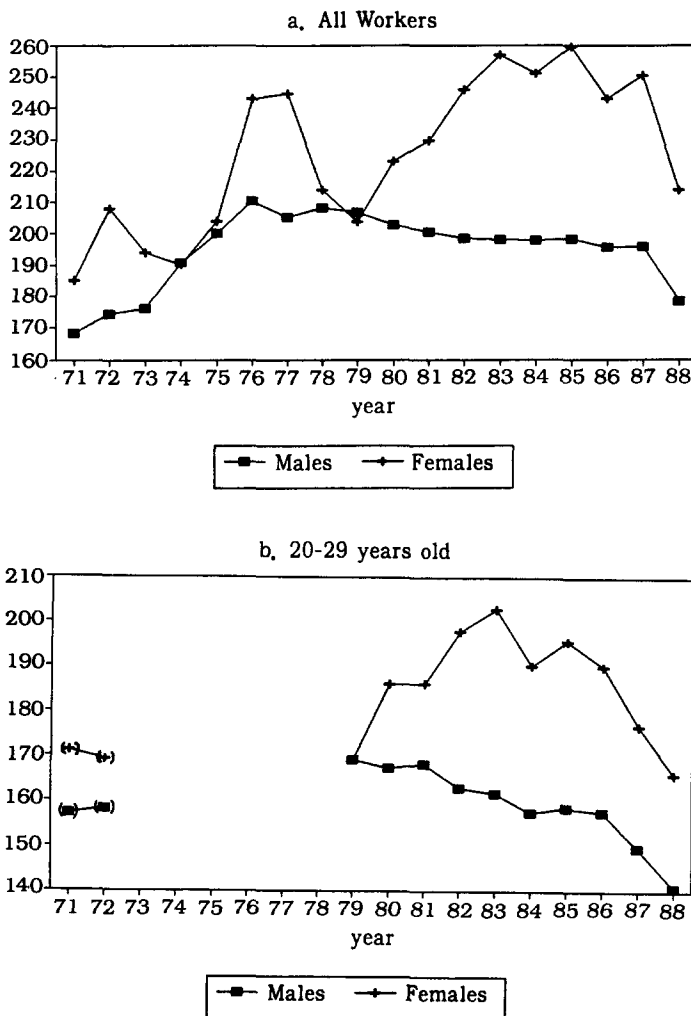


FIGURE 1
COLLEGE WAGE PREMIUM

Since our main interest is to analyze the effect of large supply changes of young college graduates, the college wage premiums for new

from the late 1970s started to affect the labor market only after 1987. However, one may also argue that this decline was caused by the process of active democratization and the unprecedented union movement since the Seoul Olympics in 1988. Our current work does not include the data after 1987 in order to distinguish the effects of supply change from those of new institutional development.

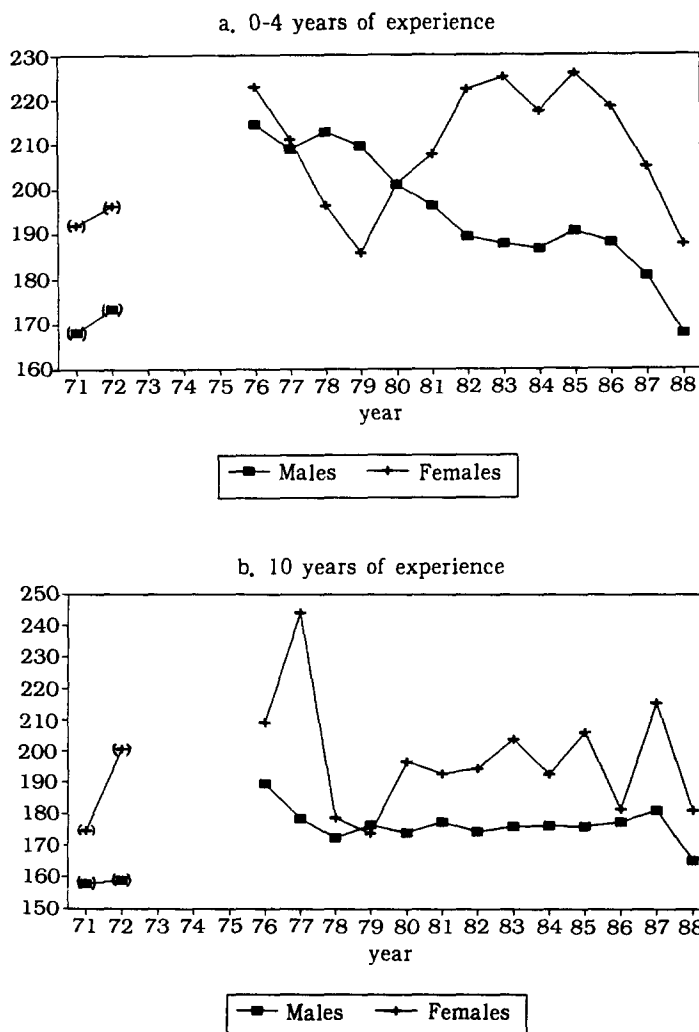


FIGURE 2
COLLEGE WAGE PREMIUM

entrants (those with less than 1 year of experience), young workers (those with less than 4 years of experience), and peak earners (those with more than 10 years of experience) are compared in Table 1 and Figure 2. For males, during 1980-86, the decline of the college wage premium was accelerated for new entrants and young workers (-10%), whereas it remained the same for peak earners. Note that Table 1 indicates that not only the relative wages but also the level of real wages of

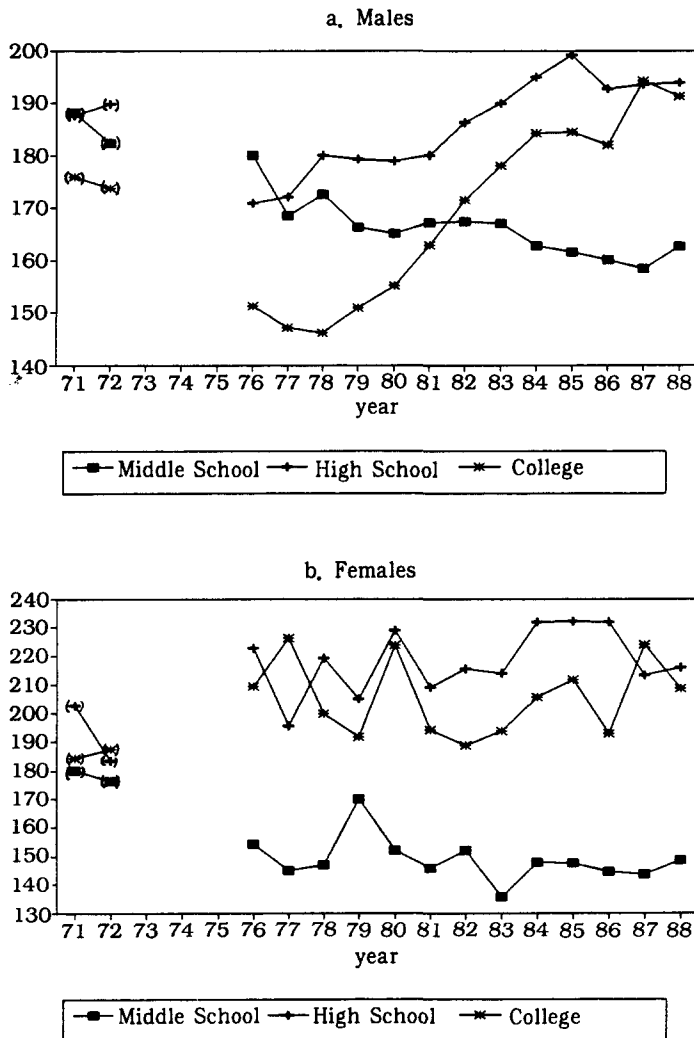


FIGURE 3
EXPERIENCE WAGE DIFFERENTIALS

young male college workers decreased during 1980-86. For females, the picture is drastically different. Like males, the college premium of female peak earners decreased slightly throughout the full period. But young female college workers and new entrants gained substantially (8%) against young female high school graduates during 1980-86.

The fact that the changes of wage differentials are much larger for young workers than for peak earners is consistent with the internal

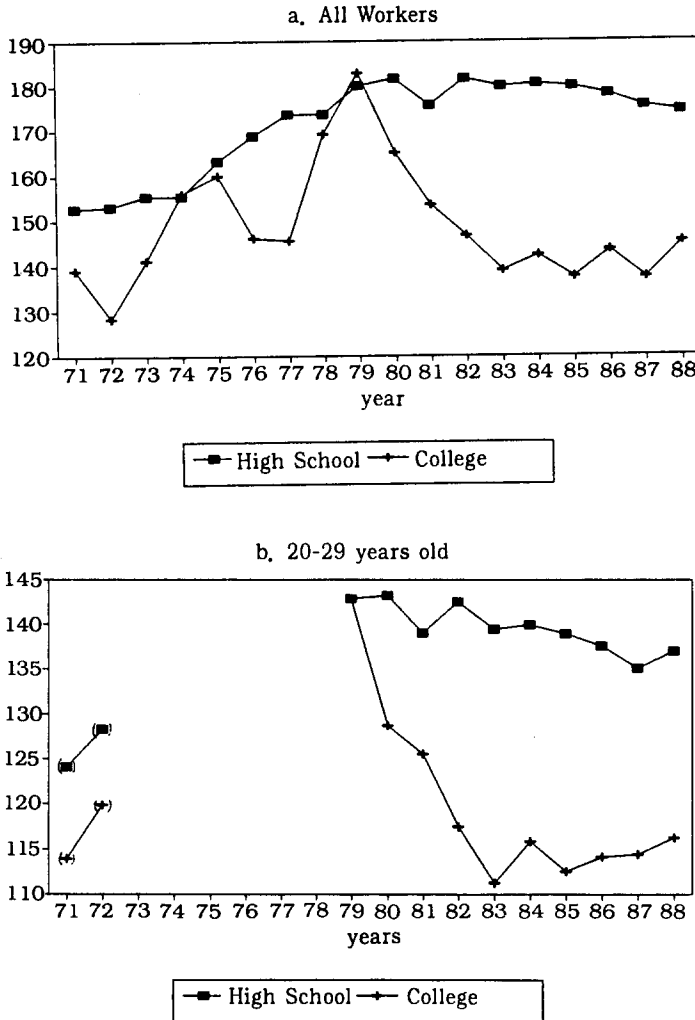


FIGURE 4
GENDER WAGE DIFFERENTIALS

labor market hypothesis that young workers, rather than experienced workers are more likely to bear the burden of adjustment to external shocks. However, considering a similar supply increase of male and female college graduates relative to high school graduates, we are surprised to find increasing female wage differentials between 1980 and 1986. Whether the demand for female college graduates has increased enough to be able to explain this increasing premium is a focal issue in

the next section. This gender difference also makes us doubt the view that the decreasing college premium for young male workers reflects a declining quality of recent college graduates due to rapid expansion of the quota.

Table 1 and Figure 3 examine experience wage differentials within an education group. In Figure 3, the wages of peak earners relative to young workers are plotted for each educational attainment. Interestingly, the cross-section experience-earning profile for high school workers is the steepest in Korea throughout the sample periods. In contrast, the historical patterns in Japan and the U.S. are a steeper experience-earning profile for college than for high school workers. As for the change of experience wage differentials during 1980-86, it is noteworthy that the gap has fallen slightly for female college graduates (-4.8%); the experience differentials increased substantially (15.9%) for male college graduates; they have not changed much for male and female high school graduates.

Gender wage differentials by educational attainment are examined in Figure 4. Male-female wage differentials show positive slopes between 1975 and 1980, but the trend is reversed from 1980. During 1980-86, the male-female wage differentials for young college workers narrowed by 12 percent, whereas Table 1 suggests that gender wage differentials did not change much among peak earners with college degree. The gender wage differentials among high school workers did not change much either for young or peak earners.

In summary, the changes in education-experience-gender wage differentials consistently suggest that, relative to high school graduates and peak earners, young male college graduates have lost the most and young female college graduates have gained the most during 1980-86. Compared with high school graduates, the male college wage premium for inexperienced workers decreased by 4.3 percent during 1980-86. On the other hand, the female college wage premium increased by 5.0 percent.

Another interesting fact is that college wage premiums in Korea are larger than those in the U.S. and Japan across all gender-experience groups. Even in 1986 when the college premium is at its highest in the U.S. since 1967, the college premium for males 25-34 years old was 1.4. (In Japan, it was 1.1)⁶ The corresponding premium in Korea was 1.5, which was the lowest between 1980 and 1986. Given this high

⁶Katz and Revenga (1989).

return, it is not surprising to find excess desire for college education in Korea.

IV. A Simple Supply and Demand Framework

In this section we attempt to explain the changes in college wage premiums using a simple supply and demand model under the assumption that labor inputs from different gender, education, and experience groups are imperfect substitutes. The change in relative demand for college workers with respect to non-college workers is written as

$$\frac{\partial \ln(E)}{\partial t} = \frac{\partial \ln(x)}{\partial t} - \frac{\partial \ln(w)}{\partial t} \varepsilon, \quad (1)$$

where E and w are, respectively, the demand and wages of college workers relative to non-college workers. x is a non-wage factor which determines the location of the relative demand curve. ε is the elasticity of substitution between college and non-college workers. The changes in the relative supply of college workers can be written as

$$\frac{\partial \ln(ES)}{\partial t} = \frac{\partial \ln(s)}{\partial t} - \frac{\partial \ln(w)}{\partial t} \delta, \quad (2)$$

where ES is relative supply, s is a non-wage factor which determines the location of the supply curve, and δ is the supply elasticity of college workers. We assume that the supply of graduates is predetermined by past enrollment decisions and that the elasticity of enrollment in schools, δ , is zero. This assumption seems innocuous for Korea where there has been huge excess demand for college education and the quota for college students has been under strict control by the government. For example, only 64 percent of the applicants could enter colleges in 1984.⁷

With inelastic labor supply and market clearing condition, the change of wage differentials can be written as

$$\frac{\partial \ln(w)}{\partial t} = \left[\frac{\partial \ln(x)}{\partial t} - \frac{\partial \ln(s)}{\partial t} \right] / \varepsilon. \quad (3)$$

Given the parameter ε and measures for the shifts in relative supply and demand, we can compare the actual changes in wage differentials with the one implied by equation (3). However, we are not aware of any

⁷Cited from Yun (1988, p. 2).

estimate of ε for Korea, though Freeman's (1981) estimates of ε for the U.S. is in the order of 1 to 3.⁸ We may get useful insights by calculating and comparing the implied elasticity, ε , across the sub-sample periods or examining the plausibility of the implied elasticities based on *ad hoc* knowledge such as Freeman's estimates.

Needless to say, the above analysis is quite restrictive since we do not allow indirect interactions among various sub-groups. For example, when we analyze the college wage premium relative to high school graduates, we are implicitly assuming that labor markets for college and high school graduates are perfectly segregated from those for middle school graduates. Katz and Murphy (1992) circumvented this problem by distributing middle school graduates between college and high school groups based on measured substitutability from wage regressions.⁹ To avoid possible distortion to supply measures in their method, we decide to keep our simple framework and examine how far it can go in explaining the changes in relative wages. The next two sections explain our measure of supply and demand shifts.

A. Shifts in Supply

An ideal variable for supply shifts might be a measure of the economically active population grouped by educational attainment. Unfortunately, the variable is available only after 1980 for population aged over 15. Table 2 presents the available data. For the analysis of earlier sample periods and different age groups, we adopt two proxies. The first variable is the number of dropouts and graduates by educational attainment in the population. In order to match closely with the economically active population, people currently enrolled in school are excluded. The dropouts of a higher institution are treated as the graduates of the preceding lower institution. Table 3 presents the resulting figures.

From Table 3, one can observe a long run growth in the fraction of more educated workers; there has been substantial decline of middle school (or under) graduates. The growth of junior college and college

⁸Psacharopoulos and Hinchliffe (1972) found that the demand elasticities in less developed countries are lower than those in developed countries.

⁹When Katz and Murphy's method is applied to our data set, it suggests that junior college graduates are more close substitutes to college graduates than to high school graduates for males. For females, they turn out to be more close substitutes to high school graduates.

TABLE 2
 ECONOMICALLY ACTIVE POPULATION BY EDUCATIONAL ATTAINMENT
 (Unit: 1,000 people)

	Middle School or under	High School	College or over
Males			
1980	3236	2056	785
1981	3238	2190	829
1982	3231	2383	942
1983	3154	2581	1012
1984	3069	2833	1146
1985	3095	3065	1270
1986	3053	3296	1363
1987	3050	3559	1471
Females			
1980	2303	742	138
1981	2298	789	143
1982	2518	945	173
1983	2603	1045	193
1984	2517	1187	239
1985	2676	1331	308
1986	2762	1521	351
1987	2930	1731	400

Source: *Annual Report on The Economically Active Population*, various issues.

Note: The figures for college graduates are the sum of college graduates and junior college graduates.

graduates accelerated from 1980 due to the educational policy change explained in section II. However, without controlling for the level of income, the percentage of people with college degrees in Korea is still low compared with those in the developed countries. While 25 percent of males aged between 18 and 65 were college graduates in the U.S. in 1987¹⁰, the proportion was only 11 percent in Korea in 1985. Also, the expansion of the college system from the late 1970s has not had enough time to change the educational composition of whole population: Between 1980 and 1985, among the population over 15 years old, the supply of college workers (plus junior college workers) relative to high school workers increased by 6.8 percent for males and by 6.2 percent for females (0.2% for males and -1.2% for females excluding junior college workers). Among young people aged 20 to 29, the num-

¹⁰Katz and Revenga (1989, p. 19).

TABLE 3
POPULATION BY EDUCATIONAL ATTAINMENT

(Unit: 1,000 people)

	Middle School or under	High School	Junior Col.	College or over
Males				
15 years or over				
1970	6210 (.76)	1314 (.16)	229 (.03)	418 (.05)
1975	6383 (.73)	1738 (.18)	242 (.03)	556 (.06)
1980	6343 (.60)	2904 (.28)	390 (.04)	879 (.08)
1985	5652 (.49)	4064 (.35)	667 (.06)	1233 (.11)
20-29 years old				
1970	1418 (.63)	627 (.28)	100 (.04)	120 (.05)
1975	1767 (.66)	688 (.26)	89 (.03)	132 (.05)
1980	1565 (.50)	1131 (.36)	213 (.07)	203 (.07)
1985	1137 (.32)	1757 (.49)	390 (.11)	319 (.09)
40-49 years old				
1970	1078 (.82)	133 (.10)	36 (.03)	73 (.05)
1975	1107 (.72)	250 (.16)	46 (.03)	131 (.09)
1980	1224 (.63)	424 (.22)	59 (.03)	241 (.12)
1985	1171 (.54)	604 (.28)	75 (.04)	299 (.14)
Females				
15 years or over				
1970	8057 (.91)	610 (.07)	61 (.01)	97 (.01)
1975	8768 (.87)	1076 (.11)	77 (.01)	166 (.02)
1980	8917 (.79)	1960 (.17)	118 (.01)	307 (.03)
1985	8559 (.68)	3204 (.26)	245 (.02)	496 (.04)
20-29 years old				
1970	1864 (.81)	336 (.15)	36 (.02)	59 (.03)
1975	1979 (.74)	576 (.21)	44 (.02)	88 (.03)
1980	2086 (.61)	1110 (.33)	66 (.02)	149 (.04)
1985	1634 (.43)	1785 (.47)	148 (.04)	241 (.06)
40-49 years old				
1970	1366 (.96)	48 (.03)	6 (.00)	6 (.00)
1975	1544 (.93)	97 (.06)	7 (.00)	15 (.01)
1980	1745 (.89)	171 (.09)	13 (.01)	36 (.02)
1985	1751 (.82)	285 (.13)	21 (.01)	67 (.03)

Source: *Population and Housing Census Report*, various issues.

Note: 1. The figures are the numbers of graduates plus dropouts by educational attainment. People currently enrolled in schools are excluded. The dropouts of a higher institution are treated equally with the graduates of the preceding lower institution.

2. The figures in parenthesis are the proportions with respect to total graduates and dropouts in the subgroups.

bers are 9.3 percent for males and 11.6 percent for females (1.2% and 0.1% excluding junior college workers).

However, the figures in Table 3 do not capture the changes in the relative supply of labor correctly. Only when the relative participation rate by educational attainment is time invariant, can Table 3 represent the supply without bias.¹¹ When we calculate the supply changes of college workers (plus junior college workers) relative to high school workers from 1980 to 1986 using the available data of economically active population in Table 2, the changes are 8.4 percent for males and 21.8 percent for females, instead of 6.8 percent and 6.2 percent, respectively. This difference suggests that the relative participation rates between college workers (plus junior college workers) and high school workers increased by 1.8 percent for males and by 15.6 percent for females between 1980 and 1986.¹² In contrast, the relative participation rates do not seem to change much between middle school workers and high school workers. The calculated supply changes between them from Table 3 (-45 percent for males and -53 percent for females) are similar to the figures implied by Table 2 (-52 percent for males and -53 percent for females).

From the data available at hand, the changes in participation rate for the earlier period are not calculable. Judging from the comparison described above, the bias in using Table 3 as relative supply measures would probably be small between middle school workers and high school workers. But we cannot expect that figures in Table 3 capture the supply of college workers, especially female college workers, properly. For the analysis of college workers relative to high school workers, we will compare the results with and without adjusting Table 3 by the implied changes in participation rate calculated above. For the period between 1980 and 1986, Table 2 provides the supply measures for all groups.

The second measure of supply shifts is designed to capture the supply of young or inexperienced workers by educational attainment. The number of new entrants to the job market are calculated. New entrants are measured as the number of new graduates by educational attain-

¹¹Most of previous researches such as Freeman (1976, 1981) implicitly adopt this assumption.

¹²These numbers are close to the authors' calculated participation rates by educational attainment using the data of employed, unemployed, and population by educational attainment from various issues of *Annual Report of Economically Active Population* from 1980 to 1986.

TABLE 4
NEW ENTRANTS BY EDUCATIONAL ATTAINMENT

(Unit: 1,000 people)

	Middle School or under	High School	Junior Col.	College or over
Males				
1970	128	44	3	13
1971	128	44	1	15
1972	127	49	2	15
1973	141	58	4	15
1974	138	72	1	16
1975	114	80	1	18
1976	107	92	1	21
1977	93	106	1	20
1978	68	115	.8	24
1979	74	115	.8	24
1980	42	118	.7	24
1981	45	101	13	27
1982	46	96	13	34
1983	34	108	20	41
1984	39	122	17	49
1985	33	126	17	57
1986	32	129	17	67
1987	32	141	19	74
1988	25	144	20	86
Females				
1970	162	25	3	5
1971	172	21	3	5
1972	173	34	4	6
1973	186	39	2	6
1974	175	52	2	7
1975	155	57	2	7
1976	153	69	2	9
1977	139	82	2	10
1978	104	94	1	10
1979	86	101	1	11
1980	67	117	2	12
1981	65	108	12	13
1982	81	113	17	13
1983	65	118	21	18
1984	62	127	21	22
1985	53	141	25	33
1986	50	158	27	39
1987	47	158	32	45
1988	36	165	36	46

Source: Calculated from the data in *Statistical Yearbook of Education*.

ment minus those who enter higher educational institutions or the army.¹³ Table 4 provides the figures for new entrants. It shows the drastic increase of new entrants with college degrees from the early 1980s when the cohorts with the expanded quota started to graduate. Relative to high school graduates, new entrants with college degrees increased 75 percent between 1980 and 1985. The sum of the previous six years of new entrants was used as a proxy for the supply of workers who have less than four years' experience.¹⁴

B. Shifts in Demand

The shifts in relative demand are measured by a variant of the "fixed weight manpower requirement indices" as pioneered by Freeman (1977, 1978) and elaborated by Katz and Murphy (1992). We assume that the educational composition of workers *within* an industry is fixed during sub-sample periods, and the changes in the shares of inter-industry output cause the shifts in demand for workers by educational attainment.

Specifically, we divide the economy into j industries and the workers into i education groups. Under constant returns to scale, the cost function for industry j can be written as $C(w, Y_j) = C^j(w) \cdot Y_j$, where Y_j is output in industry j and w is a vector of wages for education groups. From Shepard's lemma, the conditional demand for worker with education level i in industry j , $X_{i,j}$ is

$$X_{i,j} = C_{w_i}^j(w) \cdot Y_j, \quad (4)$$

where $C_{w_i}^j(w)$ is the derivative of the unit cost function with respect to wage i . From (4),

$$dX_{i,j} = C_{w_i}^j(w) \cdot dY_j + \sum_k C_{w_i w_k}^j(w) \cdot Y_j \cdot dw_k. \quad (5)$$

We define $dX_{i,j}^* \equiv dX_{i,j} - \sum_k C_{w_i w_k}^j(w) \cdot Y_j \cdot dw_k$ as the shift in demand for workers with education level i in industry j , which is the counterpart expression for $\partial \ln(s) / \partial t$ in equation (2). As a proportion of total work-

¹³Due to new graduates who voluntarily leave job market, this proxy does not perfectly represent the actual number of new entrants to the market.

¹⁴The number six is arbitrarily chosen considering the possibility of unemployment or delayed entrance to the labor market. Given the lack of information, we did not consider the effect of changes in relative participation rates. But we expect that the potential bias would be small for these young groups.

ers with education level i , our measure of demand shift can be written as

$$\frac{\sum_j dX_{i,j}^*}{\sum_j X_{i,j}} = \frac{\sum_j C_{w_i}^j(w) dY_j}{\sum_j X_{i,j}} = \sum_j \left\{ \frac{X_{i,j}}{\sum_j X_{i,j}} \right\} \cdot \frac{dY_j}{Y_j} \equiv \sum_j \beta_{i,j} \cdot \frac{dY_j}{Y_j}, \quad (6)$$

where $\beta_{i,j}$ is the share of workers in industry j among workers with education level i .

The ratio of the above indices reflects relative demand changes which would arise from the shifts in industrial output if wages do not change. For example, if international competition causes high school intensive industries to shrink, the ratio of the demand index for high school workers to the index for college workers will drop. However, as pointed out by Katz and Murphy (1992), these indices are incapable of capturing shifts in demand due to the changes in manpower requirements within an industry.¹⁵ By using different $\beta_{i,j}$ for each sub-period, the bias due to within industry demand shifts could be reduced. Three sub-sample periods, 1971-76, 1976-80, and 1980-86, and fifteen divisions of industries are used in the calculation of the indices. Since published tables do not provide the information for 15 divisions of industries, seven tapes for the years 1971, 1972, 1976, 1980, 1983, and 1986 are used.¹⁶

Table 5 lists the average values of $\beta_{i,j}$ for the three sub-periods by industry and gender. Due to the sampling bias toward manufacturing industries mentioned in section III, the levels of $\beta_{i,j}$ are biased estimators for the industrial distribution of workers by educational attainment. But the ratios of $\beta_{i,j}$ across educational groups in each industry might still be good proxies for the relative educational composition in each industry. The comparison of the ratios illustrates that the education composition of employment varies greatly among industries. For example, between 1980 and 1986, the ratio of $\beta_{i,j}$'s of male college workers with respect to male high school workers varies from less than 0.35 in the mining industry to 4.7 in social and personal services. For males, service, finance, wholesale and construction industries are col-

¹⁵The three cases of "within" demand shifts mentioned in Katz and Murphy (1992) are: factor non-neutral technical progress, changes in the price and quantities of non-labor inputs, and shifts of portions of industry production out of the U.S.

¹⁶By pooling the observations in each tape, the tapes with the smaller number observations implicitly have smaller weights in the calculation of $\beta_{i,j}$.

TABLE 5
INDUSTRIAL DISTRIBUTION OF WORKERS BY EDUCATIONAL ATTAINMENT

(Unit: percentages)										
Industries	Average 1971-76			Average 1976-80			Average 1980-86			
	Midd.	High	Coll.*	Midd.	High	Coll.*	Midd.	High	J.Col.	Coll.
Males, All	100	100	100	100	100	100	100	100	100	100
Mining	11.2	4.2	1.8	8.2	2.4	1.0	9.2	2.6	1.7	0.9
Manufacturing										
Food	5.8	6.7	4.7	4.6	5.1	4.4	4.4	3.2	4.9	4.4
Textile	12.3	14.3	9.4	13.4	12.9	7.7	13.1	12.4	7.3	5.6
Wood	4.0	3.2	1.3	4.1	2.0	1.1	3.0	1.8	0.8	0.6
Paper	4.0	5.7	8.1	3.6	3.9	3.4	3.0	3.6	3.2	3.0
Chemicals	8.7	10.3	10.6	10.1	10.5	8.7	8.3	9.4	7.4	9.9
Non-Metals	5.1	4.1	2.4	4.7	3.0	2.2	5.8	3.5	3.4	2.2
Basic-Metal	2.6	4.1	1.6	3.7	4.5	3.4	4.5	4.6	5.0	2.6
Fab.-Metal	15.7	14.9	8.4	22.3	20.3	14.6	23.2	28.1	27.4	17.7
Electricity	0.7	2.6	2.6	0.4	1.9	1.6	0.4	1.4	2.3	1.4
Construction	1.8	3.8	5.9	1.6	3.8	8.3	1.9	3.6	10.8	10.3
Wholesale	2.0	2.6	2.8	2.4	5.0	7.4	1.3	4.0	4.8	7.5
Transportation	21.3	12.6	6.8	14.1	9.1	5.4	16.3	9.4	6.4	4.4
Finance	1.5	6.7	12.4	2.2	10.0	10.3	2.1	6.0	5.5	12.2
Services	3.5	4.3	21.4	4.7	5.7	20.4	3.3	3.7	9.2	17.4

TABLE 5
(CONTINUED)

Industries	Average 1971-76			Average 1976-80			Average 1980-86			
	Midd.	High	Coll. ¹	Midd.	High	Coll. ¹	Midd.	High	J.Col.	Coll.
Females, All										
Mining	0.5	0.6	0.4	0.3	0.5	0.0	0.4	0.3	0.1	0.1
Manufacturing										
Food	6.9	5.3	1.7	5.0	4.9	1.8	4.0	6.5	2.9	1.4
Textile	57.4	17.7	2.9	55.7	14.8	3.8	58.7	19.2	6.1	3.0
Wood	2.3	2.2	0.9	1.9	1.3	1.6	1.5	1.0	0.5	0.2
Paper	1.9	4.2	3.0	1.8	2.8	2.3	1.1	2.0	1.2	3.2
Chemicals	8.6	8.9	5.8	10.2	9.4	3.6	8.8	10.0	3.0	4.8
Non-Metals	1.9	1.3	0.2	2.3	1.4	0.7	2.5	1.6	0.9	0.5
Basic-Metal	0.1	1.1	0.4	0.2	1.2	0.7	0.4	0.7	0.8	0.4
Fab.-Metal	8.8	13.2	3.5	15.8	21.2	4.3	15.3	28.3	6.1	3.0
Electricity	0.0	0.4	0.2	0.0	0.6	0.0	0.0	0.4	0.3	0.1
Construction	0.2	1.9	1.3	0.1	1.8	1.8	0.1	1.7	1.9	1.1
Wholesale	1.8	6.7	1.9	1.6	9.8	3.8	0.1	7.2	5.9	4.6
Transportation	7.6	10.1	3.9	2.7	6.1	6.3	4.2	6.8	6.1	3.8
Finance	0.6	14.8	8.6	0.7	16.9	5.9	0.5	8.3	4.7	5.7
Services	1.6	11.7	65.5	1.6	7.4	63.5	1.6	6.1	59.7	68.4

Source: Authors' calculation from *Occupational Wage Survey* tapes.

Note: * : These figures should be interpreted carefully since the data have a sampling bias toward manufacturing. Before 1980, the figures for college graduates are the sum of college graduates and junior college graduates. Appendix lists the non-abbreviated classification of industries.

TABLE 6
 AVERAGE SHARES AND GROWTH RATES OF GDP BY INDUSTRY
 (Unit: Percentages)

Industries	Average Shares			Growth Rates		
	1971-76	1976-80	1980-86	1971-76	1976-80	1980-86
Mining	1.8	1.8	1.5	42.0	37.1	26.3
Manufacturing	(37.4)	(40.1)	(39.2)	(73.0)	(31.8)	(61.3)
Food	9.1	8.4	7.6	47.7	25.3	39.9
Textile	8.1	7.3	6.4	73.1	17.5	42.3
Wood	1.1	0.2	0.3	21.7	-10.4	45.6
Paper	1.9	1.7	1.1	47.0	20.8	74.4
Chemicals	6.9	8.3	8.6	77.7	40.0	62.0
Non-Metals	1.7	1.1	1.4	53.8	50.5	54.2
Basic-Metal	1.4	2.1	3.6	152.1	88.2	55.0
Feb.-Metal	7.1	9.9	10.1	107.7	29.4	89.9
Electricity	2.0	2.6	3.6	35.4	65.5	100.2
Construction	6.8	9.9	10.3	51.7	84.7	38.9
Wholesale	26.2	20.1	16.5	43.3	2.5	53.4
Transportation	9.6	9.6	10.5	37.8	48.9	55.3
Finance	11.1	12.0	13.8	33.1	70.1	62.7
Services	5.1	4.3	4.4	26.8	36.4	77.2
Total	100	100	100	52.2	38.0	58.9

Source: *National Account*, Bank of Korea, various issues.

Note: 1. Appendix lists the non-abbreviated classification of industries.

2. Producers of government services are excluded.

lege graduate intensive industries whereas manufacturing industries are generally high school graduate intensive. Surprisingly, the construction industry turns out to be college intensive, and this might be due to the fact that most of the blue collar workers in the construction industry are part-time workers and hence excluded from our data set.

Educational compositions of workers in each industry are not different across sub-periods and gender: Spearman's rank correlation coefficient of the ratios of β_{ij} for male college workers and high school workers between the first and the last sub-period is 0.88. The rank correlation coefficient between males and females is 0.60 in the last sub-period.¹⁷ One gender difference to note is that more than 68 percent of

¹⁷Under the null hypothesis that all permutations of ranking in 15 industries are equally probable, Spearman's rank correlation is symmetrically distributed with zero mean and standard deviation 0.27. See Theil (1971, p. 619).

TABLE 7
SHIFTS IN DEMAND

(Unit: Percentages)

	1971-76*	1976-80*	1980-86
Males, age 15 or over			
Middles School	60.98	34.93	59.74
High School	63.32	38.76	63.99
Junior College			65.12
College or over	52.48	40.88	64.40
Females, age 15 or over			
Middles School	68.44	23.83	53.21
High School	57.44	35.85	64.13
Junior College			69.65
College or over	37.06	36.98	71.75
Males, age 20-29			
Middles School	65.41	32.97	61.75
High School	66.60	37.36	66.32
Junior College			66.91
College or over	57.02	42.07	65.10
Females, age 20-29			
Middles School	68.61	23.53	53.16
High School	57.42	35.67	64.13
Junior College			69.29
College or over	38.48	37.83	70.88
Males and Females (age 15 or over)			
Middles School	64.26	29.47	56.50
High School	62.11	37.95	64.04
Junior College			66.11
College or over	51.30	40.40	64.88
(age 20-29)			
Middles School	67.23	27.52	56.49
High School	63.40	36.64	65.27
Junior College			67.70
College or over	53.30	40.86	65.92

Source: Authors' calculation from *Occupational Wage Survey* tapes.

Note: *: Before 1980, the figures for college graduates are the sum of college graduates and junior college graduates.

female college graduates are concentrated in service industry. (This is remarkable considering the bias of the data toward manufacturing!) In summary, the substantial variation of β_{ij} across industries suggests

that industrial output variation can possibly generate significant changes in relative demand for workers with different educational attainment.

The shares and the growth rates of Gross Domestic Products by industry are presented in Table 6. The basic message of the table is that manufacturing industries were the engine of the growth in the early 1970s, the construction industry was the leader between 1976-80, and the fast growth sectors in the 1980s were service, electricity, and finance industries. This is suggestive of a demand shift in favor of high school graduates in the early 1970s and in favor of female college graduates in the 1980s. Due to stagnation in the construction industry, the demand shift for male college graduates in the 1980s is hard to predict.

Table 7 presents the estimated demand shifts for education and gender groups. The figures should be interpreted in the following manner: If wages do not adjust, labor demand for college workers would have increased 64 percent between 1980 and 1986, and so on.¹⁸ Table 7 suggests that the demand shifts toward less educated workers had been substantial in the early 1970s: The demand shifts for college workers relative to high school workers were -10 and -20 percent for males and females, respectively. This trend was reversed from the late 1970s. In the 1980s, there has been a demand shift in favor of female college graduates by 7.6 percent relative to female high school graduates. The relative demand between male college graduates and high school graduates did not change much between 1980 and 1986. The relative demand for middle school workers decreased significantly in the 1980s.

C. Summary

Tables 8 and 9 summarize the changes in wages and our measures of demand and supply shifts for the three sample period.¹⁹ Besides the figures for workers aged 15 or over, those for inexperienced workers (less than four years experience) are presented to analyze the effect of

¹⁸Real GDP has grown 59 percent during this period.

¹⁹We choose the sub-periods in consideration of changes in wage differentials, educational policy, and the availability of the supply measure and the tapes. Using the supply measure of the years 1970, 1975, 1980, and 1985 for the analysis of changes in wage differentials between 1971-76, 1976-80, and 1980-86 would not cause significant biases, since Census is usually conducted in November and *Occupational Wage Survey* is compiled in April.

TABLE 8
COLLEGE GRADUATES VS. HIGH SCHOOL GRADUATES
(Unit: Percentages except ε)

		$\frac{\partial \ln(W)}{\partial t}$	$\frac{\partial \ln(x)}{\partial t}$	$\frac{\partial \ln(s)}{\partial t}$	ε
1971-76	15 years old or over				
	Males and Females	20.2	-10.8	-12.3	0.07
	Males	17.3	-10.8	-6.9	
	Females	15.2	-20.3	-13.8	
	0-4 years of experience				
	Males and Females	20.9	-10.1	-35.7	1.22
	Males	19.4	-10.3	-30.9	
	Females	6.4	-19.3	-41.0	
1976-80	15 years old or over				
	Males and Females	-2.3	2.5	-6.0	-3.69
	Males	-5.2	2.1	-4.9	
	Females	-7.9	1.1	-3.8	
	0-4 years of experience				
	Males and Females	-7.6	3.5	-34.7	-5.03
	Males	-8.8	3.4	-27.9	
	Females	-11.1	1.4	-43.1	
1980-86	15 years old or over				
	Males and Females	-6.6	1.1	7.9	1.03
	Males	-7.0	0.5	8.4	
	Females	3.4	6.5	21.8	
	0-4 years of experience				
	Males and Females	-8.1	0.9	77.4	9.44
	Males	-10.9	-0.0	81.9	
	Females	3.3	5.5	78.2	
1980-86 (Without Junior college)	15 years old or over				
	Males and Females	-2.9	0.8	1.2	0.14
	Males	-3.5	0.4	2.0	
	Females	8.5	7.6	14.3	
	0-4 years of experience				
	Males and Females	-4.1	0.6	47.2	11.36
	Males	-6.6	-0.2	59.1	
	Females	8.1	6.4	36.9	

Note: The figures for college graduates are the sum of college graduates and junior college graduates except the figures in the last box.

the rapid increase in young college graduates in the 1980s. The demand elasticities of substitution implied by equation (3) are calculated in the last columns of the tables.

TABLE 9
MIDDLE SCHOOL GRADUATES VS. HIGH SCHOOL GRADUATES
(Unit: Percentages except ϵ)

		$\frac{\partial \ln(W)}{\partial t}$	$\frac{\partial \ln(x)}{\partial t}$	$\frac{\partial \ln(s)}{\partial t}$	ϵ
1971-76	15 years old or over				
	Males and Females	0.7	2.2	-15.5	25.2
	Males	-2.1	-2.3	-18.3	
	Females	25.2	10.9	-48.3	
	0-4 years of experience				
	Males and Females	0.7	2.8	-65.1	97.0
	Males	-6.6	-1.9	-61.5	
	Females	15.0	10.6	-78.0	
1976-80	15 years old or over				
	Males and Females	15.1	-8.5	-56.9	3.20
	Males	14.5	-3.8	-58.8	
	Females	10.9	-12.0	-58.2	
	0-4 years of experience				
	Males and Females	15.2	-8.6	-84.9	5.02
	Males	18.8	-3.5	-79.4	
	Females	11.4	-11.5	-94.0	
1980-86	15 years old or over				
	Males and Females	12.0	-7.5	-47.3	3.32
	Males	6.3	-4.2	-45.1	
	Females	8.5	-10.9	-53.2	
	0-4 years of experience				
	Males and Females	16.9	-9.2	-107.2	5.80
	Males	11.5	-5.3	-110.7	
	Females	11.1	-11.1	-111.2	

The college wage premium relative to high school graduates is analyzed in Table 8. Since the data for junior college graduates are separately available from college graduates only after 1980 in general, the figures for college workers in the first two sample periods include junior college workers as well. For the sample period between 1980 and 1986, the figures with and without junior college workers are reported separately. Since the number of junior college graduates before 1980 was negligible, we think a consistent inter-period comparison would be to use the figures without junior college workers rather than those including them in the last sample period.

In Table 8, the signs of the implied demand elasticities indicate a mixed performance of the model in explaining the college wage premi-

um. The implied elasticity in the period between 1980 and 1986 is 1.03 which is within the range of Freeman's estimates for the U.S. economy. But the implied elasticity in the second sample period has a wrong negative sign. In evaluating the performance of the model, however, we want to discount the pre-1980 results heavily. As discussed in section IV. B, due to the lack of information for participation rates, we are less confident in the quality of supply measures for college workers before 1980.²⁰ In contrast, Table 9 shows the reasonable performance of the model in explaining the high school wage premium relative to middle school graduates for all sample periods. The implied elasticities are larger than Freeman's favorite estimates of elasticities of substitution between college and high school graduates. Judging from skill differentials, the larger substitutability between high school and middle school graduates seems plausible.

In Table 8 and 9, the implied elasticities are not separately reported for males and females since it requires an implausible assumption that labor markets for females and males are perfectly separated.²¹ Considering the crudeness of our proxies, we regard the following interpretations as the most we can get from our simple demand supply framework.

First, the increase of relative earnings of the least educated groups (middle school or under) was mainly due to the supply factor: their relative supply has been rapidly decreased throughout the whole sample period. Even though the demand for the least educated workers has fallen, the supply effect dominated.

Second, given the similar magnitude of increase in the supply of young male and female college graduates relative to high school graduates, there must have been significant relative demand growth for female college workers to explain the increase in the female college wage premium in the 1980s. In fact, there has been positive demand growth for young female college graduates whereas the demand for male college workers did not change significantly. Note that, before 1980, the demand for male and female college workers co-moved.

²⁰If we recalculate the supply measures in Table 8 by adopting the courageous assumption that the changes in relative participation rates before 1980 were similar in magnitude to the changes in the 1980s, the implied elasticities become close to zero in the first two sample periods.

²¹When calculated, most of the implied demand elasticities of substitution between female college graduates and high school graduates have wrong negative signs.

Expansion of service sectors, where most female college workers are concentrated, in the 1980s is the main reason for this divergence.²²

Given the mixed performance of the simple demand and supply model, especially for explaining the pre-1980 college wage premium, we consider another hypothesis which is a polar opposite, in spirit, in explaining college wage premiums.

V. An Alternative Explanation of Wage Differentials

Consider the following story which introduces non-price adjustment into the simple demand and supply model. If wages of "college-level" occupations are downwardly rigid, the increase of college workers would result in the rationing of "college-level" occupations *ceteris paribus*. Those who are unable to find "college-level" occupations in the primary market would either find jobs normally held by non-college workers, remain unemployed, or leave the labor market. Since male workers are usually primary earners whereas female workers are secondary earners, male workers are more likely to accept low-ranking jobs rather than being unemployed. In that case, even though the wages of "college-level" jobs do not decline compared with the wages in jobs previously held by non-college workers, the observed relative wage of the male college employees could decrease due to the people who take a job in the secondary market. In contrast, if female college workers prefer unemployment to taking a job in the secondary market, the observed relative wages would not decrease. Instead the unemployment rate of female college workers would be higher than that of males.²³

Some suggestive evidence for the above hypothesis of occupational choice deterioration is presented in Table 10 and 11. Table 10 examines the unemployment rates by educational attainment. The proposed hypothesis predicts that the unemployment rate of female college workers relative to female high school workers should grow faster than that of males. Between 1980 and 1985, the ratio increased by 35 percent from 0.6 to 0.85 for males. For females the ratio increased by 96 per-

²²The fact that relative demand and wage increases for female college workers aged over 15 are larger than those for inexperienced workers is not inconsistent with the fact that young female college workers gained against female peak earners (Table 2). It suggests that the demand increase is not only for inexperienced workers but also for young female workers in general.

²³The above argument implicitly assumes that there exists perfectly elastic labor demand in the secondary labor market.

TABLE 10
UNEMPLOYMENT RATE BY EDUCATIONAL ATTAINMENT

(Non-Farm Household)

	Elementary School	Middle School	High School	College or over
Males				
1980	8.0	9.1	9.5	5.7
1981	6.8	8.0	9.4	6.2
1982	5.3	7.7	8.9	5.8
1983	5.7	7.1	7.6	5.9
1984	5.4	6.2	6.5	5.2
1985	5.0	6.2	6.7	5.7
1986	5.0	5.6	6.2	6.3
1987	3.4	4.5	5.1	5.1
Females				
1980	2.9	4.6	11.3	8.7
1981	1.3	2.8	9.1	6.3
1982	1.5	2.2	8.1	6.9
1983	1.2	2.1	6.2	6.7
1984	1.2	2.0	5.1	7.6
1985	1.0	1.9	4.7	9.4
1986	0.8	1.4	4.1	8.3
1987	0.6	1.4	3.2	7.5
Males and Females				
1980	5.6	7.7	10.0	6.3
1981	4.2	6.3	9.3	6.3
1982	3.3	5.9	8.7	5.9
1983	3.4	5.3	7.2	6.0
1984	3.1	4.7	6.0	5.6
1985	2.8	4.6	6.1	6.5
1986	2.7	4.0	5.6	6.7
1987	1.9	3.2	4.5	5.6

Source: Authors' calculation from *Annual Report on the Economically Active Population Survey*.

cent form 0.76 to 2. But, if the cyclical sensitivity of unemployment is different between male and female workers, this simple comparison of the growth rates would be inappropriate. In order to eliminate the possible cyclical bias, we regressed the ratio of female and male relative unemployment rates between college workers and high school workers on the GNP gap. The comparison of the residuals also shows that the ratio for females grew faster than those of males, which is consistent

TABLE 11
 THE CHANGES IN EMPLOYMENT BY EDUCATIONAL ATTAINMENT AND OCCUPATIONS
 (Unit: 1,000 people)

	1975-80		1980-85	
	Junior Col. and over	High Sch. and under	Junior Col. and over	High Sch. and under
Males				
Pro. & Technical	85.9	25.2	86.7	54.0
Adm. & Managerial	27.6	10.0	39.4	37.1
Clerical	29.5	135.2	165.3	176.4
Sales	6.2	177.3	57.0	203.0
Service	-2.0	92.5	27.8	178.2
Production & Trans.	-0.7	598.8	9.7	599.3
Total	146.5	1039.3	386.1	1248.5
Females				
Pro. & Technical	48.0	11.0	74.0	56.4
Adm. & Managerial	-1.6	-0.5	1.3	3.0
Clerical	5.7	198.1	31.1	173.9
Sales	1.1	80.6	20.2	326.3
Service	0.7	60.1	13.6	304.6
Production & Trans.	-0.4	179.0	4.2	164.6
Total	55.0	528.0	144.7	1029.0

Source: Calculated from the data in *Population and Housing Census Report* and *Annual Report on the Economically Active Population Survey*.

with the prediction of the proposed hypothesis.

Table 11 summarizes the type of occupations obtained by workers from 1975 to 1985. Between 1975 and 1980, employment of male college graduates grew by 0.146 million. Among them, 77 percent of these new employees could get either professional and technical jobs or administrative and managerial jobs which have been college worker intensive and have higher college wage premiums.²⁴ Between 1980 and 1985, in contrast, only 32 percent of the college workers could find a job in these occupations. For female college graduates, the correspond-

²⁴For example, in 1986, 87 percent of male middle school graduates were production workers. Among male high school graduates, 56 percent were production workers, 27 percent clerical workers, 6 percent professional workers, and 4 percent administrative workers. In contrast, 41 percent, 20 percent, and 36 percent of male college graduates had professional (and technical), administrative, and clerical occupations, respectively. (Source: *Annual Report on the Economically Active Population Survey*)

TABLE 12

CHANGES IN RELATIVE WAGES IMPLIED BY CHANGES IN OCCUPATIONAL DISTRIBUTION
(Unit: percentages)

	Actual Changes		Implied Changes	
	1971-80	1980-86	1971-80	1980-86
College vs. High Sch. including Junior Col.				
15 years old and Over				
Males and Females	17.8	-6.6	9.8	-2.7
Males	12.1	-7.0	11.9	-1.4
Females	7.3	3.5	12.7	5.3
0-4 years of Exp.				
Males and Females	13.3	-8.1	7.0	-5.6
Males	10.8	-10.9	6.8	-4.8
Females	-4.6	3.4	-0.2	4.8
College vs. High Sch. excluding junior Col.				
15 years old and Over				
Males and Females		-2.9		-1.6
Males		-3.5		-0.2
Females		8.5		5.3
0-4 years of Exp.				
Males and Females		-4.1		-5.3
Males		-6.6		-4.0
Females		8.1		4.0
Middle School vs. High School workers				
15 years old and Over				
Males and Females		12.0		0.2
Males		6.3		1.4
Females		0.8		4.2
0-4 years of Exp.				
Males and Females		16.9		3.3
Males		11.5		4.4
Females		11.1		4.6

Source: Authors calculation from *Occupational Wage Survey Tapes*.

ing likelihood to find those occupations declined from 84 percent to 52 percent. These figures indicate that there has been noticeable deterioration of occupational choice by young college workers, and the deterioration was more severe for males than for females.

To quantify the importance of occupational deterioration, we compute the wage changes implied by changes in occupational distri-

bution. First, we estimate the distribution of workers by educational attainment across six occupations for the years 1970, 1980 and 1986. Using the wages in 1970 (respectively, 1980) as given, the implied wages for each education group and their relative wages are recalculated for 1980 (respectively, 1986). These indices measure the relative wage differentials due to changes in occupational distribution assuming wages are fixed at the beginning year of the sub-sample period. The results are reported in Table 12.²⁵

The first two columns of Table 12 show the actual changes in college or middle school wage premiums during 1970-80 and 1980-86. The third and the fourth columns report the implied changes in wage premiums due to changes in occupational distribution. For example, of the 10 percent decline of the college wage premium between 1980 and 1986, 4.8 percent can be attributed to occupational deterioration for young male college workers relative to high school workers even without any change in wage rates. The figures suggest that there had been occupational upgrading of college workers relative to high school workers during 1970s. However, in the 1980s, occupational choice significantly deteriorated for male college workers, especially for inexperienced workers, whereas the choice improved for female college workers.

Care should be taken in interpreting the figures in Table 12. The change in occupational distribution might be due to "within" industry demand change that resulted from factor non-neutral technological progress, etc. In fact, occupational upgrading of female college workers is bad news to a pure form of the proposed hypothesis which predicts no change or slight downgrading of occupational choice of female college graduates, not upgrading. Also, the fact that the proportion explained by occupational choice changes is larger in the 1970s than in the 1980s is inconsistent with the proposed hypothesis. If rationing of jobs is a main reason for observed wage changes, it should be more prevalent in the 1980s when the relative supply changes are larger. These consideration suggests that there has been favorable demand change toward more professional occupations, which cannot be fully captured by our demand index in section IV. Further study on the gender differences in the college wage premium in the 1980s seems in order.

²⁵Due to the small number of observation in 1976 survey tape, we could not break the sample into three sub-periods as in previous tables.

VI. Conclusion

This paper documents and tries to explain the changes in educational wage differentials in Korea from 1971 to 1986. We are especially interested in analyzing the effect of a rapid exogenous increase of young college graduates in the 1980s due to educational policy change. We do not find a simple model which can explain the various facts of educational wage differentials in Korea consistently. However, even with the data limitations, we believe that the few stylized facts summarized in the introduction are robust and deserve further investigation.

A remark is in order regarding the updating of our analysis with the data after 1987. The extended sample period would let the expansion of the college system from the late 1970s have enough time to change the educational composition of whole population. In fact, we are aware of a recent rapid decline of the college wage premium in Korea. However, Korea has been experiencing institutional changes such as active democratization and unprecedented union movement since the Seoul Olympics in 1988. In explaining the recent decline of the college wage premium, distinguishing the effects of the increased supply of young college workers from those of new institutional developments in the labor market would be useful but difficult.

Appendix: Industry Classification

Mining	Mining and quarrying
Manufacturing	
Food	Food, beverages and tobacco
Textile	Textiles, wearing apparel and leather industries
Wood	Wood and wood products including furniture
Paper	Paper, paper products, printing and publishing
Chemicals	Chemicals and chemical, petroleum, coal, rubber and plastic products
Non-Metals	Non-metallic mineral products except petroleum and coal
Basic-Metal	Basic metal industries
Fab.-Metal	Fabricated metal products, machinery and equipment
Electricity	Electricity, gas and water
Construction	Construction
Wholesale	Wholesale and retail trade, restaurants and hotels
Transportation	Transport, storage and communication
Finance	Finance, insurance, real estate and business services
Services	Community, social and personal services

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