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Heeseon Choi

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ABSTRACT

ESSAYS ON THE IMPACT OF MATERNITY LEAVE POLICY AND EDUCATIONAL POLICY ON THE LABOR MARKET OUTCOMES OF WORKERS

By

Heeseon Choi

This dissertation is composed of two chapters that explore the labor market outcomes of the policy: Chapter I about the maternity leave policy in the United States and Chapter II about the college education expansion policy in South Korea.

Chapter I investigates the effects of maternity leave benefit on the labor market outcomes of mothers with newborn babies. Until the FMLA (The Family and Medical Leave Act) has passed in 1993, the general policy approach towards maternity leave was to attempt to increase the number of employees with maternity leave coverage by legislative mandates. Existing literature, therefore, examines whether the implementation of a certain mandates was efficient by showing that there was no disemployment effect on the benefited group. Chapter I provides an argument in favor of this approach by showing that existing maternity leave program seems to benefit the women they covered.

I estimate the effect of maternity leave benefit after controlling for substantial intrinsic differences between maternity leave covered workers and uncovered workers. The fixed effects estimation method is used to analyze the wage effect.

Also, more explanatory variables are added to designate heterogeneity for the analysis of the turnover and employment effects.

The results of the Chapter I support the hypothesis that maternity leave coverage is beneficial on women's labor market outcomes. Maternity leave significantly lessens turnover one year after childbirth, and is closely related with higher employment one or two year after childbirth. Also, it is found that women who had a covered job maintain steeper wage profiles before and after childbirth.

Chapter II explores the effects of the college education expansion policy on wages and employment during the 1980s and the 1990s in South Korea, including a sudden increase in the college entrance quota in 1981.

First, changes in the returns to the college education before and after a large increase in the quota in 1981 are explored by using the difference-in-difference method. Second, a time series analysis provides the overall impact of the college education expansion policy. The estimation results of the reduced form equation indicates that the relative wages and employment of all workers including both young and old responds to the policy with the time lag. Third, the estimation result of the determinants of college enrollment, after controlling for trend and the first order autocorrelation, shows that the declining wages of college graduates have discouraged the college enrollment. It implies that the market incentives are still working in private decisions to enroll in college in South Korea where the government has regulated the behavior of college enrollment.

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CHAPTER 1

THE EFFECTS OF MATERNITY LEAVE BENEFITS ON LABOR MARKET OUTCOMES

I. Introduction

The job-reinstatement right that maternity leave policy provides is believed to affect women's earnings profiles by extending their pre-birth job tenure. By removing fertility-related career interruption, this right can narrow the wage gap between working mothers and single women workers as well as the wage gap between male and female workers (Waldfogel 1998). Getting maternity leave covered jobs in their earlier careers is considered to be important for young women to find equal footing with their male counterparts in the workplace.

The job-reinstatement right has become an essential part of maternity leave benefits. Earlier versions of maternity leave policy such as the 1978 Pregnancy Discrimination Act (the PDA) required eligible employers to cover the medical insurance costs for pregnancy or childbirth. Although the guidelines of the PDA prohibited dismissals due to pregnancy or childbirth, guaranteeing the job-reinstatement right was not the main concern of PDA. Indeed, maternity leave policy practiced by firms was largely informal and discretionary before the late 1980s. (Kamerman, Kingston and Kahn 1983). Most firms that permitted such a leave did not provide a formal guarantee of job protection. Thus, guaranteeing a job-reinstatement right became the core issue in the implementation of the state

maternity/parental/family leave statutes during the late 1980s. After the Family and Medical Leave Act (the FMLA) was passed in 1993, job-reinstatement rights became an essential part of the maternity leave benefit on a national scale.[1]

Since the job-reinstatement right is at the core of maternity leave benefits after the 1980s, we can ask whether it has significantly increased employment of mothers of new-born babies by helping them to return to pre-childbirth employers. This paper will investigate the effect of firms' provision of a maternity leave benefit on labor market outcomes of mothers with newborn babies. A maternity leave program is expected to remove involuntary job-separation at the time of giving birth, so could contribute to a steeper wage profile. Also, a maternity leave program, by guaranteeing the future job-reinstatement right, could encourage young women to participate more in the labor force, to invest more resource in the education and training before giving birth, and therefore to increase their earnings.

However, there is a serious barrier to attempts to estimate the size of these effects. Jobs that offer maternity leave coverage may be correlated with higher wages. In other words, women with more unobserved ability or greater labor force attachment may self-select into covered jobs. Then, an unobserved heterogeneity between maternity leave covered women and not-covered women would result in biased estimates of the effect of coverage. In this paper, I try to estimate the effect of

[1] The FMLA covers women who are employed by firms with more than 50 employees and who have worked more than half-time for their employer for at least one year. Around 45 percent of women workers are classified into this category (Waldfogel 1998). Prior to the FMLA, estimated percentage of actual coverage varies by studies. Waldfogel (1998) estimated that 40 percent of working women had employers who offered maternity leave in 1991. According to my calculation using the NLSY, maternity leave coverage was 65.1 percent in 1988, 66.9 percent in 1991, and 65.2 percent in 1996. This calculation includes all workers including part-time workers.

maternity leave benefits, after controlling for substantial intrinsic differences between maternity leave covered workers and not-covered workers.

Existing studies on the effects of maternity leave were largely inspired by the growth of women's rights movement. Their main argument is that the maternity leave policy has exerted significant and positive effects on women's wages and employment. Representative works are Waldfogel (1993; 1997; 1998), Albrecht, Edin, Sundstrom, and Vroman (1998), Ruhm (1998), Trzcinski (1991), and Spalter-Roth and Hartman (1991). Among them, Waldfogel (1998) is closest in spirit to this paper, as it attempted to evaluate the effect on women of working in a job that provided maternity leave benefits, rather than the effect on outcomes of all women of childbearing age of legislated maternity leave mandates that leave many women uncovered. Waldfogel found a large wage premium for those who were covered by and who used maternity leave at the time of giving birth, a premium large enough to offset the negative wage effect from childbearing.

However, other studies cast doubt on the large wage premium attributed to maternity leave by Waldfogel. For example, Mincer and Polachek (1974), Mincer and Ofek (1982), Sandel and Shapiro (1982), and Corcoran, Duncan, and Ponza (1983) investigated the effect of an interrupted career on women's wages and found the wage "rebound" phenomenon that took place with a quick return to the labor force. Malkiel and Malkiel (1973), Garvey and Reimers (1980), Filer (1993), and Light and Ureta (1995) also argued that if wages were more closely related with actual experience rather than with tenure, the alleged beneficial effects of maternity

leave policy on wages would be depreciated.[2] In addition, Waldfogel did not consider the fact that women with higher unobserved skills may self-select into maternity leave covered job, a possibility I will explicitly explore in this paper

Contrary to above studies which evidenced the positive effects of maternity leave for women, another stream of studies, like, Summers (1989), Klerman and Leibowitz (1997), Ruhm (1997), Kane (1997), and Bond (1991), Baum (1998), Gardecki (1997), Gruber (1994), emphasized the "efficiency cost" of maternity leave, that is, the disemployment effect of the policy on the benefited group. It is argued that "efficiency cost" happens when women do not value the benefit of maternity leave, so wages are not lowered after the implementation of the mandates.

In this paper, I use the sample of women who gave births and worked at the time of giving births during 1988-1992 from the National Longitudinal Survey of Youth (NLSY) data set. This sample is appropriate for evaluating the effect of maternity leave benefit or more concretely the job-reinstatement right of that benefit on women's labor market performance. The treatment group is maternity leave covered women and the control group is not-covered women. Clear definition of the treatment and control group is an advantage of my sample. The unclear control group of some studies about the effect of enactment of maternity leave legislation often brings them ambiguous results.

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[2] Malkiel and Malkiel (1973), Garvey and Reimers (1980), Filer (1993), and Light and Ureta (1995) argued that actual experience is more important than tenure in the earlier career. They argued that quick returnees to the labor force suffer little detrimental effect from their time out of labor force. However, that does not mean that the wage level of returnees can catch that of continuous workers. That is, since these studies is about the effect of job separation in general, their results cannot be directly compared with studies which argues that fertility-related involuntary job separation might be significantly detrimental.

This paper proceeds as follows. Section II briefly summarizes the issues in the maternity leave policy. Section III reviews previous studies and Section IV covers data. Section V performs empirical analysis for the effect on turnover, employment, and wage profiles. Concluding remarks follow in Section VI.

II. Issues in the Maternity Leave Policy: A Historical Perspective

Maternity leave policy was first conceived as a means of protecting the health of pregnant women workers and their infants. Maternity leave policy was originally advocated in the movement to improve working conditions of women in the early stages of industrialization in Europe, though a major component of the protective legislation also included the limitation of work hours for women. Maternity protection was first introduced in Germany in 1883 as a part of the social insurance program by Bismarck. This measure has been regarded as the origin of such policies (Kamerman 1988, Frank and Lipner 1988).

However, a more powerful motivating force for the policy was the pro-natalistic movement in the 1930s in Europe, giving rise to the second conceptualization of the policy. In that period, Europe suffered from an unprecedented low birth rate, a trend that had begun about a century before (van de Walle and Knodel 1980). Therefore, some authors argued that the historical and ideological origin of the maternity leave policy began in Sweden. At that time, Sweden aimed to foster fertility of working women (Gustafsson and Stafford 1995). During that period, maternity leave policy was extended toward infant care leave policy. In contrast, the birth rate in the United States in that period was relatively high, which might explain why the introduction of the nationwide maternity leave policy in this country was delayed until 1993 (Allen 1988).

The third and most recent purpose of maternity leave policy was the promotion of equality between genders in the work place. As female labor force participation increased dramatically, gender equality in the work place became a crucial issue. The benchmark event was the parental leave law that was passed in Sweden in 1964. Permitting fathers to take a leave of absence was expected to promote equality between genders in the work place as well as in the function of child rearing.[3] Establishment of gender-neutral family leave would guarantee that working women would not be penalized from child rearing.

In the United States, the Pregnancy Discrimination Act (the PDA) in 1978, the first nationwide maternity leave policy, was passed in the spirit of anti-discrimination.[4] However, the most controversial aspect of the PDA was its requirement that pregnancy and childbirth coverage be included in employer sponsored group health insurance programs. Moreover, the PDA did not require the job-reinstatement right.[5]

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[3] The effect of the parental leave on the distribution of childrearing effort has been largely symbolic in that the total amount of parental leave taken by men is low. (Allen 1988)

[4] The 1978 PDA, as an amendment of Title VII of the 1964 Civil Rights Act, explicitly prohibited the discrimination against pregnancy and childbirth in accessing the fringe benefit program. The text follows:

The terms "because of sex" or "on the basis of sex" include, but are not limited to, because of or on the basis of pregnancy, childbirth, or related medical conditions; and women affected by pregnancy, childbirth, or related medical conditions shall be treated the same for all employment-related purposes, including receipt of benefits under fringe benefit program, as other persons not so affected but similar in their ability and inability to work, and nothing in section 703(h) of this title shall be interpreted to permit otherwise.

In sum, if a firm provides health insurance, disability insurance and leave, then it should cover pregnancy and childbirth.

[5] The guideline of the 1978 PDA prohibited dismissal because of pregnancy or childbirth in view of antidiscrimination against pregnancy or childbirth. However, it is different from the job-reinstatement right that was included in the state maternity/parental/family leave statutes in the late 1980s. According to Kamerman, Kingston, and Kahn (1983), the policy is informal and probably discretionary in most of the firms permitting such a leave but not providing a formal guarantee of job protection. Therefore, they called the PDA an implicit national maternity policy. Frank and Lipner (1988) also did not regard the PDA as maternity leave policy, while Trzcinski (1991) did.

While maternity leave policies with the protective or pro-natalistic rationales contributed to improve the working conditions in the early industrial periods, they proved to be sometimes contradictory to the advance of women's equality in the work place. As Ferber (1997) mentioned, "the maternity leave policy which insisted pregnant women and women after childbirth not to work for some period of time often intended to restore the traditional family and to fix the sex roles." Also, evidence from Europe showed that substantially longer leaves might actually have discouraged women from participating in work for pay (Allen 1988). In fact, in the United States, equality in the work place was one of the most crucial issues for the women's rights activists.[6] As early as the 1920s, when women's suffrage amendment was passed, leaders of the women's movement began to question the impact of the protective laws on working women's advancement (Frank and Lipner 1988). They argued "protection, no matter how benevolent in motive, unless applied alike to both sexes, amounts to actual penalization" (Rothman 1978).[7] Instead, the job-reinstatement right was viewed as the most important concept in the issue of equality in the work place. It was believed to promote an equal employment opportunity for women along with social equality. In fact, the term "leave (of absence)" conveyed a meaning of a guarantee of returning to a job. Job-protected leave would help women

[6] The point of view of American Women's Movement is different from that of European Women's Movement. While the latter was more willing to focus on the condition and needs of working mothers, the leader of the former rather focused on legal equality (Frank and Lipner 1988). For example, women's rights activists during the implementation of the maternity leave legislation in Sweden expected that the leave policy would help to improve the living standards of working class and let them to have more children while in stable jobs.

[7] The President's Commision in 1963 also showed this viewpoint. It concluded that "wherever practiced, legislation affecting labor standards should benefit men as well as women, especially where women employees might be placed at a disadvantage otherwise"(Kamerman, Kahn, and Kinston 1983).

to remain in the labor force. Of course, the maternity leave benefit with a job-reinstatement right would be used only for a few occasions in a woman's work life and not all covered women would use it. However, the employment guarantee including the maternity period was crucial for preserving seniority as well as for increasing the labor force attachment in women's work lives. There can be an incentive for women to enter the labor force before having a child in order to qualify for parental leave (Ruhm 1998). Or, by reducing the conflict between maternity leave and employment, this program could induce more young women to enter and remain in the labor market. This would increase lifetime earnings of working mothers and induce greater investment in education and training, resulting in further increase in earnings and labor supply (Winegarden and Bracy).

Even after the passage of the PDA, there still existed a wide variation in the percentage of firms in the private sector that provided job-protected leaves in the early 1980s. The fact that most surveys depended heavily on large and medium-sized firms can be one reason for that. However, the job-compatibility also explains parts of this variation. Although women were formally qualified for a job-protected leave, they frequently found it impossible to return to their former employers, because their newly allocated jobs were no longer comparable to their previous jobs. (Kamerman, Kahn, and Kingston 1983) Therefore, most of the state maternity/parental/family legislation in the late 1980s and the 1993 FMLA included an explicit and detailed requirement of the job-reinstatement right.

III. Critical Review of Previous Studies

Redistribution Toward Women

A substantial number of studies have already been done about the effects of maternity leave policies. Most studies of the 1980s and in the early 1990s concentrated on the question of the enactment of a nationwide leave policy. This is because the enactment of the FMLA took a long time from its first introduction in 1985 to its passage in 1993. The enactment of the FMLA in the United States was late compared to other industrialized nations.

Many of these studies, inspired by the women's rights movement, strongly advocated the enactment of maternity leave. They argued that a job-protected leave policy could enhance the labor market performance of women workers. According to Trzcinski (1991), forcing women out of the labor market for reasons of pregnancy or childbirth was one of the structural barriers to economic equality for women. The chief goal of the state maternity leave statutes in the late 1980s was the promotion of equal employment opportunities for women. This was well represented in the majority opinion written by Justice Marshall in the U.S. Supreme Court decision in the case of California Federal Savings and Loan Association vs. Guerra (1987).[8]

[8] Justice Marshall wrote that "Title VII, as amended by the PDA, did not preempt the California statute, since both the federal and the state provisions shared the goal of promoting 'equal employment opportunities' for women". That is, the purpose of such legislation is to eliminate discrimination against women by making their opportunities for long-term employment equal to those for men. (Trzcinski 1991)

Confronting the opponents to the enactment of mandated leave legislation, advocates emphasized the long-term benefits of a job-protected leave for the society as well as for women. A strong dissident group against the enactment of leave legislation consisted of small employers, who faced a relatively large increase in costs. Small employers argued that a mandated leave policy would hurt optimality based on the neoclassical economics. However, for larger firms, a leave policy did not mean a substantial cost increase. Many of them had already provided the benefits and they had a large pool of employees to substitute temporarily for the work of workers on leave.

Trzcinski (1991) argued that the economic dynamics behind this process for promoting equality depended on supply-side effects. For her empirical study, she used May 1979 and May 1983 CPS and chose individuals who resided in a state with maternity leave statutes as a treatment group. She thought that neoclassical economics, which usually concentrates on the short-run employment and wage effects, does not take into consideration the supply-side effects. Maternity leave legislation would eliminate structural barriers to labor market participation of women, and by doing so it would break the occupational segregation that had confined women to lower paying jobs. Her empirical study of the impact of mandated leave roughly supported her argument. Although wages and employment were not adversely affected in states that passed the parental leave mandates, parental leave legislation significantly improved the labor market position of childbearing aged women. This was especially the case in states with Temporary Disability Insurance (TDI).

Although her study was influential in the debate over maternity leave legislation and was quoted by many authors, it had two weak points. Her result was strongly dependent upon firm size. Also, although she emphasized that the job-reinstatement right was the important legislative initiative and TDI should not be directly linked to it, her empirical result was especially supportive in states with TDI.

Ruhm and Teague (1997) investigated the relationship between mandated leave policies and national income and labor market outcomes. They created a longitudinal data set for seventeen countries during the 1960s-1989 period using the International Labor Office' *Legislative Series* and 1984 global survey on protection of working mothers, along with *Social Security Programs Throughout the World* by the United States Social Security Administration. Their result supported the view that parental leave hardly reduces economic efficiency, though the result was sensitive to the length of parental leave. Instead, parental leave provided a modest beneficial impact. Short to moderate durations of parental leave raised per capita incomes, employment-to-population ratios, and labor force participation rates. That is, the result suggested that "short to moderate period of family leave may increase economic efficiency, as measured by incomes and labor market status, while lengthy duration could reduce it".

Waldfogel (1997 and 1998) confirmed the positive effect of maternity leave policy on wages by showing that maternity leave covered women maintained higher wages than maternity leave not-covered women after giving birth. Using the data sets of the NLSY in the United States and the National Child Development Study of Britain (NCDS), she examined the effect of past maternity leave coverage at the time

of a woman's most recent birth on her current wages. Her result showed a large maternity leave wage premium, which is big enough to offset the negative wage effect from childrearing.

Waldfogel interpreted this result as implying that maternity leave policies could be an effective recipe for the "family gap", defined as the wage differential between working mothers and childless women. She viewed the lack of a job-protected maternity leave as a "family barrier", since it prevented women with children from competing on an equal footing in the labor market. In this regard, she found the similarity between women who have children without the right to a job-protected maternity leave and displaced workers. Therefore, in her view, extending the job-protected maternity leave rights would further reduce the "family gap" for future working mothers by increasing their likelihood of returning to their current employers after childbirth.

However, Blank (1997) criticized Waldfogel, arguing that the positive association between wages and maternity leave coverage did not show the impact of maternity leave uncontaminated by other effects. According to Blank, Waldfogel's result was not compatible with a standard labor economic theory, where wages and fringe benefits are interchangeable with each other within total compensation. If Job A is almost identical to Job B except that Job A provides the fringe benefit, then the wages of Job A will be lower than those of Job B roughly by the amount of pecuniary value of the benefit. More important problem in her study is that she did not fully handle heterogeneity between maternity leave covered workers and not-covered workers. Interpreting the positive association as a causal relationship from

the former to the latter is problematic. It is true that maternity leave coverage at the time of giving birth could raise wages by removing involuntary job separation at that time. However, higher wages from maternity leave coverage can also be explained by unobserved heterogeneity. Even after controlling for observed characteristics, maternity leave coverage is positively associated with wages. It implies that maternity leave covered workers may have greater unobserved ability. Maternity leave tends to be more prevalent for "good" jobs and at large firms, and these attract workers with more skills, observed and unobserved. Also, women with more labor force attachment and higher potential productivity will self-select into covered jobs.

Efficiency Costs of the Mandates

After Summers(1989) mentioned the efficiency cost of an employer mandates by reducing employment of the benefited group, many studies examined the effect of maternity leave policy following his suggestion. This group of studies, unlike the above studies such as Waldfogel (1998), did not identify the people who were actually covered by maternity leave benefit. Instead, they looked for the effect of the introduction of maternity leave mandates on all childbearing aged women in the jurisdiction that passed the mandate, both covered and not-covered. For example, when Kane (1998) examined the effect of the state maternity leave legislation, the treatment group was all women in states that implemented this legislation and the control group was all women in states that did not implement this legislation. Gruber (1994) used all childbearing aged women as the treatment group and men and

remaining women as the control group when he examined the effect of the PDA. Meanwhile, Waldfogel (1998) used women who were actually covered by maternity leave as her treatment group and women who were not as her control group.

Ordinary people who think that the purpose of maternity leave policy is to help women might be confused when they see that so many studies contended that the enactment of maternity leave policy had negligible effect or negative consequences on labor market outcomes for women. It is mainly because those studies examined the immediate effect of introducing a maternity leave mandate. Their argument can be interpreted like this: even though an existing maternity leave program might be beneficial, the marginal effect of further extension of this program would have efficiency costs. For example, a maternity leave benefit that is provided by individual firms might be efficient since it is voluntary, while state or federal maternity leave mandates might not be efficient. Following this line of argument, Gardecki (1997) asserted that implementation of state maternity leave mandates before 1979 was efficient, while implementation of the federal PDA was inefficient. However, it is not clear to me whether they argued that a certain maternity leave provision was inefficient or whether maternity leave provision itself is inefficient. Originally, Summers (1989) pointed out the possibility of the latter. He mentioned, "employer mandate, no matter how socially attractive it is, can bring an efficiency cost by reducing employment of the benefited group".[9] However, a mandated leave

[9] Summers (1989) argued that in a perfectly flexible market, mandated employer benefit programs would increase inefficiency, since they hamper free bargaining over the terms of compensation packages. There are some rationales, however, for a mandated leave policy. First, there can be positive externalities associated with welfare of children (Kamerman 1991, Bravo 1991, Stoiber 1990, Gilland 1989, Decker 1991). However, some economists found that this rationale unconvincing and not sufficient for government intervention (Summers 1989 and Gruber 1994). The second rationale for government intervention is based on adverse selection. If there exists adverse selection, it is clear

policy can also work efficiently if employees value the benefit and if there is no structural barrier to wage adjustment.[10] Evidence of efficiency costs of a mandated maternity leave policy was found in Europe, where the full-scale maternity leave policies have been in effect longer than in the United States. In this context, the 1952 Convention on Maternity Protection of the International Labor Organization (ILO) emphasized that employers who provided maternity benefits should not have individual liability. This revision reacted to a concern that individual employer liability for maternity leave benefits could result in employment discrimination against women (Pizzo 1988).

Gruber (1994), in his seminal work, investigated whether Summers' efficiency argument could be sustained for the group-specific mandate case, which extends benefits for a demographically identifiable group.[11] He thought it necessary to analyze whether the cost of the mandate is shifted to the wages of the benefited group in view of efficiency of these mandates. Using the CPS 1974-1982, Gruber estimated the responses of the labor market to the enactment of the state maternity mandates in the 1970s and the 1978 federal PDA. He used the difference-in-difference-in-difference (DDD) estimation method, which controls for any systematic shocks to the labor market outcomes of the treatment group in the

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that "the market solution will not provide the desirable amount of maternity leave, even though all young women are willing to pay more than it costs" (Summers 1989).

[10] "Their wages would fall, offsetting the cost of the benefit to the employer, and in the limit there would be no efficiency cost" (Summers 1989).

[11] "In the case of maternity leave mandates, there would be less scope for the free adjustment of wages to reflect the valuation of the benefit by the targeted group. Anti-discrimination regulations or workplace relative-pay norms which prohibit differential pay for the same job across groups may affect not to adjust their wages" (Gruber 1994).

experimental states.[12] He reported an extensive shifting of the cost of the state maternity mandates to group-specific wages. Meanwhile the implementation costs of the federal PDA were not shifted and there was some disemployment effect. Gardecki (1997), largely a replication of Gruber(1994), generally confirmed his results. Furthermore, she argued that states only adopted the level of state maternity legislation considered efficient, when she explained the disparity between the significant cost shifting in his state study and the strong disemployment effect in his federal study. According to Gardecki (1997), workers in states that enacted the state maternity mandates knew its benefits very well, while in states that had to follow the federal PDA, the cost of implementing the mandates outweighed the benefits.

However, Klerman and Leibowitz (1997)'s estimate of the labor supply effects of state maternity leave legislation is different from Gruber (1994). Using a sample of the census Public Use Microdata Sample for 1980 and 1990, they found that maternity leave policy had little effect on employment. The treatment group was mothers of younger children who would be protected by a maternity leave legislation and the control group was mothers of older children. To control pre-existing differences between states with maternity leave legislation and without legislation, they also used a DDD approach.

Kane (1998), using the NLSY data set, evaluated the impact of such mandates on part-time vs. full-time employee substitution, on access to leave, and on wages. She constructed a model that consisted of the wage offer equation and the

[12] Experimental states are states which have maternity leave mandates, while the treatment group is individuals of 20-40 year-old married women and/or their husbands. The DDD estimation method has become a popular method that has been widely used in the studies that examined the effect of implementing maternity leave legislation.

hours of work equation with selection mechanism and estimated these equations by Heckman's two-step procedure. She found that with the enactment of the mandates the employment decreased for some time, but after that eventually increased, while the wage has increased for a time, but after that, eventually decreased.[13] Based on this result, she strongly opposed to the expansion of mandated benefit.[14] Baum (1999) also tackled the same question as Kane (1998). He investigated the effect of state maternity leave legislation and the FMLA on mothers' labor supply after childbirth. Although he used data from NLSY that identifies who was actually covered, he did not use that information. Instead, he followed the typical method of existing studies that examined the effect of implementing maternity leave legislation at the state level on all the women in the state. The treatment group was mothers who gave births in a state that had maternity leave legislation or the FMLA during 1987-1994.[15] His theoretical model predicted that the effect of maternity leave legislation on a mother's return to work decision was ambiguous. However, his empirical work reported that maternity leave legislation slightly increased the hazard rate for returning to pre-birth employers, though that result depended on the time of return. On the other hand, he reported that maternity leave legislation had a negative effect

[13] Kane(1998)'s result was different from Gruber (1994), who found the negative wage effect for the treatment group after mandate was enacted. Also, her evaluation that "women place positive value on the availability of maternity leave", which was the same proposition of Gruber who uses this for determining the maternity leave mandates as the efficient policy, was hardly compatible with her strong opposition to the mandate.

[14] According to Kane(1998), "the negative wage impact suggests that advocates for the expansion of mandated benefits should temper their enthusiasm for such legislation." Also, according to her, there was no evidence of substituting full-time women workers with part-time women workers. State maternity leave mandates hardly increase the demand for female part time employees relative to female full time employees.

[15] "If a mother gives a birth in a state that has maternity leave legislation and the FMLA is in effect, then her maternity leave legislation variable equals the number of weeks of leave guaranteed by the more generous legislation..... Even if the data suggests that a mother does not meet the eligibility

on the starting wages for women who found a new job after giving birth. The merit of Baum (1999) is that it constructed an unified framework which could determine the effects of maternity leave legislation on leave, employment, and wages at the same time. However, it is the demerit of his model in that it was very structural, with a heavy burden of identification problems.

Since the existing literature has used different treatment and control groups as well as different methods and samples in estimating the economic effects of maternity leave mandates, it is sometimes hard to summarize those results. For example, when Kane (1998) examined the effect of the state maternity leave legislation, the treatment group was all women in states that implemented this legislation and the control group was all women in states that did not implement this legislation. Gruber (1994) chose all childbearing aged women as the treatment group, while using remaining women and men as the control group when he examined the effect of the PDA. Meanwhile, Waldfogel (1998) used women who were actually covered by maternity leave as her treatment group and women who were not as her control group. Generally speaking, most studies found that implementation of maternity leave legislation discouraged turnover and boosted employment. However, on wages, it is hard to say that existing studies reached a consensus, though most studies had suggested that introduction of a certain maternity leave legislation had negative effect on wages of any of the treatment groups that they chose.

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requirement, I assign her the mandated amount of leave if she lives in a state with a mandate" (Baum, 1999).

IV. Data

This paper uses the National Longitudinal Survey of Youth 1979 (NLSY 1979) to estimate the effects of employer provision of maternity leave benefits on women's labor market outcomes. The sample is women who had births during 1988-1992 and worked just before giving births. If a woman had multiple births during that period, the most recent birth during that period is counted. From this procedure, every woman in the sample has only one birth during 1988-92. I refer to that birth as the reference birth.

The 1988-1992 period is chosen, since the late 1980s are the periods when the state maternity leave legislation was vigorously implemented. Since maternity leave has been generalized since 1993 when the FMLA was passed. If I would include the early 1980s or the late 1990s, heterogeneity problem would become serious. In the early 1980s, large firms tended to provide maternity leave benefits to women workers, and those women may be intrinsically different from those who received maternity leave benefits after states or federal mandates. In the late 1990s, women who are not covered by maternity leave benefit might be more likely part-time workers or new entrants. Or they might be working in a small firm or in an exempted industry.

Since I use the calendar year for childbirth, constructing a sample that satisfies the condition that women worked just before giving birth is a little cumbersome. For the base year wage or the zero year wage in my paper, I use the pre-birth wage, which is the wage that is found in the childbirth year if the interview

date is earlier than the childbirth date. If interview date is later than the childbirth date in that year, then the pre-birth wage is the previous year's wage.[16] The base year or the zero year is the year when women worked just before the reference birth. All variables such as tenure, industry, occupation, firm size, marital status, and so on, are adjusted according to the above rule.

The advantage of a sample that consists of women who had birth and worked just before giving birth is that these women are directly affected by the job-reinstatement right. However, there is a disadvantage, too. In order to accurately account for employment effect, transition from not-working to working as well as the transition from working to not-working should be considered. Since my data consists of women who worked at the time of giving birth, the employment effect cannot include the transition from not-working to working. However, this sample is better for showing the effect of maternity leave coverage on turnover, which is a major issue in assessing the program. Also, even for testing the employment effect, women who had birth can be an appropriate sample, since we have little reason to regard all childbearing aged women as a group who are equally interested in and affected by maternity leave program. In sum, since the purpose of my paper is not to investigate the effect of extending maternity leave mandates but to investigate the effect of job-reinstatement right on mothers' labor market performance, this sample is an appropriate one for the question.[17]

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[16] For example, the base year wage for a woman who gave birth on July 1st 1988 and whose interview date was May 1st 1988 is the wage that was reported on interview date in 1988. However, the base year wage for a woman who gave birth on July 1st 1988 and whose interview date was September 1st 1988 is the wage that was reported on interview date in 1987.

[17] Some state mandates includes men in a benefited group for paternity leave and family and medical leave. But I do not include men in the sample as a part or as a whole control group. According to Kane (1998), men are not a good control group for women because their labor market outcomes are

Among women who gave birth during 1988-1992 and worked just before giving birth, women who were full-time students at the entering year of my panel data were deleted, because low wages of full-time students at the entering year will make the slope of the wage profiles upward biased. Women whose highest hourly wages are more than a hundred dollars or whose wages are less than a dollar are excluded. Hourly wages are deflated using the CPI. I also exclude women who do not have information about maternity leave coverage even though they worked at the base year. After cleaning those observations, the number of women in the sample is around 850.

affected to a smaller degree by this program. "Maternity leave program might increase the input costs of male labor as well as female labor, but perhaps not to the same extent if men are less likely to take advantage of the mandated leave. ... men do not value this program as much as women do and therefore wages for men will be less affected than wages of women." Kane (1998).

V. Empirical Analysis

V-1. Effects vs. Heterogeneity

Maternity leave is expected to give benefits mainly through the job-reinstatement right. A popular argument from existing literature that analyzed the effects of the enactment of a maternity leave legislation is that the benefited group bears the costs after the enactment, since maternity leave gives benefits in the form of the job re-instatement. Although most studies assume the maternity leave benefit to be considerable, no major study except Waldfogel (1998) examined the size of the benefit provided by maternity leave coverage. Waldfogel argued that the effect of the maternity leave benefit on wages was big enough to cancel the negative effect of childbearing. However, by only focusing on the wage profile after giving birth, she missed an important point: the heterogeneity between maternity leave covered women and uncovered women.

Systematic differences in the labor market outcomes between maternity leave covered and uncovered women could be attributed to unobserved heterogeneity as well as the beneficial effect of maternity leave coverage. The main theme of this subsection is whether we can identify positive significant effect of maternity leave benefits on labor market outcomes such as wages and employment even after controlling for heterogeneity.

Maternity leave coverage may not be randomly determined.[18] Women with more unobserved ability or labor force attachment might prefer covered jobs. This is the concept of individual heterogeneity. And, jobs that offer coverage may be different or better in other ways as well that are correlated with higher wages. This is the concept of job heterogeneity in this paper.

Higher wages of maternity leave covered women can result from their own self-selection. Assuming that chhildbearing aged women favor the maternity leave covered job, women who have more unobserved ability or commitment to the labor force may self-select into the maternity leave covered job. In this case, maternity leave coverage variable is systematically related to unobserved abilities. Also, unobserved job characteristics that are correlated with maternity leave coverage cause the coefficient of the maternity leave coverage variable to be biased. That is, we are worried that the average value of the error term (ε) depends on the coverage variable: $E(\varepsilon|COV=1) \neq E(\varepsilon|COV=0)$.

This paper uses two different approaches to deal with unobserved heterogeneity. For the wage analysis, this paper adopts the fixed effects estimation method. For the turnover and employment analysis, this paper adds more explanatory variables that designate to be a better control for unobserved heterogeneity. Adding more explanatory variables is one way to alleviate the heterogeneity problem, since

[18] Some researchers have argued that maternity leave coverage can be regarded as an exogenous variable. Klerman and Leibowitz (1998) suggested potential endogeneity of maternity leave policies. However, although Ruhm and Teague (1998) suggested that an issue of causation is problematic and needs more investigation, they find that maternity leave policy can be more likely an exogeneous variable. Changes in family leave policy precedes corresponding movements in the macroeconomic variables. Winegarden and Bracy (1992) also found that maternity leave program variable is exogeneous in their three equations for infant mortality rates, labor force participation rates, and fertility rates. Some researchers have argued that maternity leave coverage can be regarded as an exogenous variable.

factors in the error term that can be correlated with maternity leave coverage variable can be controlled to a certain degree. Of course, a potential bias problem remains, if a significant amount of heterogeneity remains uncontrolled for even after adding more explanatory variables. However, finding an proper instrument variable for the maternity leave coverage variable is not easy. Also, constructing a panel data set for fixed- or random effects estimation for turnover or employment is not feasible. Assume that the effect of maternity leave coverage on employment a year after giving birth is estimated by the random effects logit model. Then, a hypothetical panel data set may consist of women who had multiple births and worked at the time of giving those births. However, this hypothetical sample may have sample selection bias, since career oriented women who have fewer children will be counted less. Also, whether the childbirth is, for example, the first or the second would affect a woman's decision to work just after giving birth. Therefore, this paper adopts the method of adding more explanatory variables that control for heterogeneity for labor supply analysis.

Heterogeneity is easily detected in my sample. Figure I-1 shows that the proportion of working women of the maternity leave covered group is always, before as well as after giving birth, higher than that of the uncovered group. X-axis represents the time distance from the base year. This time distance uses the assumption of time invariance. For example, a covered women **A** of 1989 base year is assumed to be in the same group in 1993 with a covered women **B** of 1990 base year in 1994. Y-axis shows the proportion of the sample that is employed. The large difference just after giving birth may represent the effect of maternity leave benefit.

However, the significant difference before giving birth suggests a systematic difference in labor force attachment between the two groups. The proportion of working women of the maternity leave covered group is higher than that of uncovered group before as well as after giving birth. Figure I-2 also suggests the same implications as Figure I-1. The large difference in weekly working hours after the base year suggests the effect of maternity leave coverage. And, weekly working hours of the covered group was always larger than that of the uncovered group.

Figure I-3 shows the time profile of the average wages of the covered and uncovered group. Figure I-4 also shows the same thing by education level. The gap in the wage level between covered and uncovered group after giving birth may reflect an effect of maternity leave. However, significant difference in the slope as well as in the level of the wage profile before giving birth also suggests heterogeneity. The maternity leave covered group always maintains significantly higher level of wages, and the level of wages of the covered group is higher than that of uncovered group even four years before giving birth.

The big gap in the wage level by groups suggests that observable characteristics such as education, actual experience, or tenure might not be able to capture all those variations in the wage regression. As is seen in Table I-1, there is little difference in the education level, number of children, and ages between the covered and the uncovered group, although there is some difference in experience years past six years between two groups. All variables refer to the base year. Difference in tenure years is substantial and tenure of the covered group is more than double that of the uncovered group at the time of giving birth. However, it is unlikely

that differences in tenure can explain the entire gap between the covered and uncovered groups. This means that there may be substantial unobserved parts in the wage variations that cannot be easily controlled by usual observables.

V-2. Effects on Turnover and Employment

Model and Variables

The hypothesis about the effect on turnover is that maternity leave induces women to return to their pre-birth job. The hypothesis about the effect on employment is that there is a positive and significant correlation between maternity leave coverage and employment. The focus is whether the positive and significant effect of maternity leave on labor supply can be recognized even after controlling for heterogeneity. The model that I use for estimating the effect of maternity leave on women's turnover and employment is the probit model of (1).

$$Y_i = \mathbf{X}\varphi + \beta_1 COV_i + \beta_2 MED_i + \beta_3 PREWAGE_i + \beta_4 UNION_i + \beta_5 SIZE_i$$
$$+ \sum_{k=88}^{k=91} \gamma_k COHORT_i^k + \sum_{k=1}^{k=8} \theta_k D^k{}_i + \varepsilon_i \quad \ldots\ldots\ldots\ldots (1)$$

where Y is a dummy variable for turnover or employment. In the case of turnover, Y is one if a woman returned to her pre-birth employer a year after giving birth, and zero if a woman changed her employer at that time. I assume that she returns to her pre-birth employer if her tenure of the next year is larger than that of the base year.

Only the CPS job is counted. In the case of employment, Y is one if a woman worked a year (or two years) after giving birth, and zero if she did not work at that time. So, the sample used to estimate the turnover model includes women who worked after childbirth, while the sample for the employment model additionally includes women who did not work after childbirth. To avoid ambiguity in treating "employed but absent from work" status that is found in some studies, I assume that a woman works when her wage is observed.[19]

Women in the sample have a certain degree of commitment to the labor force four years before childbirth. In other words, women in the sample had started their career at least four years before reference birth. That is, the sample dropped women who were full-time students four years before childbirth.

The maternity leave coverage variable (COV), a dummy variable which is one if a woman is covered by maternity leave benefit at the base year and zero if a woman is not covered, is the main concern of this paper. The NLSY collects maternity leave coverage information starting in 1985. NLSY questionnaire asks whether women have a job with maternity leave that allows them to go back to their old job or that pays the same amount of wages as the old one. Women who answered "yes" to this question for the base year job are classified as covered.

X is a vector of individual characteristics or, in other term, a vector of control variables for individual heterogeneity. This includes dummy variables for college education, SMSA, marital status, and three dummy variables for children. This also includes actual experiences and tenure. All variables are pertaining to the base year when women worked just before the reference birth. Since I pool five years of data, I

[19] Ruhm (1998).

control for five cohorts (COHORT). Although tenure is related with job characteristics, I include tenure in the individual characteristics following the human capital model. Three dummy variables for children are a dummy variable for children under age two except the reference child, that for children aged two to five, and that for children aged six to seventeen. Three dummy variables can better control for the number of children than one variable can, since additional young children under age two may deter their mothers from working.

To control for job heterogeneity, I include a variable indicating whether the job offers medical insurance (MED), firm size (SIZE), union membership (UNION), the log of pre-birth wages (PREWAGE), industry, and occupation.[20] Medical insurance indicates a "good" job. The firm size dummy variable is one if the number of employees is larger than 200 and zero otherwise. Pre-birth wages (PREWAGE) could be regarded as a measure of individual heterogeneity. Women who earned more money with the same characteristics might have greater unobserved ability in market work. However, higher wages (holding constant human capital variables) may also reflect job heterogeneity or "match" heterogeneity, and so PREWAGE is included in the job heterogeneity variables.

Finally, I include eight dummy variables indicating recent employment histories ($\Sigma_{k=1}^{k=8} D^k$) of part-time working or not-working during four years before

[20] I make seven industry dummy variables from 13 categories of industry for CPS job. Those are the primary industries; manufacturing; transportation and communication; whole sale and retail trade; finance, insurance, and real estate; services; and public administration. Also, I make six occupation dummy variables from 10 categories of occupation for the CPS job. Those are: managerial and professional specialties; technical; sales; adminisrative support/clerical; servicies; operator and others.

the base year.[21] These variables may be correlated with each other. For example, a part-time worker a year before reference birth might have worked part-time two years before reference birth. However, this variable captures the additional effect that actual experience cannot do. Variables for recent employment histories before giving birth might be a good indicator whether a woman has a stronger propensity to work. For example, a woman who worked part-time a year before reference birth may have less incentive to return to work after childbirth, even though she has the same characteristics with others.

Findings for Turnover

I estimate equation (1) using the maximum likelihood probit estimation. Table I-2 through Table 10 reports the marginal effect of the coefficients. Table I-2 reports the results of estimating the model on a sample of all women who return to work the year after giving birth, while Table I-4 focuses on workers with a high school education or less and Table I-3 on workers with a college education.[22] The marginal effect indicates the impact of a small change in the independent variable on the probability of observing the outcome. In the case of a dummy variable such as the maternity leave coverage variable, it indicates how much that variable being true (=one) changes the outcome probability over that of that variable being false (=zero).

[21] Eight variables are: not-working a year before giving birth (D^1), not-working two years before giving birth (D^2), not-working three years before giving birth (D^3), not-working four years before giving birth (D^4), part-time-working a year before giving birth (D^5), part-time-working two years before giving birth (D^6), part-time-working three years before giving birth (D^7), part-timenot-working four years before giving birth (D^8).

[22] College educated workers have more than 12 years of schooling. High school edcuated workers have 12 years of schooling or less.

The estimation results support the hypothesis that the maternity leave benefit helps women to return to the pre-birth employer just after giving birth. Table I-2 reports that the marginal effect from maternity leave coverage is highly significant and as large as 0.216 to 0.151 depending on the models.

Without any control variables in model [1], the raw probability that maternity leave covered women stay with the former employers a year after giving birth is 0.216 higher than the probability that not covered women do so. However, this difference decreases to 0.167 after controlling for individual heterogeneity in the model [2]. Women who live in the SMSA are more likely return to the former job. However, SMSA might be closely related with job characteristics, and the marginal effect of this variable after controlling for job characteristics in the model [3] largely decreases. Marital status is also highly correlated with the returning behavior. Married women more likely return to the former job. Presence of additional young children under age two is correlated with not to return to the pre-birth job.

Another important element of individual heterogeneity that affects returning behavior is tenure. As we expected, the effect of tenure is highly significant through the specifications. However, unlike among college educated women as in Table I-3, tenure is less correlated with returning to the former job among high school educated women in Table I-4. The effect of experience is negligible after controlling for tenure. This makes sense, since what matter for returning to the former employers is tenure not actual experience.

In model [3] with job heterogeneity control variables, the marginal effect of firm size is large and highly significant. Women who worked in the large firm more

likely return to the former job. Having a medical insurance or union coverage that indicates a "good" job adds little explanation to returning behavior.[23] The effect may be small, since medical insurance is correlated with maternity leave benefit.

The most interesting variable in model [3] is perhaps the pre-birth wage. The effect of pre-birth wage is large and significant among college educated women. College educated women who earned large sum just before giving birth are highly likely return to the former employer after giving birth compared to college educated women who earned small sum. However, the effect is negligible among high school educated. Their wages may be universally low and wage difference might be too small to induce different returning behavior.

At this point, we evaluate the effect of maternity leave coverage to returning behavior with the model [3]. The model [3] is the main model in this paper. The effect of maternity leave coverage on returning to the former employers is as large as 0.156 and highly significant even after controlling for various individual and job heterogeneity. Additionally, the model [4] shows the effect of maternity leave coverage after including eight recent work history variables (D^1 to D^8). Although these eight variables are jointly significant at the 90 percent significance level, they barely affect the marginal effect for maternity leave coverage. This implies that these variables play little role in controlling for propensity to job attachment or career orientation.

The coefficient for the maternity leave coverage variable does not change much with the addition of the heterogeneity controls among all workers and among

[23] Since medical insurance is significantly correlated with maternity leave benefit, the effect of medical insurance may be small.

college educated workers. The raw marginal effect of maternity leave dropped approximately 5 percent point after including individual heterogeneity controls in the model [2], but the further drop in the model [3] and the model [4] is small among all workers and among college educated workers. Among high school educated workers, the amount of the raw marginal effect almost similar through the model [2] to the model [4].

In sum, significant and large marginal effects of additional variables that are designed to control for heterogeneity shows that there exists heterogeneity in returning behavior between maternity leave covered women and not-covered women. However, after controlling for those variables, the marginal effect of maternity leave coverage on the dependent variable, whether the woman returns to the pre-birth employer, is still substantial and significant. This result suggests that maternity leave benefit contribute to helping women to return to the former job just after giving birth.

Findings for Employment

This subsection shows the relationship between maternity leave coverage and employment one year or two years after giving birth. Unlike the above subsection, where the association between maternity leave coverage and returning behavior can be interpreted as a direct causal relationship, the relation between maternity leave coverage and employment is rather loose. However, this relationship can still be thought as a causal relationship, since women who do not have a right to return to

their pre-birth job may have more trouble in finding new employment after giving birth and so will more likely simply not to return to work.

Although the employment models have larger samples, since they include additional category of women who did not work after giving birth, the amount of the marginal effect of maternity leave coverage on employment is similar to that on returning to the pre-birth employer in the turnover model. The marginal effect after one year is 0.244 in the model [1] without any control variables. That is, the raw probability that maternity leave covered women work a year after giving birth is 0.244 higher than the raw probability that maternity leave not-covered women work that time. After including individual heterogeneity control variables in the model [2], the effect of maternity leave coverage on employment almost halved. In the model [3] with individual and job heterogeneity control variables in Table I-5, the effect further decreases to 0.129.

The marginal effect two years after giving birth is 0.269 in the model [1] with no controls and 0.156 in the model [3] in personal and job heterogeneity controls in Table I-8. The strong positive association after two years implies that maternity leave benefits bring lasting effects on employment, and thereby result in longer actual experience after giving birth. However, a part of lasting effects of maternity leave coverage on employment could result from heterogeneity, too. The positive association after one year largely comes from the turnover effect in the above subsection. Meanwhile, positive and still large association after two years also suggests that maternity leave covered women might have higher propensity to work than not-covered women.

The association between various variables and employment in Table I-5 and Table I-8 are often different from the association between those and turnover in Table I-2. Women with college education are more likely work a year after childbirth and the association between them is more intensified after two years. However, after controlling for heterogeneity, the effect of college education on employment is largely decreased. The effect of experience is large and significant especially among high school educated women a year after childbirth. Meanwhile, the effect of tenure on employment is still significant and large for all women. Unlike the turnover model, living in the SMSA has little correlation with employment. Also, as we expected, additional young children under age two deter their mothers from working and this phenomenon is more conspicuous among college educated women.

In the model [3] with individual and job heterogeneity control variables, pre-birth wage is interesting. Higher pre-birth wage affects employment among high school educated women in the employment model, while that affects returning behavior among college educated women in the turnover model. Including a pre-birth wage variable in model [3] with other job heteroteneity control variables makes the effect of maternity leave coverege far smaller than that in the model [2]. Also, additional eight variables about work history (D^1 to D^8) play a role to control for heterogeneity in the model [4]. Although eight work history variables do not pass the joint significance test with 90 percent significance level, including them in the model further decreases the marginal effect of coverage to 0.114 in the Table I-5 and to 0.121 in the Table I-8.

This phenomena of changes in the coefficients on maternity leave coverage through the model [1] to the model [4] in the employment model is similar with that of the turnover model. Adding variables to control for heterogeneity works, though not perfect. The coefficient for the maternity leave coverage decreases after including additional heterogeneity controls. But the extent of decreases through the model [2] to the model [4] is small among all workers and college educated workers. In the meantime, like the turnover model, the extent of decreses by adding heterogeneity controls is large among high scholl educated.

On the whole, we can interpret the result like this: although there is a sign of heterogeneity between maternity leave covered women and not-covered women, after controlling for heterogeneity the effect of maternity leave coverage on employment is still substantial and significant.

V-3. Effects on Wage Profiles

Model and Hypotheses

This section will discuss the effect of maternity leave coverage at the time of giving birth on hourly and weekly earnings of women who worked after birth. Any difference between the results of the hourly and weekly earnings models will reflect difference between covered and non-covered groups on the intensive margin of labor supply, that is, the hours decision rather than the participation decision. The weekly earnings variable, which has two components, that is, hourly wages and weekly work

hours, can explain the combined effect that comes from different work hours as well as different hourly wages. As we have seen in Figure I-2, weekly work hours are systematically different for covered and uncovered groups after childbirth. Meanwhile, the hourly wage model reflects changes in productivity.

The general hypotheses to be tested in this subsection are summarized as follows. The first hypothesis is that maternity leave has a beneficial impact on women's earnings after giving birth, chiefly because it extends the pre-birth job tenure. Empirically, this hypothesis is tested by measuring how much the post-childbearing earnings of both covered and uncovered workers deviate from their pre-childbearing trend. The finding that the post-childbearing earnings of the covered women did not fall below what would be expected based on their pre-childbearing earnings path, or at least did not fall as far as the earnings of uncovered women, is taken as evidence of a beneficial effect of maternity leave coverage. However, there is a caveat in deciding the effect of maternity leave coverage based on such a test. It is possible that women who select jobs with maternity leave coverage differ in tastes from those who do not. In other words, those who have jobs with coverage may on average be less likely to decide to voluntarily reduce their labor supply after the birth in order to spend more time caring for the child. This difference in tastes would show up in the form of lower weekly earnings of the uncovered group after the birth, even if coverage itself has no causal effect on earnings or labor supply.

The second hypothesis is that the covered and uncovered women have different earnings growth prior to the childbirth. This could be due either to heterogeneity or to different human capital investment decisions in response to

coverage. That is, the beneficial effect of maternity leave policy partly results from the human capital accumulated by women who, anticipating having maternity leave coverage at the time of birth, feel secure that they will continue at their current job. By removing involuntary fertility-related job separation, being covered by a maternity leave policy in their earlier career can provide women with the incentive to increase human capital investment.

This paper estimates the following fixed effects model (2) for analyzing the effect of maternity leave coverage at the time of childbirth on hourly and weekly earnings.

$$W_{it} = f_i + \mathbf{X}\varphi + \beta_1 EXP_{it} + \beta_2 EXPSQ_{it} + \beta_3 EXP_{it}*COV_i + \beta_4 EXPSQ_{it}*COV_i + \sum_{k=1}^{k=5} \theta_k D^k_{it} + \sum_{k=1}^{k=5} \delta_k D^k_{it}*COV_i + \varepsilon_{it}, \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (2)$$

W is the log of hourly wages or the log of weekly earnings. f is the fixed effect that summarizes intrinsic, time invariant differences among women in observed and unobserved characteristics. **X** is a vector of individual characteristics such as education, marital status, and number of children. EXP and EXPSQ are experience years and experience years squared, respectively. Since the slope of the simple wage profile of the covered group is significantly different from that of the uncovered group, as we have seen in Figures I-3 and I-4, I include interactions of EXP*COV and EXPSQ*COV that only apply to the covered group.

D^k is a set of dummy variables for time passage since childbirth. These variables measure the year distance from the year of giving birth. I include these

variables, since Figures I-3 and I-4 show that the slope of the wage profile might be different before and after the base year. D^k_{it} =1 if a female worker *i* has the base year *k* years before in period *t*. As is in the simple wage profiles' case, the model uses the assumption of time invariance. For example, a covered women **A** whose base year is 1989 is assumed to be in the same group in 1993 with a covered women **B** in 1994 whose base year is 1990. A dummy variable for the fourth year after the base year (1989) is one in 1993 for worker **A** ($D^4_{A,1993} = 1$) and also a dummy variable for the fourth year after the base year (1990) is one in 1994 for worker **B** ($D^4_{B,1994} = 1$). Therefore, θ_4 in the model (2) represents the effect on wages of giving birth after four years. Since the number of observations gets progressively smaller as the profile approaches the extreme, the profiles in later years are less accurate.[24] Wage series are adjusted by CPI. Since a key hypothesis of this paper is that maternity leave coverage might alter the impact on wages of giving birth, I include interactions, D^k *COV that only applies to the covered group. Finally, ε is the error term that is assumed to have constant variance and to be uncorrelated across individuals and time.

I estimate the model (2) for all women who gave birth during 1988-1992 and worked just before giving birth. The sample is almost the same as the one that I use for the labor supply model in the previous subsection. But in this model I do not drop women who were students four years before childbirth. Instead, I do not use the wage observations for years when the woman was in full-time student. If wages of full-time college students were included in the model, then the slope of the profile of

[24] The third year after giving birth (D^3) includes only 1988, 1989, 1990, and 1991 cohorts. The fourth year (D^4) includes only 1988, 1989, and 1990 cohorts. The fifth year (D^5) includes only 1988 and 1989 cohorts.

college educated women would be exaggerated, since there are many college students in the first year and the second year of the observation period.[25] Since the slope of the profiles are noticeably different according to education groups, I also estimate model (2) with college educated women and with high school educated women separately.

Findings

Table I-11 shows the estimation result of the model (2) using the log of hourly wages as the dependent variable, while Table I-12 uses the log of weekly earnings. The experience-earnings profile of the covered group is much steeper than that of the uncovered group during the whole observation period including before and after childbirth period. One year of actual experience raises the hourly wages of the covered group by 9.7 percent and that of the uncovered group by 3.3 percent.[26] Covered women maintain a significantly steeper profile than uncovered women in the sample of all women, the sample of college educated women, and the sample of high school educated women. The coefficient for EXP for covered women is 0.110 and that for uncovered women is 0.031 among college educated women. Among high school educated women, corresponding figures are 0.069 and 0.038 for covered and uncovered women, respectively. However, the negative coefficient for the interaction with quadratic term of experience, EXPSQ*COV, suggests that the

[25] Almost 20 percent of the sample is full-time and part-time college students in 1984 and 1985. After 1987, it is far less than 10 percent.

[26] The coefficient for covered women, 0.097, is the sum of the coefficient for EXP and that of EXP*COV.

profile of the covered group will be slightly more concave than that of the uncovered group.

The estimation results of Table I-11 and Table I-12 seems to support the general hypotheses. To investigate this, I construct the predicted experience-earnings profiles from the coefficients in Table I-11 and in Table I-12. Figure 5 through Figure I-10 show the predicted profiles. These profiles compare two women with the same fixed effect and the same values for the observable characteristics (X's), both of whom entered the labor force six years before childbirth.[27] Thus, based on this assumption, both have the same earnings six years before giving birth. After giving birth, the coefficients for the time-passage-since-birth dummy variables (θ_k) and interactions between these variables with the coverage variable (δ_k) capture any discrepancy from the above predicted profiles. For example, two years after the base year, the log of the wage level will be $(\beta_1 + \beta_3) * 7 + (\beta_2 + \beta_4) * 49 + \theta_2 + \delta_2$ for the covered group and that for the uncovered group will be $\beta_1 * 7 + \beta_2 * 49 + \theta_2$.

Most figures show that the uncovered group falls below its pre-birth earnings profile after the birth takes place. This is also true of the covered group as are seen ins some figures. Not being covered by maternity leave especially hurts the wages one year after childbirth. Meanwhile, the maternity leave covered group generally maintains the slope of the pre-birth wage profile until one or two years after childbirth.

[27] To concentrate the difference between the profiles of the covered group and that of the uncovered group, contributions of other observable characteristics except experience to the wage profiles are assumed to be zero in the profiles in Figure I-5 - Figure I-10.

Based on the estimation results of Table I-11 and Table I-12, this subsection tests several hypotheses. The first hypothesis is that the covered group maintains higher wage profiles than uncovered counterparts during the pre-childbearing period. The figures generally support this hypothesis. The profile of the covered group is always above the profile of the uncovered group. Specifically, I test the hypothesis that if other things are equal, the difference in the log of the wages of the covered group and the uncovered group with 5 years of experience is zero.

Hypothesis 1: $H_0: 5\beta_2 + 25\beta_4 = 0$.

The null hypothesis is rejected at 90 percent significance level for all women, college educated women, and high school educated women with the model with hourly wages. The null hypothesis for the model with weekly earnings is rejected with all women and college educated women, but not with high school educated women.

The second hypothesis is that childbirth negatively affects wages in the absence of maternity leave coverage. Specifically, for a year after giving birth, the null hypothesis is

Hypothesis 2: $H_0: \theta_1 \geq 0$.

The coefficients for D^1 are all negative in Table I-11 and Table I-12, but only for college educated women's hourly earnings is this coefficient significant. The null

hypothesis is rejected at 90 percent significance level in that case. The subsequent tests for θ_k generally suggests that the effect of giving birth on both hourly and weekly earnings is negative. Most coefficients (θ_k) are negative, several are significant, and taken together all the negative signs suggest a cumulative negative effect.

The third hypothesis is that the impact of childbirth on earnings is different for the covered group compared to the uncovered group. Specifically, for a year after giving birth, the null hypothesis is

Hypothesis 3: $H_0: \delta_1 = 0$.

The coefficients for D^1* COV (δ_1) are all positive in Table I-11 and Table I-12, but significant only for all women and college educated women with hourly wages. The null hypothesis can be rejected in those cases. In the sample of all workers and of college educated workers, δ_k is almost always positive and often significant. For high school educated workers, however, the post-childbirth earnings profile of the covered workers starts above, but then falls significantly below, that of the uncovered workers.

The fourth hypothesis is whether childbirth causes the maternity leave covered group to depart significantly from their pre-childbirth earnings profile. Maternity leave coverage at the time of giving birth may cancel some of negative effect of childbearing, but not all of them. Specifically, for a year after giving birth, the combined effect of childbearing and maternity leave coverage can be zero.

Hypothesis 4: $H_0: \theta_1 + \delta_1 = 0$.

In the model discussing the hourly wages of all women, this hypothesis is rejected only for the fifth year after childbirth. The profile of the covered group is almost on the pre-birth trajectory even after the birth except the fifth year.[28] With the sample of the college educated women, the covered group seems to maintain the pre-birth slope.[29] (Column [2] in Table I-11 and Figure I-7). With the sample of the high school educated women, covered workers maintain the pre-birth trajectory until the second year after birth, but after that their profile is significantly below the pre-birth trajectory.[30] (Column [3] in Table I-11 and Figure I-9).

In the weekly earnings model for all women, covered women do not seem to maintain their pre-birth wage profile after giving birth. The after-birth profile is significantly below the pre-birth trajectory in the second, fourth, and fifth year are seen in Figure I-6 except the fifth year.[31] It is clear that this result is being driven by the results for the high school educated workers, in which the weekly earnings profile of the covered workers falls below that of the uncovered workers. In the sample of college educated workers, there is only one significant deviation from the pre-birth earnings. Overall, the results suggest that maternity leave coverage

[28] However, the number of groups and observations are much smaller and therefore less exact in the extreme year.
[29] The p-value for the first year is 0.52, for the second year is 0.05, the third year is 0.81, the fourth year is 0.88, and for the fifth year is 0.66.
[30] The p-value for the first year is 0.42, for the second year is 0.98, the third year is 0.04, the fourth year is 0.04, and for the fifth year is 0.00.
[31] The p-value for the first year is 0.71, for the second year is 0.04, the third year is 0.24, the fourth year is 0.05, and for the fifth year is 0.06.

eliminates almost all of the negative effect of childbearing for college educated workers, but not for high-school educated workers.

VI. Conclusion

The empirical findings of this paper can be summarized as follows. First, the results support the assertion that maternity leave coverage at the time of childbirth has a beneficial effect on women's labor market outcomes. By preventing involuntary job separation at the time of childbirth, it significantly lessens turnover a year after childbirth. Also, employment a year or two years after childbirth is significantly affected by maternity leave coverage at the time of the childbirth.

Analysis of wage profiles is also consistent with the basic hypothesis. The women who had a covered job at the time of childbirth maintain steeper wage profiles before and after childbirth, although this could reflect an impact of anticipated maternity leave coverage on pre-childbearing capital accumulation or simply heterogeneity in wage growth between women in covered and uncovered jobs. Among women with a high school education or less, childbirth negatively affects the wage and weekly earnings profiles of both covered and uncovered women. Among college educated women, however, there is little evidence of negative effect of childbearing on earnings for women covered by maternity leave at the time of giving birth, but there is evidence that over a several-year period, women not covered at the time of birth suffer negative earnings consequences. Overall, the evidence for an impact of coverage on earnings seems weaker than the evidence for an impact of coverage on turnover and employment.

This paper adds to the literature by analyzing the effect of actual maternity leave coverage (as opposed to an incomplete state mandate for maternity leave

coverage) on turnover and employment, using explicit and direct controls for heterogeneity. Also, by using a fixed effect model and data on wages both before and after giving birth, this paper provides more accurate estimates of the impact on earnings of firm-provided maternity leave coverage. Although much effort has been made to control for heterogeneity that can bias the estimation result, it is possible that some heterogeneity between covered and uncovered women remains uncontrolled for.

During the 1990's, the general policy approach towards maternity leave was to attempt to increase the number of employees with maternity leave coverage by legislative mandates that required increasing numbers of employers to offer such a benefit. An argument in favor of this approach to expanding maternity leave coverage would seem to require, at a minimum, evidence that existing maternity leave programs seemed to benefit the woman they covered. This paper has provided such evidence.

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Table I-1: Summary Statistics: Women who had birth during 1988-92 and Worked just before childbirth

	COVERED	UNCOVERED
(All)		
N of Obs	709	166
Age	28.0	27.6
	(0.09)	(0.19)
Education	13.1	12.4
(years)	(0.07)	(0.14)
Tenure	3.8	1.7
(years)	(0.11)	(0.18)
Pre-birth wage	1113.2	785.8
	(18.50)	(32.65)
N of children	0.98	1.03
	(0.03)	(0.08)
Experience	5.54	4.95
(years)	(0.03)	(0.10)
(Coll Educated)		
N of Obs	344	55
Age	28.6	28.4
	(0.13)	(0.32)
Education	14.8	14.5
	(0.08)	(0.16)
Tenure	4.0	1.9
	(0.17)	(0.31)
Pre-birth wage	1318.6	948.9
	(29.28)	(65.96)
N of children	0.79	0.78
	(0.04)	(0.14)
Experience	5.74	5.07
	(0.03)	(0.17)
(High School Educated)		
N of Obs	365	111
Age	27.4	27.2
	(0.13)	(0.23)
Education	11.6	11.5
	(0.06)	(0.11)
Tenure	3.6	1.8
	(0.16)	(0.24)
Pre-birth wage	919.7	705.0
	(17.86)	(32.88)
N of children	1.16	1.16
	(0.05)	(0.10)
Experience	5.36	4.90
	(0.05)	(0.12)

Table I-2: Turnover One Year after Childbirth (All Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx sd.err.
COV	0.216(0.041)	0.167(0.040)	0.156(0.048)	0.151(0.047)
DCOLL		-0.014(0.024)	-0.025(0.026)	-0.039(0.026)
TENBASE		0.015(0.004)	0.013(0.004)	0.012(0.005)
EXPBASE		-0.001(0.006)	-0.002(0.006)	-0.003(0.006)
DRACE		-0.057(0.025)	-0.049(0.025)	-0.050(0.024)
SMSA		0.043(0.032)	0.021(0.030)	0.018(0.030)
MARRIED		0.060(0.033)	0.047(0.033)	0.055(0.033)
CHILD1		-0.072(0.036)	-0.056(0.035)	-0.053(0.034)
CHILD2		0.008(0.029)	0.009(0.029)	0.019(0.028)
CHILD3		-0.039(0.026)	-0.034(0.026)	-0.014(0.025)
MED			-0.010(0.030)	-0.006(0.030)
PREWAGE			0.031(0.031)	0.028(0.031)
SIZE			0.041(0.025)	0.036(0.024)
UNION			0.002(0.032)	-0.001(0.032)
D^{-4}(NOTN4)				0.057(0.034)
D^{-3}(NOTN3)				-0.271(0.115)
D^{-2}(NOTN2)				0.066(0.036)
D^{-1}(NOTN1)				0.085(0.026)
D^{-8}(PARTN4)				0.005(0.033)
D^{-7}(PARTN3)				-0.106(0.048)
D^{-6}(PARTN2)				0.003(0.038)
D^{-5}(PARTN1)				-0.008(0.038)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	808	808	793	793
Sig of eight Dummies*				significant

* Joint significance test for eight work history dummy variables with 90 percent significance level. This is the same from Table I-2 to Table I-10.

** Not-working a year before giving birth (D^{-1}), not-working two years before giving birth (D^{-2}), not-working three years before giving birth (D^{-3}), not-working four years before giving birth (D^{-4}), part-time-working a year before giving birth (D^{-5}), part-time-working two years before giving birth (D^{-6}), part-time-working three years before giving birth (D^{-7}), part-timenot-working four years before giving birth (D^{-8}). This is the same from Table I-2 to Table I-10.

*** Cohort dum. represents whether the model includes cohort dummy variables. Indusgry dum. represents whether the model includes industry dummy variables. Occup. dum. represents whether the model includes occupation dummy variables. This is the same from Table I-2 to Table I-10.

Table I-3: Turnover One Year after Childbirth (College Educated Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.190(0.062)	0.135(0.058)	0.121(0.066)	0.105(0.065)
TENBASE		0.022(0.006)	0.017(0.006)	0.019(0.006)
EXPBASE		-0.008(0.008)	-0.008(0.007)	-0.006(0.007)
DRACE		-0.040(0.033)	-0.031(0.033)	-0.040(0.032)
SMSA		0.070(0.050)	0.030(0.043)	0.023(0.042)
MARRIED		0.065(0.055)	0.035(0.050)	0.021(0.046)
CHILD1		-0.012(0.043)	0.003(0.038)	0.000(0.039)
CHILD2		0.014(0.038)	0.019(0.036)	0.026(0.036)
CHILD3		-0.011(0.037)	-0.006(0.034)	-0.017(0.036)
MED			-0.013(0.038)	0.000(0.040)
PREWAGE			0.062(0.039)	0.054(0.038)
SIZE			0.034(0.032)	0.032(0.031)
UNION			0.009(0.042)	0.020(0.039)
D^{-4}(NOTN4)				dropped
D^{-3}(NOTN3)				-0.707(0.266)
D^{-2}(NOTN2)				0.084(0.018)
D^{-1}(NOTN1)				0.026(0.072)
D^{-8}(PARTN4)				0.006(0.047)
D^{-7}(PARTN3)				-0.039(0.058)
D^{-6}(PARTN2)				0.026(0.044)
D^{-5}(PARTN1)				0.035(0.040)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	396	396	390	378
Sig of seven dummies				not sig

Table I-4: Turnover One Year after Childbirth (High School Educated Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.234(0.055)	0.213(0.057)	0.206(0.071)	0.188(0.072)
TENBASE		0.007(0.006)	0.005(0.006)	0.002(0.006)
EXPBASE		0.006(0.008)	0.007(0.008)	0.007(0.010)
DRACE		-0.085(0.036)	-0.080(0.035)	-0.079(0.035)
SMSA		0.034(0.042)	0.030(0.042)	0.024(0.041)
MARRIED		0.071(0.043)	0.058(0.041)	0.070(0.044)
CHILD1		-0.140(0.058)	-0.115(0.054)	-0.103(0.054)
CHILD2		-0.011(0.045)	-0.010(0.042)	0.009(0.041)
CHILD3		-0.058(0.034)	-0.042(0.032)	-0.010(0.034)
MED			-0.008(0.040)	-0.010(0.042)
PREWAGE			-0.012(0.047)	-0.009(0.049)
SIZE			0.037(0.033)	0.043(0.034)
UNION			-0.003(0.043)	0.009(0.043)
D^{-4} (NOTN4)				0.015(0.058)
D^{-3} (NOTN3)				-0.169(0.124)
D^{-2} (NOTN2)				0.030(0.068)
D^{-1} (NOTN1)				dropped
D^{-8} (PARTN4)				0.004(0.043)
D^{-7} (PARTN3)				-0.125(0.070)
D^{-6} (PARTN2)				-0.009(0.054)
D^{-5} (PARTN1)				-0.044(0.059)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	412	412	392	378
Sig of seven dummies				not sig

Table I-5: Employment One Year after Childbirth (All Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.244(0.035)	0.158(0.035)	0.129(0.040)	0.114(0.039)
DCOLL		0.049(0.023)	-0.001(0.025)	-0.003(0.026)
TENBASE		0.018(0.005)	0.012(0.005)	0.008(0.005)
EXPBASE		0.015(0.005)	0.013(0.005)	0.011(0.006)
DRACE		-0.014(0.024)	-0.019(0.024)	-0.010(0.024)
SMSA		-0.030(0.025)	-0.055(0.022)	-0.056(0.022)
MARRIED		0.051(0.030)	0.045(0.029)	0.040(0.030)
CHILD1		-0.057(0.033)	-0.051(0.031)	-0.038(0.031)
CHILD2		-0.017(0.029)	-0.009(0.028)	0.014(0.027)
CHILD3		0.012(0.024)	0.007(0.023)	0.020(0.024)
MED			-0.004(0.028)	-0.010(0.028)
PREWAGE			0.058(0.029)	0.046(0.029)
SIZE			0.003(0.025)	0.004(0.025)
UNION			0.064(0.024)	0.062(0.024)
D^{-4} (NOTN4)				0.002(0.045)
D^{-3} (NOTN3)				0.014(0.046)
D^{-2} (NOTN2)				-0.069(0.071)
D^{-1} (NOTN1)				-0.028(0.061)
D^{-8} (PARTN4)				-0.004(0.032)
D^{-7} (PARTN3)				0.018(0.030)
D^{-6} (PARTN2)				-0.110(0.049)
D^{-5} (PARTN1)				-0.091(0.042)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	928	921	898	898
Sig of eight Dummies				significant

Table I-6: Employment One Year after Childbirth (College Educated Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.183(0.054)	0.121(0.051)	0.106(0.059)	0.113(0.060)
TENBASE		0.013(0.006)	0.010(0.005)	0.006(0.005)
EXPBASE		0.008(0.007)	0.008(0.006)	0.012(0.006)
DRACE		-0.006(0.030)	-0.017(0.029)	-0.020(0.028)
SMSA		-0.059(0.027)	-0.061(0.023)	-0.062(0.020)
MARRIED		0.039(0.046)	0.039(0.047)	0.030(0.044)
CHILD1		-0.083(0.046)	-0.074(0.044)	-0.067(0.043)
CHILD2		-0.025(0.037)	-0.024(0.036)	0.004(0.031)
CHILD3		0.034(0.029)	0.023(0.028)	0.023(0.027)
MED			-0.005(0.035)	-0.013(0.031)
PREWAGE			0.007(0.034)	0.012(0.033)
SIZE			0.005(0.029)	0.005(0.027)
UNION			0.044(0.027)	0.039(0.026)
D^{-4} (NOTN4)				0.054(0.022)
D^{-3} (NOTN3)				-0.205(0.202)
D^{-2} (NOTN2)				0.032(0.046)
D^{-1} (NOTN1)				-0.037(0.091)
D^{-8} (PARTN4)				0.043(0.026)
D^{-7} (PARTN3)				-0.001(0.044)
D^{-6} (PARTN2)				-0.178(0.095)
D^{-5} (PARTN1)				-0.021(0.047)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	432	428	419	419
Sig of eight Dummies				not sig

Table I-7: Employment One Year after Childbirth
(High School Educated Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.269(0.046)	0.181(0.047)	0.156(0.056)	0.118(0.056)
TENBASE		0.024(0.007)	0.014(0.007)	0.007(0.008)
EXPBASE		0.020(0.008)	0.014(0.008)	0.011(0.010)
DRACE		-0.023(0.038)	-0.023(0.038)	-0.010(0.039)
SMSA		-0.018(0.039)	-0.055(0.033)	-0.054(0.034)
MARRIED		0.068(0.040)	0.070(0.041)	0.068(0.042)
CHILD1		-0.029(0.046)	-0.024(0.044)	-0.013(0.045)
CHILD2		-0.006(0.043)	-0.004(0.042)	0.022(0.041)
CHILD3		-0.002(0.035)	-0.010(0.034)	0.005(0.037)
MED			-0.018(0.041)	-0.016(0.044)
PREWAGE			0.141(0.049)	0.124(0.050)
SIZE			0.009(0.038)	0.023(0.038)
UNION			0.080(0.037)	0.085(0.037)
D^{-4} (NOTN4)				-0.076(0.080)
D^{-3} (NOTN3)				0.071(0.049)
D^{-2} (NOTN2)				-0.111(0.104)
D^{-1} (NOTN1)				-0.011(0.082)
D^{-8} (PARTN4)				-0.045(0.051)
D^{-7} (PARTN3)				0.044(0.041)
D^{-6} (PARTN2)				-0.088(0.064)
D^{-5} (PARTN1)				-0.154(0.067)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	496	493	472	472
Sig of eight Dummies				significant

Table I-8: Employment Two Years after Childbirth (All Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.215(0.037)	0.138(0.037)	0.113(0.044)	0.121(0.045)
DCOLL		0.123(0.028)	0.070(0.031)	0.050(0.032)
TENBASE		0.022(0.005)	0.016(0.005)	0.013(0.005)
EXPBASE		0.021(0.006)	0.019(0.006)	0.008(0.007)
DRACE		-0.043(0.029)	-0.059(0.030)	-0.058(0.030)
SMSA		-0.002(0.033)	-0.034(0.031)	-0.031(0.032)
MARRIED		0.000(0.032)	0.004(0.033)	0.007(0.034)
CHILD1		-0.041(0.036)	-0.041(0.036)	-0.038(0.036)
CHILD2		-0.001(0.033)	-0.003(0.034)	0.013(0.033)
CHILD3		0.057(0.028)	0.048(0.029)	0.066(0.029)
MED			0.015(0.038)	-0.011(0.037)
PREWAGE			0.100(0.036)	0.090(0.036)
SIZE			0.024(0.030)	0.031(0.029)
UNION			-0.011(0.039)	-0.009(0.039)
D^{-4}(NOTN4)				-0.112(0.073)
D^{-3}(NOTN3)				-0.065(0.075)
D^{-2}(NOTN2)				0.004(0.067)
D^{-1}(NOTN1)				-0.105(0.088)
D^{-8}(PARTN4)				-0.104(0.047)
D^{-7}(PARTN3)				0.030(0.038)
D^{-6}(PARTN2)				-0.032(0.047)
D^{-5}(PARTN1)				-0.051(0.046)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	928	921	898	898
Sig of eight Dummies				significant

Table I-9: Employment Two Years after Childbirth
(College Educated Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.153(0.056)	0.081(0.049)	0.137(0.070)	0.145(0.072)
TENBASE		0.021(0.006)	0.021(0.006)	0.020(0.006)
EXPBASE		0.013(0.007)	0.009(0.007)	0.002(0.007)
DRACE		0.013(0.034)	-0.021(0.033)	-0.023(0.032)
SMSA		0.012(0.043)	0.007(0.041)	0.010(0.041)
MARRIED		-0.010(0.044)	0.011(0.046)	0.012(0.046)
CHILD1		-0.135(0.052)	-0.145(0.054)	-0.136(0.054)
CHILD2		0.010(0.038)	0.016(0.033)	0.027(0.032)
CHILD3		0.098(0.029)	0.078(0.027)	0.090(0.027)
MED			-0.018(0.038)	-0.019(0.038)
PREWAGE			0.043(0.038)	0.028(0.038)
SIZE			-0.043(0.035)	-0.033(0.034)
UNION			-0.096(0.053)	-0.096(0.054)
D^{-4}(NOTN4)				-0.091(0.131)
D^{-3}(NOTN3)				-0.130(0.165)
D^{-2}(NOTN2)				-0.109(0.142)
D^{-1}(NOTN1)				-0.026(0.086)
D^{-8}(PARTN4)				-0.018(0.056)
D^{-7}(PARTN3)				0.021(0.041)
D^{-6}(PARTN2)				0.011(0.047)
D^{-5}(PARTN1)				0.014(0.042)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	432	428	419	419
Sig of eight Dummies				not sig

Table I-10: Employment Two Years after Childbirth
(High School Educated Workers)

(The Probit Model)

	[1] dF/dx s.err.	[2] dF/dx s.err.	[3] dF/dx s.err.	[4] dF/dx s.err.
COV	0.232(0.048)	0.178(0.051)	0.098(0.060)	0.094(0.062)
TENBASE		0.023(0.008)	0.012(0.008)	0.005(0.008)
EXPBASE		0.027(0.010)	0.021(0.010)	0.006(0.012)
DRACE		-0.088(0.047)	-0.086(0.048)	-0.083(0.048)
SMSA		-0.025(0.048)	-0.081(0.045)	-0.071(0.046)
MARRIED		0.008(0.046)	0.014(0.047)	0.019(0.049)
CHILD1		0.056(0.049)	0.057(0.049)	0.059(0.049)
CHILD2		-0.021(0.052)	-0.009(0.052)	0.000(0.053)
CHILD3		0.012(0.043)	0.000(0.044)	0.025(0.046)
MED			0.033(0.057)	-0.004(0.057)
PREWAGE			0.194(0.061)	0.200(0.063)
SIZE			0.079(0.045)	0.094(0.045)
UNION			0.067(0.057)	0.078(0.056)
D^{-4}(NOTN4)				-0.202(0.100)
D^{-3}(NOTN3)				-0.043(0.095)
D^{-2}(NOTN2)				0.033(0.090)
D^{-1}(NOTN1)				-0.046(0.114)
D^{-8}(PARTN4)				-0.173(0.067)
D^{-7}(PARTN3)				0.020(0.060)
D^{-6}(PARTN2)				-0.038(0.068)
D^{-5}(PARTN1)				-0.095(0.068)
COHORT DUM.	No	Yes	Yes	Yes
INDUSTRY DUM.	No	No	Yes	Yes
OCCUP. DUM.	No	No	Yes	Yes
N of Obs	496	493	479	479
Sig of eight Dummies				significant

Table I-11: The Effects of Coverage at the Time of Childbirth on the Wage Profiles (Hourly Wages)

(The Fixed Effects Estimation)

Dep. Var. = Hourly Wages

	[1] All Workers		[2] Coll Wkrs		[3] High S. Wkrs	
	Coeff.	std.err.	Coeff.	std.err.	Coeff.	std.err.
EDU	0.070	(0.007)	0.073	(0.008)	0.007	(0.019)
NUMCD	-0.033	(0.008)	-0.069	(0.011)	0.006	(0.011)
MARR_D	-0.002	(0.014)	0.006	(0.022)	0.000	(0.019)
MARR_N	-0.016	(0.013)	-0.012	(0.016)	-0.002	(0.020)
EXP	0.033	(0.009)	0.031	(0.013)	0.038	(0.014)
EXP*COV	0.064	(0.010)	0.079	(0.013)	0.031	(0.016)
EXPSQ	-0.001	(0.001)	0.000	(0.001)	-0.002	(0.001)
EXPSQ*COV	-0.004	(0.001)	-0.005	(0.001)	-0.001	(0.001)
D^1	-0.051	(0.031)	-0.089	(0.048)	-0.023	(0.041)
D^1*COV	0.066	(0.035)	0.102	(0.052)	0.043	(0.048)
D^2	-0.020	(0.036)	-0.028	(0.052)	-0.020	(0.049)
D^2*COV	0.042	(0.039)	0.071	(0.056)	0.020	(0.055)
D^3	-0.079	(0.041)	-0.063	(0.060)	-0.095	(0.058)
D^3*COV	0.054	(0.045)	0.069	(0.065)	0.035	(0.064)
D^4	-0.093	(0.044)	-0.088	(0.065)	-0.100	(0.059)
D^4*COV	0.058	(0.049)	0.084	(0.071)	0.033	(0.068)
D^5	-0.035	(0.048)	-0.081	(0.072)	-0.004	(0.064)
D^5*COV	-0.026	(0.054)	0.066	(0.079)	-0.103	(0.074)
CONSTANT	5.555	(0.095)	5.519	(0.115)	6.280	(0.216)
N of Groups	1025		559		466	
N of Obs	9708		5437		4271	
Obs per Grp (avg)	9.5		9.7		9.2	
	F(18,8665)=75.43		F(18,4860)=68.80		F(18,3787)=11.90	

* The number of groups and observations are progressively smaller after the third year. The third year after giving birth (D^3) includes only 1988, 1989, 1990, and 1991 cohorts. The fourth year (D^4) includes only 1988, 1989, and 1990 cohorts. The fifth year (D^5) includes only 1988 and 1989 cohorts. This is the same in Table I-12.

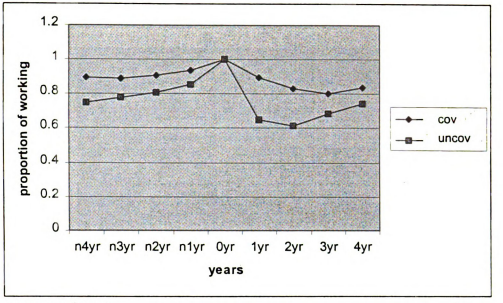
Table I-12: The Effects of Coverage at the Time of Childbirth on the Wage Profiles (Weekly Earnings)

(Fixed Effects Estimation)

Dep. Var. = Weekly Earnings

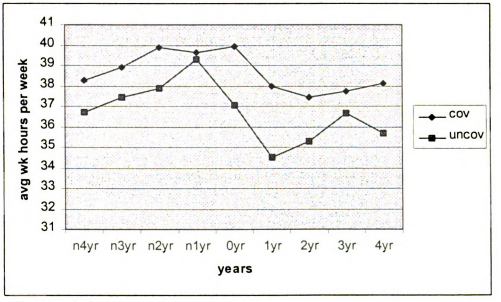
	[1] All Workers		[2] College Wkrs		[3] High S. Wkrs	
	Coeff.	std.err.	Coeff.	std.err.	Coeff.	std.err.
EDU	0.180	(0.014)	0.215	(0.016)	-0.010	(0.032)
NUMCD	-0.099	(0.014)	-0.138	(0.020)	-0.042	(0.020)
MARR_D	0.078	(0.025)	0.097	(0.041)	0.075	(0.031)
MARR_N	0.043	(0.022)	0.018	(0.030)	0.106	(0.033)
EXP	0.083	(0.018)	0.066	(0.025)	0.133	(0.026)
EXP*COV	0.088	(0.019)	0.118	(0.026)	0.001	(0.029)
EXPSQ	-0.004	(0.001)	-0.003	(0.002)	-0.006	(0.002)
EXPSQ*COV	-0.005	(0.001)	-0.006	(0.002)	0.001	(0.002)
D^1	-0.100	(0.065)	-0.098	(0.094)	-0.108	(0.089)
D^1*COV	0.110	(0.071)	0.091	(0.101)	0.143	(0.097)
D^2	-0.129	(0.079)	-0.129	(0.114)	-0.149	(0.106)
D^2*COV	0.060	(0.085)	0.050	(0.122)	0.101	(0.117)
D^3	-0.104	(0.076)	-0.131	(0.116)	-0.105	(0.096)
D^3*COV	0.065	(0.082)	0.139	(0.124)	0.008	(0.106)
D^4	-0.128	(0.079)	-0.330	(0.118)	0.034	(0.102)
D^4*COV	0.053	(0.087)	0.342	(0.129)	-0.204	(0.115)
D^5	0.081	(0.096)	0.000	(0.141)	0.144	(0.126)
D^5*COV	-0.164	(0.106)	-0.010	(0.155)	-0.299	(0.140)
CONSTANT	7.469	(0.180)	6.870	(0.227)	9.822	(0.380)
N of Groups	1020		557		463	
N of Obs	7597		4331		3266	
Obs per Grp (avg)	7.4		7.8		7.1	
	F(18,6559)=56.34		F(18,3756)=48.91		F(18,2785)=10.67	

Figure I-1: Proportion of Working (Non-Zero earnings) by Groups



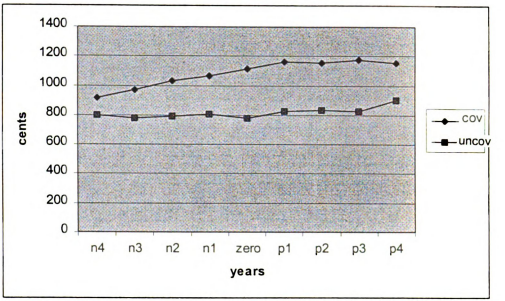
cov: covered group
uncov: uncovered group
Data for 3yr only includes women with reference birth year of 1988, 1989, 1990, 1991, since the 1994 data is the latest one. Data for 4yr only includes women with reference birth year of 1988, 1989, 1990.

Figure I-2: Average Work Hours per Week by Groups



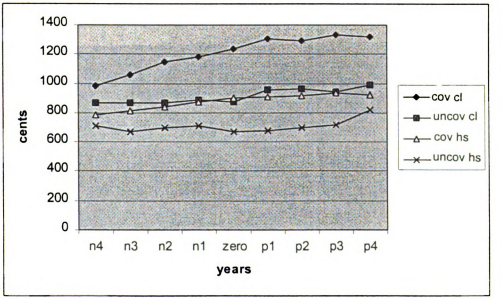
cov: covered group
uncov: uncovered group
Data for 3yr only includes women with reference birth year of 1988, 1989, 1990, 1991, since the 1994 data is the latest one. Data for 4yr only includes women with reference birth year of 1988, 1989, 1990.

Figure I-3: Simple Wage Profiles of All Workers (CPI adjusted)



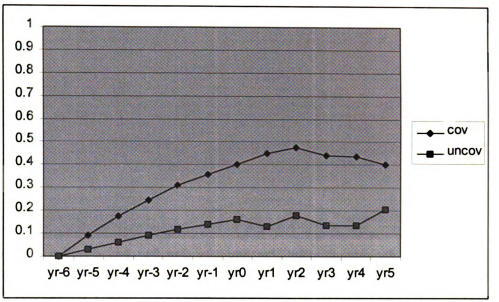
cov: covered group
uncov: uncovered group

Figure I-4: Simple Wage Profiles by Groups (CPI adjusted)



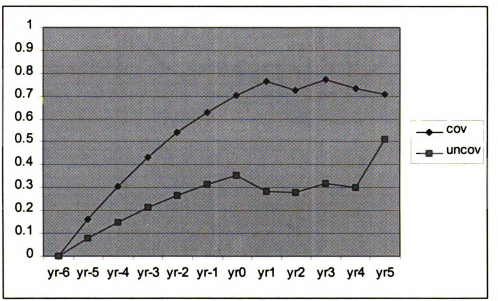
cov cl: college educated covered group
uncov cl: college educated uncovered group
cov hs: high school educated covered group
uncov hs: high school educated uncovered group

Figure I-5: Predicted Hourly Wage Profiles (All Workers)



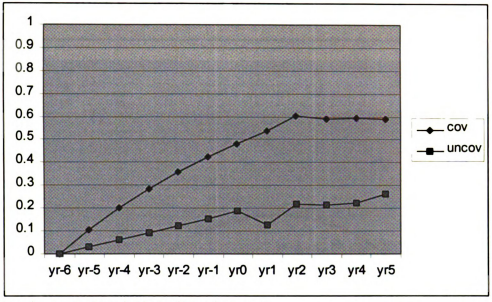
X axis: years, Y axis: log of hourly wages
cov: covered group, uncov: uncovered group

Figure I-6: Predicted Weekly Earnings Profiles (All Workers)



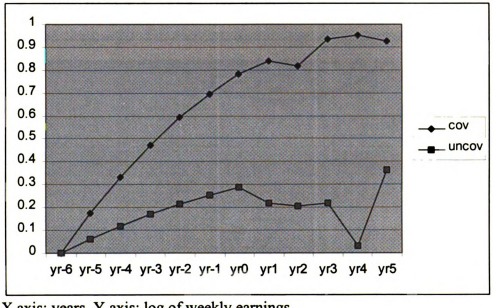
X axis: years, Y axis: log of weekly earnings
cov: covered group, uncov: uncovered group

Figure I-7: Predicted Hourly Wage Profiles (College Educated Workers)



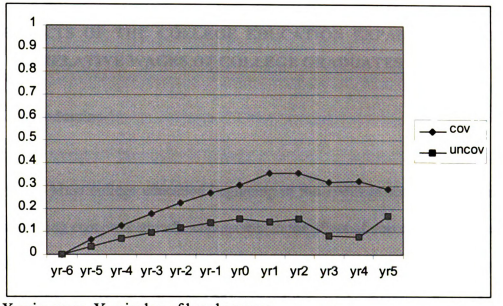
X axis: years, Y axis: log of hourly wages
cov: covered group, uncov: uncovered group

Figure I-8: Predicted Weekly Earnings Profiles
(College Educated Workers)



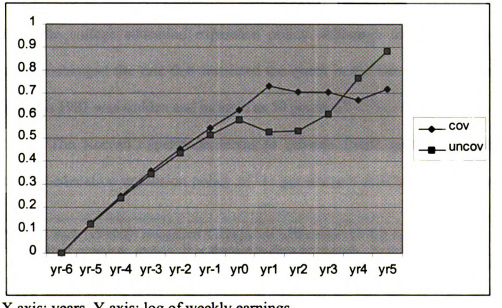
X axis: years, Y axis: log of weekly earnings
cov: covered group, uncov: uncovered group

Figure I-9: Predicted Hourly Wage Profiles
(High School Educated Workers)



X axis: years, Y axis: log of hourly wages
cov: covered group, uncov: uncovered group

Figure I-10: Predicted Weekly Earnings Profiles
(High School Educated Workers)



X axis: years, Y axis: log of weekly earnings
cov: covered group, uncov: uncovered group

CHAPTER 2

EFFECTS OF THE COLLEGE EDUCATION EXPANSION POLICY ON THE RELATIVE WAGES OF COLLEGE GRADUATES IN KOREA

I. Introduction

Mass college education beginning in the 1980s in Korea has contributed to sustaining economic growth, comparable to the effect of universal primary education that had provided the basis to initiate industrialization in the 1960s.[32] The college education expansion policy in 1981 opened the epoch of mass college education by abruptly increasing the college education entrance quota. This policy was thought to cause an eruption of the supply of young college graduates in the labor market after the mid-1980s. Therefore, a major development in the wage structure in that period, that is, a sharp decline of relative wages of college graduates, was thought to result from the college education expansion policy. Although the Korean government already changed the rule that restricted the quota in the late 1970s, increase in the quota in 1981 was sudden and as large as 50 percent.[33]

The Korean experience seems to provide fertile ground to study how a college education expansion policy of the government affects the labor market. But

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[32] World Bank (1998/99) recognized Korea as one of the countries that successfully linked education to consistent economic growth. It is thought to help to upgrade the average skill level of Korean workers in the international division of labor, thereby helping to raise their average wages in the world economy in the long run.

[33] 58.6 percent increase in the quota of four-year college. 48.7 percent increase in the quota including two-year college. The Korean government has regulated the number of college entrants by setting the

only a few studies have been devoted to that topic. Previous studies documented a severe decline in the relative wages of college graduates and an increase in within-group inequality after the sudden increase in college entrance quota in 1981 (Ihm 1990, Kim and Topel 1995, Choi 1996). These studies attempted regression analysis of the relationship between the relative employment of college graduates and the relative wages of them. However, the data on employed college graduates would be a poor measure of the supply of college graduates if the unemployment rate for them is unusually high as in Korea after the mid-1980s. Moreover, the data on the supply of college graduates also would not serve for a good independent variable in estimating the effect of government educational policy on the relative wages of college graduates, because it reflects the demographic and overall socioeconomic changes as well as the effect of the government educational policy.

This paper explores the college education expansion policy on wages and employment during the 1980s and the 1990s, including a sudden change in the college entrance quota in 1981. First, this paper explores the changes in the returns to the college education before and after a sudden increase in the quota in 1981 by using the difference-in-difference (DD) method. A DD estimate shows that the relative wages for all workers as well as young workers quickly dropped immediately after large influx of college graduates, that is, between 1982-83 and 1987-88.

Second, considering that the DD strategy does not allow one to analyze the effect of the policy throughout the 1980s and 1990s, this paper uses time series

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college entrance quota every year, based on population increase and the forecast for manpower demand during the 1970s.

analysis to examine the policy of regulating the college entrance quota. The reduced form equations for the relative supply and the relative wages as well as the demand curve are estimated. The reduced form equations include the policy variable such as the quota or the resulting target variable such as the enrollment rate as an explanatory variable. The estimation results indicate that the relative wages and employment of all workers including both young and old responds to the policy with a time lag.

Third, this paper estimates the enrollment equation that includes the current relative wages as an explanatory variable. The current relative wages is positively and significantly associated with the enrollment rate, after controlling for trend and first order autocorrelation. This means that the market incentives were not totally paralyzed in the private decisions to enroll in college during that period.

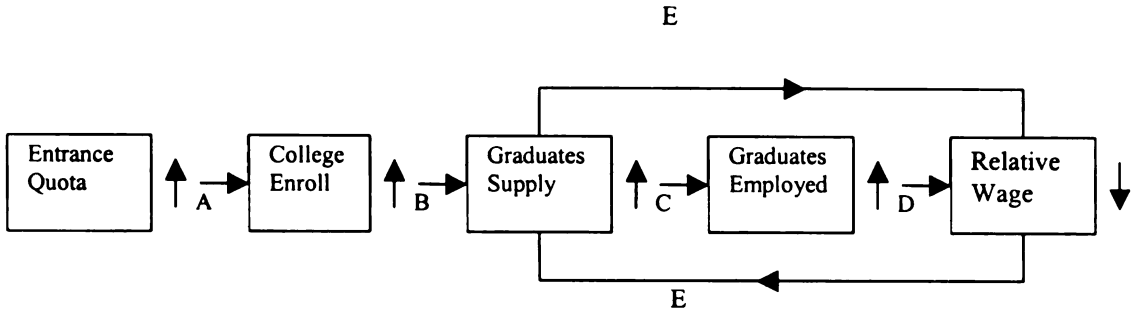
This paper is organized as follows. Section II reviews previous studies. Section III describes the data used in this paper. Section IV overviews the background of the college education expansion policy and the changes in wage structure during the 1980s and 1990s. Section V explains the empirical strategy for estimating the impact of the college education policy on the relative wages of college graduates and reports the estimation results. Conclusion and policy implications follow in Section VI.

II. Critical Review of Previous Studies

About the effect of the college education expansion policy on the relative wages, a handful of related studies exist. Among them, Ihm(1990), Kim and Topel(1995), Choi(1996), Kim and Yoo(1994) are worthy of discussion.

Figure II-1 depicts the conceptual framework that helps us to understand the transmitting process of the college education expansion policy on relative wages. The college entrance quota is the policy variable set by the government and the college enrollment rate is the target variable. Conceptually, abrupt increase in the quota can be viewed as a supply shock. Under the chronic excess demand for higher education, increase in the quota is expected to be directly reflected in the enrollment. Therefore, the process (A) might be automatic and this paper confirms that. And the increase in the quota results in an increase in college enrollment, leading to increase in the supply of college graduates and their relative employment, exerting downward pressure on their relative wages. In this process, there exists a time lag between the increase in college enrollment and the increase in the supply of college graduate (B). And the demand works in the process (C). Only some of the college graduates who enter in the labor market will be hired.

Figure II-1: The Effect of the College Education Expansion Policy on the Wages of College Graduates



If the technical identity can be obtained in the relation (A), that is, between the quota and the number of enrolled college students, as was evidenced by Kim and Yoo(1992), we can use the college enrollment rate as well as the college entrance quota for a policy variable that reflects the college education expansion policy.[34]

Most of the previous studies on the effect of the policy concentrated only on the relation (D) or the relation (C) and (D), that is, relations between relative supply or relative employment and their relative wages (Ihm 1990 and Choi 1996). Ihm(1990) found that supply of college graduates exceeded the industrial demand, even within the context of a rapidly developing economy, using the 1986 Occupational Wage Survey. He also found a strong sign of occupational filtering and educational upgrading in the 1980s. While the earnings premium associated with college education has continued to grow in absolute amounts, the rate of growth declined during the period.

[34] Indeed, the college entrance quota set by the government has been almost exactly translated into the college enrollment in Korea during 1980s and 1990s when the excess demand for college education existed. In Figure II-1, relation (B) between the number of enrolled college students and the college graduates that constitute the labor supply in the college labor market can also be assumed

Kim and Topel(1995) also identified the changes in relative supply as a main determinant for explaining the changes in the wage structure after the mid-1980s. They analyzed the overall labor market performance during the 1970s-1990s, the period of rapid growth and structural changes. The upshot of their argument is that there was little evidence of the demand shifts in affecting relative wages.[35]

Choi(1996) also suggested the supply shock. The rapid increase in the number of college graduates among the total economically active population since 1985 has resulted from the college education expansion policy in 1981. He referred this supply shift of college graduates as exogeneous. (Choi 1996). From investigating the experience-earnings profile, he found that the large increase in the supply of young college graduates during the 1980s reduced their relative wages. However, he did not refer the sudden increase in relative supply of young college graduates as a prime cause of declining relative wages of college graduates. Instead, he emphasized that changes in the relative wages have been small, despite the substantial increase in the number of college graduates. And he thought that factor biased technological changes favored more educated workers can be behind this.

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technically identical, especially in the situation where the college drop-out ratio were negligible, like Korea in the 1980s-1990s.

[35] They argued that wages converge over observable characteristics such as schooling and age, but relative demand shifts played a trivial role. They were surprised at one of their findings that industrial policies, with which the government purposely pushed toward manufacturing and exports, did not raise the relative demand for less skilled workers. However, the apparent small changes in the relative demand for less skilled workers in this period could be attributed to the defectiveness of the demand shift measure. According to Katz and Murphy (1992), the demand shift index could understate the "true" between-sector growth for college graduates relative to high school graduates. Indeed, it is widely acknowledged in the studies on the wage structure in the 1980s in the United States that the shift in the industrial composition of labor demand has little effect on the relative wage (Katz and Murphy 1992, Juhn, Murphy, and Pierce 1993, Johnson and Bound 1992). Choi (1996) also indicated that effect of labor demand changes brought by product demand changes across industries on the relative wages was negligible.

However, these studies overlook one important point. The unemployment rate of college graduate labor market entrants was extremely high in Korea in the 1980s and 1990s, and the supply of college graduates is the sum of employed and unemployed college graduates. As their analysis is limited to the relation (D), they cannot be viewed as studies on the effect of the college education expansion policy on the relative wages of college graduates. Also, there is a problem of the studies such as Kim and Topel (1995). Those studies depend on their methods of singling out the supply effects on the relative wages, since only changes in employment which combine the supply effects and the demand effects are observed in the labor market.

Unlike previous studies, the time series analysis of this paper uses the reduced form equation for relative wages. In that equation, the supply shock is incorporated into the quota or the enrollment rate as an explanatory variable. This reduced form equation estimation also informs how long it took to transmit the college education expansion policy to changes in relative wages.

Moreover, this paper attempts to discuss one of the hot issues in that period, that is, whether the economic incentives worked in private decisions to enroll in college. There may be a feedback effect of resulting changes in the relative wages of college graduates on the demand for college education revealed in the college enrollment rate.

Kim and Yoo(1994) studied a similar issue. They tried to find determinants of demand for college education which was reflected in the number of college applicants. They examined whether abrupt increase in college entrance quota brought

about the rapid increase in demand for college education. They used the Occupational Wage Survey and the Annual Report of Educational Statistics for 1962-92 period. The results indicated that the college entrance quota as well as relative wages of college graduates and several other determinants had significantly affected the demand for college education.[36]

However, from the analysis of the enrollment equation, this paper finds that the enrollment rate for college education did respond to change of relative wages, after controlling for time trend and the first order serial correlation. This result is contrary to previous studies which attributed the puzzling phenomenon in the 1980s, that is, ever-increasing enrollment rate despite continuously decreasing relative wages of college graduates, to the so-called "excessive fever for higher education", originating from Korean culture (Kim and Kim 1992),

[36] It is controversial whether a decrease in college-high school wage differentials would lead to a decrease in the demand for college education. According to Kim and Yoo(1992), the abrupt increase in the college entrance quota during the early 1980s has led to enormous increase in the number of college applicants far beyond the increase in the quota. On the other hand, the number of college applicants has decreased significantly as entrance quota was fixed during 1982-86. When the government increased the college entrance quota once more after the late 1980s, the number of college applicants also increased more rapidly than the college entrance quota.

III. Data

The main data of this paper mainly is the Occupational Wage Survey (OWS) that is reported annually by the Ministry of Labor of Korea. Another important data source is the Annual Report of Education Statistics published by the Ministry of Education of Korea. The original OWS data set includes various kinds of wages, employment, and demographic information for about 500,000 workers per year. Although the number of observations is large, the number of variables is quite small compared to the Current Population Survey (CPS) in the United States. The OWS data also differs from CPS data, in that the sampling units are firms rather than households. The survey includes only firms with at least ten employees, therefore the manufacturing sector is over-represented and retail trade industry is under-represented in the sample. As a result, it omits roughly one-third of the non-agricultural labor force in a typical year (Kim and Topel 1995). Another major drawback is that the public sector is excluded from the survey. Therefore, OWS data does not provide accurate information about actual wage structure by industries.

This paper uses a random ten percent sample from the original OWS data. The number of observations is roughly 25,000 to 50,000 for each year. This paper also uses yearly aggregated data that is calculated from the original OWS data and published in the printed version of OWS. Wages include regular payments and overtime payments. I summed up all types of monthly payments and also included one-twelfth of the special payment that is usually paid once a year at the end of the

year. I calculated the hourly wages for full-time workers who work more than 180 hours and less than 300 hours per month and then took a natural logarithm of the hourly wage rates.

The education level is classified into five groups. 1 = elementary school graduates, 2 = middle school graduates, 3 = high school graduates, 4 = junior college graduates, and 5 = college graduates. I give actual years for each category. Elementary school graduates including elementary and middle school dropouts are given six years. Middle school graduates including high school dropouts are given nine years. High school graduates including junior college dropouts are given twelve years. Junior college graduates including vocational school graduates and college dropouts are given fourteen years. College graduates including more than sixteen years of schooling are given sixteen years.

Table II-1 is a summary of statistics for workers aged 19-59 from the ten percent sample of the OWS data in each period. Table II-2 is an equivalent of Table II-1 for young workers aged 19-29. Monthly wages are adjusted by the consumer price index (CPI). Although the policy was implemented in 1980, the effects began to be observed after the mid-1980s when the first cohort following the policy graduated and entered into the labor market. I chose 1982-83 for the before-the-effect period, and 1987-88 for the after-the-effect period. Many male college graduates who entered college in 1981 may have entered the labor market around 1987, because most of them had to complete about three years of military service. A difference in average age between young male college graduate workers and their female counterparts in Table II-1 mainly reflects the gap due to military service. A

sudden large influx of female college graduates began to enter the labor market after 1985. However, their number was still far smaller than their male counterparts as we have seen in Table II-2. A short time interval of around five years allows us to avoid considering the significant structural changes of the economy. Workers in the 1987-88 samples can be regarded as part of the first generation that received the mass college education. Data for 1995-1996 are added for updated information.

IV. Overview of Changes in the Wage Structure

The Background of the College Education Expansion Policy

The epoch of mass college education began with the unprecedented expansion of the college entrance quota by the Korean government in 1981. In Korea, the government has regulated the college entrance quota, deciding the entrance quota level each year. Especially before 1981, the increase in the entrance quota was restricted approximately according to the increase in population (Choi 1996). With the college education expansion policy announced in 1980, the Korean government dramatically enlarged the college entrance quota of 1981 by 48.7 percent.[37] The enrollment rates for four-year-college including teachers' colleges increased about 5 percent points annually in the 1980-1984 period. [38]

The Korean government proclaimed that the objective of the expansion of college entrance quota was to fulfill the increasing demand for high-skilled manpower. The previous mode of economic growth based on low-wage and low-skilled labor had faced its limits during the late 1970s, and skill-based industries were needed for further growth. Also, the "Baby Boom Generation" who arrived at the gates of higher education in the late 1970s suffered from limited admission to colleges.[39] However, political consideration cannot be ignored in this sudden

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[37] 48.7 percent increase in the quota including two-year college. 58.6 percent increase in the quota of four-year college.

[38] The enrollment rate of all higher education including colleges, universities, teachers colleges, junior colleges and miscellaneous schools, also increased about 5 percentage points in this period.

[39] The "Baby Boom Generation" usually has a strong demand for higher education, as they received the universal elementary school education unlike the previous generation.

expansion of college entrance quota in 1980. Indeed, the Korean government initially announced that they would increase only the college entrance quota, while keeping the number of graduates at the same level as before the increase of quota. But the government soon abandoned the initial policy of restricting the number of graduates, as it became clear that government could not technically control college graduation. Thereafter, the increase of college entrance quota by the government almost directly led to the increase of college graduates whatever the initial intent of policy-makers.

Declining Relative Wages of College Graduates: Changes in the Wage Structure during 1980-1995

The economic effect of the abrupt expansion of the college entrance quota began to be felt after the mid-1980s when the unprecedented large number of college graduates flooded the labor market. Since the Korean economy was in the middle of the recession in the early 1980s after the fast growth of two decades, the economy could not absorb a sudden inflow of many college graduates. The unemployment rate of college graduates soared. The sharp increase in the unemployment rate of college graduates in the 1980s coined the word "the educated unemployed" which referred to the unemployed college graduates. For the first time since the rapid industrialization from the 1960s, the unemployment rates of college graduates in Korea started to exceed that of high school graduates from 1985.[40] During the mid-1980s, some of the

[40] The employment rates of all college graduates who had just entered the labor market dropped from 73.0 percent in 1980 to 52.1 percent in 1985. The employment rate of female college graduates dropped more severely: it was 55.2 percent in 1980 and 31.7 percent in 1985, while that of male college graduates was 83.4 percent in 1980 and 67.6 percent in 1985. However, the low employment

college graduates who could not find managerial or professional jobs rushed into technical or clerical jobs that had been previously regarded as jobs for high school graduates.[41] This phenomenon was referred to as "overeducation" or "downward employment". However, from a dynamic point of view, the growth of the education level of the labor force might be seen as "occupational upgrading".

The influx of unprecedented large numbers of college graduates also resulted in a substantial decline in their relative wages, as is seen in Table II-3 and Figure II-2. The labor market conditions for college graduates were directly reflected in the monetary returns of college graduates. As coefficients for a dummy variable for college graduation vs. non-college graduation (column (1), (2) and (3) in Table II-3) show, the relative returns to college education experienced a severe downward trend for young workers aged 19-29 and all workers aged 19-59, respectively. Young college graduates earned 61.3 percent more compared to young non-college graduate workers in 1982-83, 49.1 percent more in 1987-88, and 30.5 percent more in 1995-1996.[42] Young male college graduates earned 67.8 percent more than young male

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rate of female college graduates did not persist for a decade. After the 1990s the employment rate of female college graduates restored almost to the level of the 1970s. In 1995, the employment rate of female new entrants was 50.0% and little lower than 55.2 % in 1980. The employment rate of male new entrants was 69.2 % in 1995, much lower than 83.4 % in 1980. The remarkable recovery of the employment of female workers was largely caused by the cyclical boom in the late 1980s which was triggered by "three low prices", low oil price, low international interest rate, and low Won (especially compared to high Yen). In addition, the peculiar recruitment practice that hampers the accumulation of unemployed female college graduates made the recovery of the employment rate of female college graduates relatively easy, compared to their male counterparts.

[41] As Ihm (1990) pointed out, increasing proportions of college graduates have taken occupations of lower status and lesser prestige. He argued that same level of schooling is not rewarded equally in all occupations. For example, higher level education is best rewarded in higher level education-specific occupations, particularly those in the professional/technical category. This implies that downward employment has been one of the causes of the decrease of relative wage of college graduates.

[42] Since the schooling data is right censored, the estimate of the returns to college education could be an overestimate. The number of people who earned M.A. or Ph.D. degree has increased enormously recently. The number of people who newly earned M.A. degrees was 1,978 in 1970, 5,028 in 1980, and 25,787 in 1994. The number of people with newly earned Ph.D. degrees was 172 in 1970, 524 in 1980, and 3,818 in 1994. (Ministry of Education, Annual Report of Education.) However, there is no

non-college graduate workers in 1982-83 and 54.4 percent more in 1987-88. Young female college graduate workers earned 63.5 percent more in 1982-83 and 48.6 percent more in 1987-88.

Figure II-2 also shows the decline in the relative wages of college vs. high school graduates in the actual and detrended relative wage series. In Figure II-2, relative wage of college vs. high school graduates among all workers stayed at a stable level until 1987, dropped abruptly in 1988, and then declined consistently until 1995. In the case of younger workers, relative wages were consistently declining throughout the 1980s and the early 1990s. This was particularly severe during the late 1980s. In both cases of younger and all workers, there exists a strong association between the abrupt increase in the college entrance quota in 1981 and declining relative wages after the mid-1980s.

These figures show two things. First, the outstanding feature in the changes of the wage structure during the 1980s was the decline in the relative wages of college graduates. Indeed, the relative wages of college vs. less than high school graduates consistently declined, though the relative wages of high school vs. less than high school graduates was fairly constant during that period. Second, the detrended relative wages moved inversely with the detrended relative supply throughout the 1970s and 1990s. Figure II-4 and Figure II-5 show the actual and detrended relative supply of college vs. high school graudates, respectively. This implies that change in relative supply of college graduates was an important factor in explaining the change in relative wages in that period.

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comprehensive data that classifies more than 16 years of education and their wages. In the OWS data, workers whose schooling years are equal to or over 16 years are put together into the category of

The coexistence of falling relative earnings and declining employment rates shows that focusing only on changes in earnings would understate the declining position of college graduates (Eckhaus 1973, Chiswick and Mincer 1972, and Blaug, Layard and Woodhall 1969).[43] In fact, substantial decline of relative wages of college graduates and sharp increase in unemployment rates lead to concern about "overeducation".

However, the detrended relative wage movement in Figure II-3 shows that relative wage of college graduates had consistently increased for more than a decade before the policy effect revealed in the mid-1980s. In this perspective the decrease of relative wages during the late 1980s and the early 1990s should be understood in the context of the long-term adjustment of relative wages in the labor market. Despite the above qualifications, it is beyond doubt that the decrease in relative wages of college graduates since the mid-1980s was the result of sudden increase of college entrance quota by the government in 1981.

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college education.

[43] Especially in developing countries a crude estimate of returns to schooling can overestimate the profitability of investment in education. For example, Blaug, Layard and Woodhall (1969) showed that chronic unemployment resulted in lower returns to higher education in India. About the possibility of underestimation of the returns to schooling owing to the existence of hidden unemployed, see Filer, Hamermesh and Rees (1996). They also indicated that the official unemployment rate does not include discouraged workers who would have searched jobs if they had not thought of the searching efforts as hopeless.

V. The Effect of the College Education Expansion Policy on Relative Wages of College Graduates : Empirical Analysis

This subsection is about the empirical analysis of the effect of the college education expansion policy on relative wages of college graduates. First, by using a DD model, this subsection estimates the effect of the college education expansion policy in 1981 which abruptly and enormously raised the college entrance quota by approximately 60 percent. The DD estimation method is widely used for assessing the policy effects by comparing them before and after the introduction of the policy. To avoid the fundamental structural and demographic changes during the comparison period, a relatively short time span (five years) is considered. The before-the-policy period is 1982-83 and the after-the-policy period is 1987-88 in this subsection.

Second, by using a time-series regression and directly introducing a policy variable or a policy target variable, this subsection estimates the effect of the college education expansion policy through the 1980s and 1990s.

Third, by examining the determinants of college enrollment, this subsection explores a much-discussed issue about the college education expansion policy: whether the market mechanism worked in affecting the private decision to enroll in college during that period.

DD Estimation for the Effect of the Policy in 1981

This subsection estimates the impact of the college education expansion policy, more specifically, the abrupt increase in the college entrance quota in 1981, on the returns to the college education by using the following DD estimation method.

$$\ln W_{it} = \beta_0 + \beta_1 COLL_i + \beta_2 AFTER_t + \beta_3 COLL_i{*}AFTER_t + X_{it}\delta + \varepsilon_{it} \qquad (1)$$

$COLL_i$ is a dummy variable for four-year college education vs. non-college education. $AFTER_t$ is a dummy variable for the after-the-policy period (1987-88) vs. the before-the policy period (1982-83). Changes in economic conditions such as changes in aggregate demand or relative demand shift between college graduates and high school graduates are incorporated into the variable $AFTER_t$. $COLL_i{*}AFTER_t$ is an interaction between $COLL_i$ and $AFTER_t$. It represents the policy effect that reflects changes in the relative returns to college education after the policy. A vector of all other control variables X_{it} include tenure years, industries, marital status, and gender.

The estimation results are shown in column (3) in Table II-3. The DD estimate, that is, the coefficient on the interaction term $COLL_i{*}AFTER_t$ was -0.150. This indicates that the returns to four-year college education declined approximately 15 percentage points after the effects of the policy operated. The returns to the college education among young workers age of 19-29 declined 19.8 percent point.

This implies that the impact of the educational expansion policy on the returns to college education was larger among young workers than among all workers.

Another conspicuous result is that the returns to college education of female college graduates dropped more than that of their male counterparts. The DD estimate for male workers was -0.093, while it was -0.253 for female workers in Table II-3. Among young workers, it was -0.138 and -0.266, respectively. DD estimates were little different between young female college graduates and total female college graduates, since most female workers in the work force were young.

Table II-4 reports that returns to the four-year college education dropped more than that of two-year college education in that period. [45] The returns to the four-year college education dropped 15.1 percentage points, while those to the two-year college education dropped 12.6 percentage points. Table II-4 shows that this phenomenon is more conspicuous among young workers and among female workers. Especially among young female workers, the returns to the four-year college education dropped 29.0 percent point, while those to the two-year college education dropped 23.7 percent point.

Figure II-2 also shows a relatively large policy effect on female workers. During 1987-88, actual relative wages of college graduate female workers dropped more severely than those of their male counterparts.

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$$\ln W_{it} = \beta_0 + \beta_1 COLL_i + \beta_2 JC_i + \beta_3 AFTER_t + \beta_4 COLL_i{*}AFTER_t + \beta_5 JC_i{*}AFTER_t + X_{it}\delta + \varepsilon_{it} \quad (1')$$

Where all variables except JC or JC*AFTER are the same as the model (1). JC_i is a dummy variable for two-year college graduation. JC_i*$AFTER_t$ is an interaction between JC_i and $AFTER_t$. It represents the policy effect that reflects changes in the relative returns to two-year college education after the policy along with $COLL_i$*$AFTER_t$.

In sum, the impact of the abrupt expansion of the college entrance quota in 1981 was larger among young workers than all workers, and larger among female workers than male workers.[46] And, it was larger for four-year college graduates than two-year college graduates.

Time Series Regressions

The above DD estimation examined the effect of the college education policy on wages by comparing wages before and after the abrubt increase in the quota in 1981. This subsection analyzes the effect of the college education expansion policy through 1976-1998 by directly introducing policy variables.

As we have seen in Figure II-1, the college education policy affects wages through a process composed of a couple of links. This subsection analyzes the whole process in a demand-supply framework, focusing on whether the policy variable directly affects the supply of college graduates and whether the change in relative wages can be understood as a consequence of the supply shock owing to the policy change.

The first hypothesis is that the policy directly and explicitly affects the relative supply of college graduates. The second hypothesis is that the effect of the

[46] However, after one and a half decade of an exogenous increases in college entrance quota, the DD estimates for the 1982-83 vs. 1995-96 period indicates that the returns to college education dropped 40.5 percent points. Among male workers in age of 19-59, it dropped 31.1 percent point and, among female workers in those ages, it dropped 53.5 percent point. However, among young workers, a gender difference was not conspicuous. Irrespective of gender, returns to college education for young workers dropped about 40 percent during that period. This means that, although other factors should also be considered, generally speaking, the college education expansion policy affects female workers more in the short period, but those effects is gender neutral after one and half decades.

policy variable can be identified directly and explicitly in the changes in the relative employment and the relative wages. The college entrance quota and the college enrollment rate are referred as the policy variable and the policy target variable, respectively.

In order to test the first hypothesis, I examine whether the college entrance quota directly affects the college enrollment rate and whether increase in the college enrollment rate affects the relative supply of college graduates. In this case, the relative employment is examined instead of the relative supply.[47] Analysis of the relationship between the entrance quota and the enrollment would be the first step for studying the effect of the college education expansion policy, since the immediate target of the entrance quota policy is the control of college enrollment.[48] The following model captures the effect of the college entrance quota on the enrollment rate.

$$\log (\text{ENROLL})_t = \beta_0 + \beta_1 \log \text{QUOTA}_t + \beta_2 \text{TREND}_t + \varepsilon_t, \qquad (2)$$

In the model (2), QUOTA is the college entrance quota divided by the number of high school graduates for every year[49] ; ENROLL is the enrollment rate, the ratio of the number of college entrants to the number of high school graduates for

[47] Although changes in relative employment include changes in relative demand as well as changes in relative supply, it is difficult to identify the changes in relative demand (Kim and Topel 1994 and Katz and Murphy 1992).

[48] The entrance quota for each college is still the upper limit over which the college is not allowed to admit new entrants. However, some local private colleges have had difficulties in finding enough new entrants to fill their entrance quota in the 1990s.

[49] College includes two-year junior college.

every year.[49] The number of enrolled college students cannot exceed the number of college entrance quota, and the college enrollment has always filled up the college entrance quota under the chronic excess demand for college education. Choosing the college enrollment rate as a policy target variable has a merit for my study, as it is reported by gender. Meanwhile, the college entrance quota has been allotted to each college in lump suum without gender distiction. The model includes a time trend (TREND) in order to eliminate the problem of spurious regression. This can happen when we do not detrend the time-series processes, or do not include a time trend variable in the regression. In many cases, two trending variables appear to be correlated simply because each variable is growing over time.

Table II-5 shows that, with the trend variable, the coefficient for the log of QUOTA is 0.812 and highly significant. However, there remains another problem. Durbin-Watson d statistic is 0.483 and this strongly suggests the problem of positive autocorrelation. To correct the serial correlation, Corchrane-Orcutt AR(1) regression method is used. The Corchrane-Orcutt iterated estimate is 0.736 and also highly significant. After Corchrane-Orcutt transformation, Durbin-Watson d statistic is 1.372.

As the relationship between the college entrance quota and the enrollment rate is established in the above discussion, we can proceed to examine the relationship between the enrollment rate and the relative employment in the labor market. Since the object of this subsection is to study the effect of the enrollment rate as a supply shock on the relative employment and the relative wages, it estimates the reduced form equations. From the structural equations which consist of the relative

[49] College includes junior college.

demand for college graduates and relative supply of them, two reduced form equations are derived: the relative employment equation and the relative wage equation.[51] In this specification, the college education expansion policy affects the dependent variables of the reduced form equations *via* the lagged enrollment rate. That is, the lagged enrollment rate which is included in the relative supply equation as an exogenous supply shock affects the relative employment and the relative wages. The following model is the reduced form relative employment equation. This model is estimated by the Cochran-Orcutt procedure to correct the first order autocorrelation of the error term.

$$\log (S_{CG}/ S_{HS})_t = \beta_0 + \beta_1 \log \text{ENROLL}_{t-7} + \beta_2 \text{TREND}_t + Z_t\gamma + \varepsilon_t, \quad (3)$$

The dependent variable is the log of relative supply of college graduates (log (S_{CG}/ S_{HS})). Although college includes two-year junior college, the time lag to transmit the exogenous supply shock is based on the time it takes for four-year college graduates to enter the labor market. Approximately two thirds of college students graduated four-year college. A seven-year lag to ENROLL is chosen, for it takes about seven years for changes in the college enrollment rate to affect the relative supply of college graduates (four years of college attendance plus about three years of military service for male college graduates). For female workers' case, a four-year lag for ENROLL is chosen. Z_t includes the log of DINDEX and the log

[51] The structural equations are:
$\log (X_{CG}/X_{HS})^d_t = a_0 + a_1 \log (W_{CG}/W_{HS})_t + a_2 \text{TREND}_t + a_3 \log \text{GDP}_t + a_4 \text{DINDEX}_t + u_t$
$\log (X_{CG}/X_{HS})^s_t = b_0 + b_1 \log (W_{CG}/W_{HS})_t + b_2 \text{TREND}_t + b_3 \log \text{ENROLL}_{t-7} + \varepsilon_t$

of Real GDP. DINDEX is Freeman's fixed-coefficient "manpower requirements" index of the relative demand for college graduates.[52] GDP controls for changes in aggregate demand.

Table II-6 reports the results for the relative employment. The coefficient for the seven-year lag (L7.ENROLL, column (1)) among all workers is 0.249 and highly significant. The coefficient for the seven-year lag among male workers is 0.216 and highly significant, while that for four-year lag among female workers are 0.200 but not significant. For sensitivity analysis, Table II-8 reports the coefficient for the seven-year lag, six-year lag, five-year lag, and four-year lag enrollment rates. In all workers' case and male workers' case, the coefficients for the six-year lagged enrollment rate are the largest and significant. This indicates that the effect of the college education expansion policy on the relative employment in the labor market reveals itself after six years. In women workers' case, all the coefficients for the lagged enrollment variables are positive. The effect of the policy can be detected after four years. However, the effect is largest after six years, like male workers, and it is puzzling why transmitting the effects does not occur more quickly for female workers, who do not have a military service requirement.

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[52] The index is calculated as $\Sigma_j \alpha_{1j} E_{jt} / \Sigma_j \alpha_{2j} E_{jt}$, according to Freeman (1975), where α_{ij} is the proportion of workers with education level i in industry j in the base year (1978). i = 1 defines the college group and i = 2 defines the high school group. E_{jt} is actual employment in the industry j in year t. t is from 1978 to 1996. I used the 1-digit industry code for calculation. Since the industry code is revised in 1993, I converted the old code to the new code from 1978 to 1992. There are 17 industries in one-digit industry code and OWS only includes 14 industries. This measure is widely used for estimating the effect of between-sector demand shifts on relative labor demands. However, as Katz and Murphy (1992) criticized, it may understate the relative demand shift favoring groups with increases in relative prices.

The effect of changes in college enrollment rate on the relative wages of college graduates is also identified in the following reduced form equation for the relative wages.

$$\log (W_{CG}/W_{HS})_t = \beta_0 + \beta_1 \log \text{ENROLL}_{t-7} + \beta_2 \text{TREND}_t + Z_t\gamma + \varepsilon_t, \qquad (4)$$

The dependent variable is the log of relative wages of college graduates (log $(W_{CG}/W_{HS})_t$. A seven-year lag to ENROLL is chosen, for the same reason of the above relative employment model. Table II-7 reports a strongly negative association between the lagged college enrollment rate and the relative wages among all workers and among male workers. The elasticity of relative wages with respect the the enrollment rate is 0.648 for all workers and 0.416 for male workers.[53] Among female workers, the coefficient for the four year-lagged college enrollment rate is positive and insignificant, while the coefficient for the lagged enrollment rate is negative after five years as is seen Table II-8. In both male and female workers case, a seven-year lag yields the largest effect, and this is one year longer than what was found for relative employment.

Therefore, the estimation results of both equations, (3) and (4), suggests that the second hypothesis that the effect of the policy variable can be identified in the changes in the relative employment and the relative wages is plausible. Also, it suggests that transmitting the effect of the increase in the enrollment to the relative

[53] Since the dependent variable and independent variable are in the log, the coefficient can be interpreted as the elasticity of dependent variable with respect to the independent variable.

supply takes at least six years and that to the relative wages takes one more year, seven years.

Although this paper focuses on the reduced form that contains the policy target variable, I also estimate the usual demand schedule in order to compare my results with previous studies.[54] I do this by substituting the current relative labor supply variable (log $(S_{CG}/S_{HS})_t$) for the lagged enrollment rate (log $ENROLL_{t-7}$). Table II-9 reports the results. It shows that the coefficient for the relative labor supply variable is negative but not significant. It indicates that the relative wages are not highly associated with relative supply in this period.

However, in the labor demand schedule, the relative quantity variable that is used as a proxy variable for the relative supply variable also incorporates the resulting demand changes. Therefore, previous studies have tried hard to isolate the supply effect from the demand effect. Kim and Topel(1995) argued that changes in relative wages of college graduates in the 1980s in Korea were mainly supply-driven. They got that result by examining the relationship between the growth in relative supply and changes in relative wages of Korea in 1971-86.[55] In their study, an

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[54] I also confirm that change in relative supply was a dominant factor in explaining the change in relative wages by using the following time-series regression that is similar with Blackburn, Bloom and Freeman (1990).

$$\log (W_{CG}/W_{HS})_t = b_0 + b_1 \log (X_{CG}/X_{HS})_t + b_2 TREND_t + b_3 \log GDP_t + b_4 DINDEX_t + \varepsilon_t$$

In the above model, $(W_{CG}/W_{HS})_t$ is the log of the relative wages of college vs. high school graduates, $(X_{CG}/X_{HS})_t$ is the log of the relative supply of college vs. high school graduates. $TREND_t$ is a measure of shifts in college vs. high school graduate relative labor demand. GDP_t is the log of real GDP. Like other studies, the relative employment in the labor market is used for relative supply.

[55] Katz and Murphy(1992) also estimated the model that relates relative wages with relative labor supply during 1963-87 in the United States. They got much larger coefficient for relative supply of college graduates than Blackburn, Bloom and Freeman(1990) got for the same period. The demand shift index may understate the "true" growth of demand for college graduates relative to high school graduates in the 1980s and overstate the shifts in the 1970s. The overall demand shift measure is the

increase in relative supply of both high school graduates vs. less than high school graduates and college graduates vs. less than high school graduates reduced their relative wages respectively.[56] It implies that the rapid upgrading of the education level of Korean workers might be a crucial factor for changes in the wage structure. In the United States, there are several studies that have attempted to account for changes in relative wages of college graduates mainly by changes in relative supply of college graduates in the 1980s (Blackburn, Bloom and Freeman 1990, Topel 1994).[57] Katz and Murphy(1992) also found that changes in the returns to college education have been driven more by fluctuations in the growth of supply of college graduates, while admitting the importance of relative factor demand growth within-industry for explaining the changes in wage structure.[58]

In sum, this paper confirms the finding of previous studies by using the reduced form equation that contains a policy target variable such as the enrollment

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combined measure of deceleration in between-industry demand shift and acceleration in within-industry demand shift from the 1970s to the 1980s.

[56] In addition, Kim and Topel(1994) argued that almost all the variation in the relative net supply of workers could be explained by changing relative employment shares. According to them, differences in industry growth rates had no conspicuous effect on relative demands for college graduates in Korea.

[57] In a study on declining position of less skilled men, Blackburn, Bloom and Freeman(1990) concluded that the increase of wage differential between college graduates and high school dropouts among men aged 25-34 was largely supply-driven between the 1970s (1973-79) and the 1980s (1979-87). Topel(1994) also analyzed the impact of changing input quantities (supply) in comparison with that of an employment-share weighted average of industry scales (demand). They concluded that virtually all of the variation in net supply is due to variation in input quantities. Virtually none is due to changes in the industry composition of demand.

[58] In fact, it is not easy to estimate the effect of the demand shifts. Katz and Murphy(1992), using their "demand shift index", argued that rapid secular growth in the relative demand for "more-skilled" workers is a key component of any consistent explanation for rising inequality and changes in the wage structure over the last 25 years (1963-1987). However, they also found that the measured demand shifts towards more-educated workers and towards women have been significantly smaller than the observed relative supply changes. Also, in a time-series regression of the log of relative earnings on the log of relative labor supply and a time trend (the relative demand shift), the coefficient on the relative labor supply is bigger than that of the relative demand shifts.

rate. The education policy *via* the enrollment rate directly and explicitly influences the relative supply or the relative employment, thereby, the relative wages.

Determinants of the College Enrollment Rate

Until now, we have discussed the effect of college education policy on labor market outcomes. This subsection explores the opposite direction, that is, the determinants of college enrollment, especially focusing on the feedback effect of changes of relative wages of college graduates on college enrollment. Since the enrollment rate is a policy target variable and the relationship between the quota and the enrollment rate has already been established, this section excludes the discussion about the quota.

The following model (5) is an enrollment equation in that it explains the determinants of college enrollment.[59]

$$\log \mathrm{ENROLL}_t = \beta_0 + \beta_1 \log (W_{CG}/W_{HS})_t + \beta_2 \log \mathrm{GDP}_t + \beta_4 \mathrm{TREND}_t + \varepsilon_t \qquad (5)$$

The dependent variable is the log of the enrollment rate (ENROLL_t). Real GDP_t controls for changes in aggregate demand. Since the dependent variable and most of independent variables have a trend, TREND_t is included to control for a time trend.[60] This equation is identified because the current enrollment will not affect

[59] Freeman(1975) constructed the similar enrollment equation with explanatory variables such as relative earnings of college graduates and the relative demand index.

[60] A coefficient from the regression of ENROLL on t is 0.07 (standard error = 0.008). That of log $(W_{CG}/W_{HS})_t$ is –0.03 (standard error = 0.002). That of GDP is 0.15 (standard error = 0.002). This

the current wages. However, there may be correlation between current enrollment and the past enrollment. This section estimates equation (5) using the Corchran-Orcutt method.

Although, tuition costs would be a good candidate for an explanatory variable in the enrollment equation, this model does not include that variable, because the number of observations is very small. However, the omission of tuition costs variable does not seem to cause the severely biased estimates. Indeed, some evidence shows that growth rate of the enrollment rate was relatively high in 1982 when tuition grew rapidly, while it was low during 1983-88 when tuition increases literally stabilized.[61] Also, Kim and Yoo(1994) found that tuition cost did not affect enrollment for 4-year college.

Table II-10 reports that all coefficients for $(W_{CG}/W_{HS})_t$ are positive. Although the coefficients for all workers in column (1) and for male workers in column (2) are not significant, the coefficient for female workers in column (3) are significant. The negative sign of the coefficient on GDP is mysterious. While GDP is included to control for the shift in relative demand for college graduates, this variable is problematic. First of all, the causal relationship between GDP and ENROLL can run in both direction. While the rapid growth of GDP could cause high enrollment, high

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result indicates that real GDP has the strongest upward trend and most of variables also have a significant time trend.

[61] Tuition cost is a very important determinant of enrolling college in the United States. Trusteeship (1994) reports that about 30% of new college entrants chose their colleges because tuition costs of their colleges were lower than other colleges in the United States. Since the consistent time-series data about the tuition costs in Korea is not available, it is hard to find out how much the enrollment decisions are affected by the tuition costs. However, limited evidence shows that the government officially set the annual growth rate of tuition as follows; 1982: 15-30% (public and private university and college); 1983: 5-7% (public), 5% (private); 1984: basically not increased; 1985: 3% (public and private); 1986: 3% (public and private); 1987: 3% (public) 4.5% (private); 1988: 6% (public) 7% (private). Before 1989, government set the basic level of tuition costs. After that, although

enrollment also could bring about the rapid growth of GDP in the long run through the accumulation of human capital. Although the latter causal relationship seems to be weak compared to the former one, it could not be ignored, when we remember that Korea is a model case of the rapid economic growth based on investment in human capital. In fact, until the 1970s, Korean parents have supported the cost of college education for their children, not because their income was high enough, but because they expected that their children will earn more money with the college diploma. However, in the 1980s, as the demand for high-skilled manpower increased with the industrial upgrading towards high-wage, high-technology industries, high college enrollment rate began to reflect the economic growth.

In sum, this result about the relationship between current wages and the enrollment rate suggests that the market mechanism was weak but anyway worked during the 1980s and the 1990s. Although the ever-increasing enrollment rate with the continuously decreasing relative wages appears to be contradictory, market incentives may still affect private decisions to enroll in college. After controlling for trend and the first order serial correlation, the estimation results show the weak positive association between the college enrollment rate and the current relative wages. Therefore, to seek the cause of changes in demand for college education only among non-economic factors might not be appropriate. It is also not always correct to regard excessive fever for higher education, one of the famous cultural traits of

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government still basically set the level of tuition, the Association of College Education Institutions could influence that process. Kim, Song, Park, and Weidman(1996)

Koreans, as a main cause of the persistence of ever increasing demand for college education as Choi(1989) argued.[62]

[62] Also, although it was difficult to calculate the expected returns to college education especially in the 1980s, 'overinvestment' in college education in the 1980s did not seem to be the result of this difficulty. The expected returns to college education are calculated by the current returns to college education multiplied by the probability of being employed. Since investors will harvest benefits from the educational investment over their lifetimes, it is not easy to calculate the expected lifetime benefits from the investment in college education.

V. Summary and Policy Implications

This paper found that the impact of the abrupt increase in the college entrance quota in 1981 on the returns to the college education was enormous. The difference-in-difference (DD) estimation shows that the returns to the four-year college education declined 15.1 percent point between 1982-83 and 1987-88. This policy effect was greater among young workers and female workers. The returns to the college education of young workers declined 19.8 percent point and those of all female workers declined 25.3 percent point. Also, in this period, the returns to four-year college education dropped more than that of two-year college education.

This paper also confirms that the college education expansion policy has increased the relative supply and reduced the relative wages of college graduates throughout the 1980s and 1990s by using a time series regression. Also, the reduced form equations for the relative employment and the relative wages which include the polciy variable of the college enrollment rate as a supply shock indicates that transmitting the effect of the increase in the enrollment to the relative supply takes at least six years. It takes one more year, seven years, to transmit the effect on the relative wages.

This paper also found that the increase in college entrance quota directly led to increase in college enrollment under the enormous excess demand for college education. However, analysis of the determinants of college enrollment shows that the declining relative wage of college graduates may have exerted a negative effect on the college enrollment, though not strong enough to reverse its initial increase

induced by the expansion of college entrance quota. Although the influence of the government policy has been enormous in the behavior of college enrollment, it does not imply that the market mechanism has been absent in the college graduates labor market in Korea.

There are some limitations in this paper. First, it does not explicitly deal with the effect of the college graduate unemployment on the relative wages of college graduates in relation with the college education expansion policy. As the increase of the unemployment of college graduates contributed to the decrease of their relative wages, any estimate that does not consider unemployment may be biased. Second, while stressing the short-run negative effect of the college education expansion policy on the relative wages of college graduates, this paper does not examine the widely assumed long-run positive effect of the policy on wages through the accumulation of human capital.

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Table II-1: A Summary of Statistics of All Workers Aged 19-59

	Before Effects (1982-83)	After Effects (1987-88)	Recent (1995-96)
(All Workers)			
Total			
Monthly Wages*	561.5	675.4	1410.7
	(1.89)	(1.94)	(2.69)
# of Obs (persons)	49572	54381	76533
Age (years)	29.8	31.0	34.2
Tenure (years)	3.51	4.30	6.15
Coll Grads			
Monthly Wages*	1207.0	1269.0	1893.2
	(7.96)	(7.93)	(6.25)
# of Obs (persons)	6017	7476	21132
Age (years)	34.7	34.4	34.5
Tenure (years)	4.96	5.66	6.15
Junior Coll Grads and Less			
Monthly Wages*	472.4	580.8	1226.7
	(1.38)	(1.44)	(2.43)
# of Obs (persons)	43555	46905	55401
Age (years)	29.1	30.5	34.1
Tenure (years)	3.31	4.08	6.15

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Table II-1 (cont'd)

(Male Workers)			
Total			
Monthly Wages*	703.9	819.4	1596.2
	(2.51)	(2.55)	(3.18)
# of Obs (persons)	31878	35552	55499
Age (years)	32.8	33.7	35.8
Tenure (years)	4.16	5.17	6.98
College Grads			
Monthly Wages*	1226.0	1295.0	1941.1
	(8.21)	(8.24)	(6.59)
# of Obs (persons)	5669	6903	19019
Age (years)	35.0	34.8	35.0
Tenure (years)	5.07	5.79	6.35
Junior Coll Grads and Less			
Monthly Wages*	591.0	704.8	1416.4
	(1.86)	(1.92)	(3.01)
# of Obs (persons)	26209	28649	36480
Age (years)	32.3	33.5	36.1
Tenure (years)	3.96	5.02	7.31
(Female Workers)			
Total			
Monthly Wages*	305.0	403.5	921.3
	(1.30)	(1.51)	(3.08)
# of Obs (persons)	17694	18829	21034
Age (years)	24.4	26.0	30.2
Tenure (years)	2.33	2.65	3.96
College Grads			
Monthly Wages*	898.0	955.6	1462.2
	(27.63)	(25.54)	(16.88)
# of Obs (persons)	348	573	2113
Age (years)	29.7	29.9	30.1
Tenure (years)	3.17	4.07	4.41
Junior Coll Grads and Less			
Monthly Wages*	293.1	386.1	860.9
	(1.02)	(1.11)	(2.50)
# of Obs (persons)	17346	18256	18921
Age (years)	24.3	25.8	30.3
Tenure (years)	2.31	2.60	3.91

Standard errors are in parenthesis.
* in thousand won (real price)

Table II-2: A Summary of Statistics of Young Workers Aged 19-29

	Before Effects (1982-83)	After Effects (1987-88)	Recent (1995-96)
(All Workers)			
Total			
Monthly Wages*	390.1	481.6	993.3
	(1.24)	(1.28)	(2.20)
# of Obs (persons)	28362	27603	28353
Age (years)	23.4	23.8	24.7
Tenure (years)	2.07	2.21	2.31
College Grads			
Monthly Wages*	770.5	784.2	1192.5
	(5.51)	(5.37)	(5.36)
# of Obs (persons)	1815	2361	6259
Age (years)	27.0	27.0	26.9
Tenure (years)	1.49	1.70	1.59
Junior Coll. Grads and Less			
Monthly Wages*	364.1	453.3	936.9
	(1.10)	(1.16)	(2.24)
# of Obs (persons)	26547	25242	22094
Age (years)	23.1	23.5	24.1
Tenure (years)	2.11	2.26	2.51

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Table II-2 (cont'd)

(Male Workers)			
Total			
Monthly Wages*	495.3	586.2	1101.3
	(2.20)	(2.06)	(3.12)
# of Obs (persons)	13162	12874	15091
Age (years)	25.2	25.8	26.1
Tenure (years)	1.97	2.13	2.09
College Grads			
Monthly Wages*	782.0	800.2	1208.1
	(5.94)	(5.59)	(5.95)
# of Obs (persons)	1575	2003	4946
Age (years)	27.2	27.2	27.3
Tenure (years)	1.46	1.65	1.56
Junior Coll Grads and Less			
Monthly Wages*	456.3	546.7	1049.3
	(1.85)	(1.99)	(3.59)
# of Obs (persons)	11587	10871	10145
Age (years)	25.0	25.5	25.5
Tenure (years)	2.03	2.22	2.35
(Female Workers)			
Total			
Monthly Wages*	299.0	390.2	870.4
	(1.08)	(1.16)	(2.71)
# of Obs (persons)	15200	14729	13262
Age (years)	21.7	22.1	23.2
Tenure (years)	2.16	2.28	2.55
College Grads			
Monthly Wages*	695.5	694.4	1134.0
	(13.81)	(15.82)	(13.46)
# of Obs (persons)	240	358	1313
Age (years)	25.4	25.6	25.6
Tenure (years)	1.66	2.00	1.73
Junior Coll Grads and Less			
Monthly Wages*	292.6	382.6	841.4
	(1.00)	(1.04)	(2.49)
# of Obs (persons)	14960	14371	11949
Age (years)	21.7	22.0	23.3
Tenure (years)	2.17	2.29	2.64

Standard errors are in parenthesis.
* in thousand won (real price)

Table II-3: Changes in the Returns to College Education before/after the Policy

The dependent variable is the log of the hourly wages.

	(1)	(2)	(3)	(4)	
	OLS			DD	
		1982-83	1987-88	1995-96	82-83 vs 87-88
All Workers					
Total					
COLL		0.663	0.594	0.393	-0.150
		(0.005)	(0.004)	(0.003)	(0.006)
(# obs)		49572	54381	76533	103953
(Adj R2)		0.6693	0.6634	0.6129	0.6722
Male					
COLL		0.704	0.586	0.421	-0.093
		(0.006)	(0.004)	(0.003)	(0.007)
(# obs)		31878	35552	55499	67430
(Adj R2)		0.5545	0.5686	0.5534	0.5698
Female					
COLL		0.752	0.619	0.432	-0.253
		(0.018)	(0.013)	(0.007)	(0.021)
(# obs)		17694	18829	21034	36523
(Adj R2)		0.4961	0.4898	0.5393	0.5370
Young Workers					
Total					
COLL		0.613	0.491	0.305	-0.198
		(0.009)	(0.007)	(0.004)	(0.010)
(# obs)		28362	27603	28353	55965
(Adj R2)		0.5636	0.5353	0.4522	0.5725
Male					
COLL		0.678	0.544	0.302	-0.138
		(0.010)	(0.008)	(0.005)	(0.012)
(# obs)		13162	12874	15091	26036
(Adj R2)		0.4663	0.4760	0.4536	0.4864
Female					
COLL		0.635	0.486	0.361	-0.266
		(0.021)	(0.015)	(0.008)	(0.024)
(# obs)		15200	14729	13262	29929
(Adj R2)		0.4634	0.4083	0.4064	0.5014

* Standard errors are in parenthesis.
** (1), (2) and (3): The coefficient for a dummy variable of four-year college graduation vs. non-graduation (COLL).
(4): The coefficient for an interaction between the college graduation dummy variable and the after-policy years (1987-88) dummy variable(COLL*AFTER).
*** All regression models include control variables such as potential experience years and its square term, tenure, marital status, gender, and industry.

Table II-4: Changes in the Returns to College Education (including four-year college and two-year college) before/after the Policy

The dependent variable is the log of the hourly wages.

	(1) DD Total	(2) DD Male	(3) DD Female
All Workers			
COLL*AFTER	-0.151	-0.093	-0.270
	(0.006)	(0.007)	(0.020)
JC*AFTER	-0.126	-0.087	-0.240
	(0.005)	(0.013)	(0.020)
(# obs)	103953	67430	36523
(Adj R2)	0.6813	0.5823	0.5554
Young Workers			
COLL*AFTER	-0.203	-0.144	-0.290
	(0.010)	(0.012)	(0.024)
JC*AFTER	-0.166	-0.130	-0.237
	(0.013)	(0.017)	(0.021)
(# obs)	55965	26036	29929
(Adj R2)	0.5879	0.5043	0.5520

Table II-5: The Relationship between Quota and the Enrollment Rate

	(1)	(2)**
dep. var.= log of the enrollment rate		
log of QUOTA	0.812	0.736
	(0.100)	(0.122)
TREND	0.014	0.020
	(0.002)	(0.008)
N of Obs	31	30
	F(2,28) =150.3	F(2,27) =36.32
D.W. statistic	0.483	1.372

* Standard errors are in parenthesis.
** Cochran-Orcutt AR(1) regression

Table II-6: The Determinants of Relative Employment
(the Reduced Form Equation)

	(1)	(2)	(3)
	All	Male	Female
dep. var.= log of the enrollment rate			
Log of lag of ENROLL**	0.249 (0.079)	0.216 (0.082)	0.200 (0.278)
Log of Real GDP	-1.007 (0.175)	-0.918 (0.196)	-0.790 (0.518)
Log of DINDEX	0.039 (0.022)	0.051 (0.024)	-0.048 (0.059)
TREND	0.105 (0.014)	0.095 (0.016)	0.119 (0.041)
N of Obs	16	16	16
	F(4,11) =727.23	F(4,11) =529.98	F(4,11) =167.75
Estimated Rho	-0.103 (0.137)	-0.279 (0.191)	0.300 (0.130)

* Standard errors are in parenthesis.
** In all workers' case and male workers' case: L7.ENROLL
In women workers' case: L4.ENROLL

Table II-7: The Determinants of the Relative Wage
(the Reduced Form Equation)

	(1) All	(2) Male	(3) Female
dep. var.= log of the enrollment rate			
Log of lag of ENROLL**	-0.648 (0.147)	-0.416 (0.122)	0.405 (0.455)
Log of Real GDP	0.291 (0.172)	0.161 (0.192)	-0.258 (0.485)
Log of DINDEX	-0.036 (0.033)	-0.030 (0.036)	0.080 (0.084)
TREND	-0.047 (0.014)	-0.034 (0.016)	-0.025 (0.039)
N of Obs	18	18	18
	F(4,13) =38.44	F(4,13) =21.10	F(4,13) =6.87
Estimated rho	0.817 (0.043)	0.727 (0.137)	0.744 (0.062)

* Standard errors are in parenthesis.
** In all workers' case and male workers' case: L7.ENROLL
In women workers' case: L4.ENROLL

Table II-8: The Sensitivity Analysis
(Coefficient for the lagged enrollment rates)

Relative Employment Equation

	Coefficients for L7.ENROLL	L6.ENROLL	L5.ENROLL	L4.ENROLL
All	.249	.275	-.009	-.060
	(.079)	(.109)	(.138)	(.100)
Male	.216	.400	.034	-.033
	(.082)	(.081)	(.122)	(.090)
Female	.063	.343	.319	.200
	(.234)	(.256)	(.330)	(.278)

Relative Wages Equation

	Coefficients for L7.ENROLL	L6.ENROLL	L5.ENROLL	L4.ENROLL
All	-.648	-.001	-.014	.229
	(.147)	(.219)	(.231)	(.195)
Male	-.416	.002	.039	.143
	(.122)	(.162)	(.173)	(.150)
Female	-1.435	-.927	-.655	.405
	(.243)	(.406)	(.441)	(.455)

* Standard errors are in parenthesis.

Table II-9: The Relative Wages and the Relative Supply
(The Demand Curve)

	(1) All	(2) Male	(3) Female
dep. var.= log of the relative wages			
Log of rel. Supply	-0.416 (0.419)	-0.510 (0.357)	-0.383 (0.377)
Log of Real GDP	-0.173 (0.525)	-0.413 (0.482)	-0.671 (0.727)
Log of DINDEX	0.017 (0.051)	0.007 (0.049)	0.072 (0.087)
TREND	-0.007 (0.052)	0.019 (0.045)	0.029 (0.070)
N of Obs	16	16	16
	F(4,11) =13.53	F(4,11) =9.29	F(4,11) =7.06
D.W. stat (orig.)	1.030	0.871	0.803
(trans.)	1.420	1.343	1.511

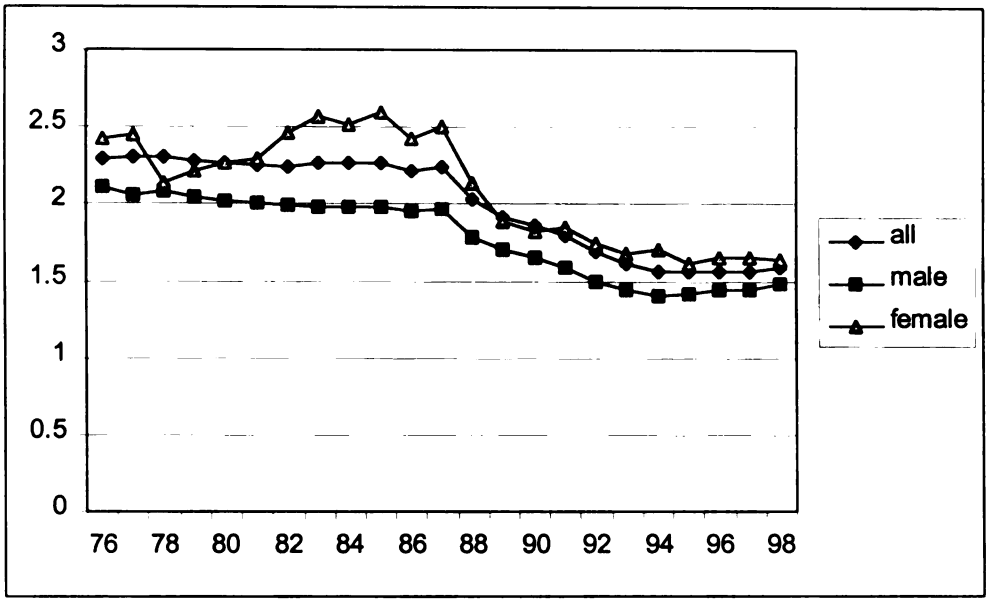
* Standard errors are in parenthesis.

Table II-10: The Determinants of the Enrollment Rates

	(1) All	(2) Male	(3) Female
dep. var.= log of the relative employment			
Log of Current Relative Wages	0.774	1.416	0.760
	(1.114)	(1.256)	(0.411)
Log of Real GDP	-0.382	-0.477	-0.398
	(0.673)	(0.811)	(0.482)
TREND	0.084	0.099	0.091
	(0.049)	(0.053)	(0.034)
N of Obs	21	21	21
	F(3,17) =2.86	F(3,17) =4.20	F(3,17) =6.73
Estimated rho	0.696	0.535	0.731
	(0.159)	(0.188)	(0.141)

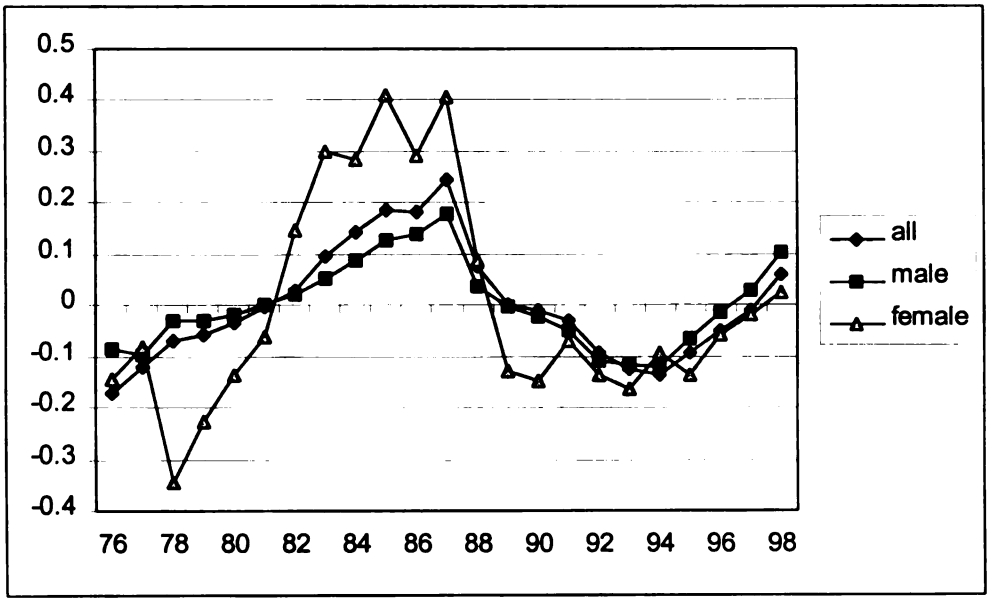
* Standard errors are in parenthesis.

Figure II-2: Actual Relative Wages of College vs. High School Graduates (All Workers)



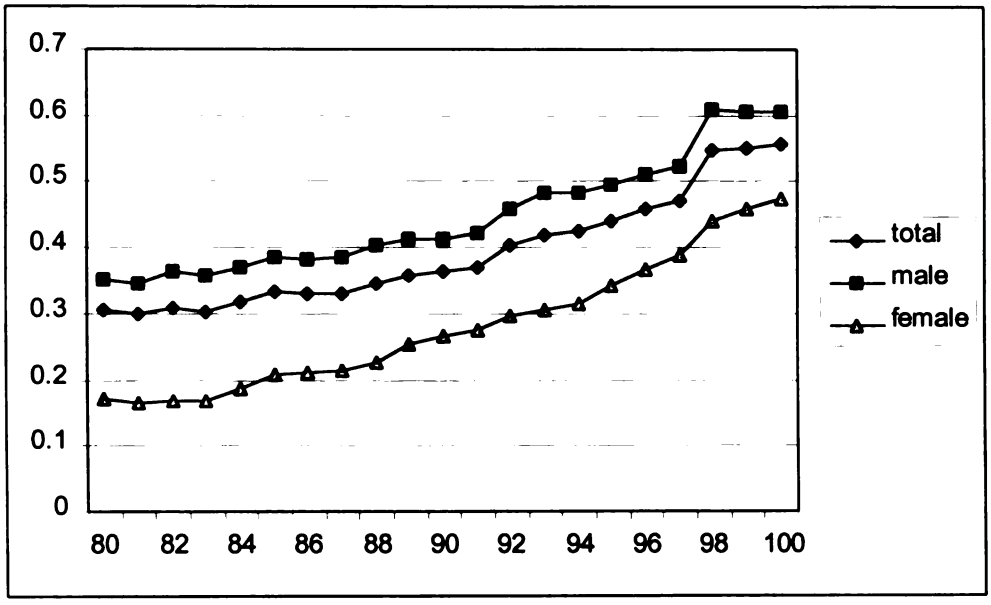
X axis: year, Y axis: ratio

Figure II-3: Detrended Relative Wages of College vs. High School Graduates (All Workers)



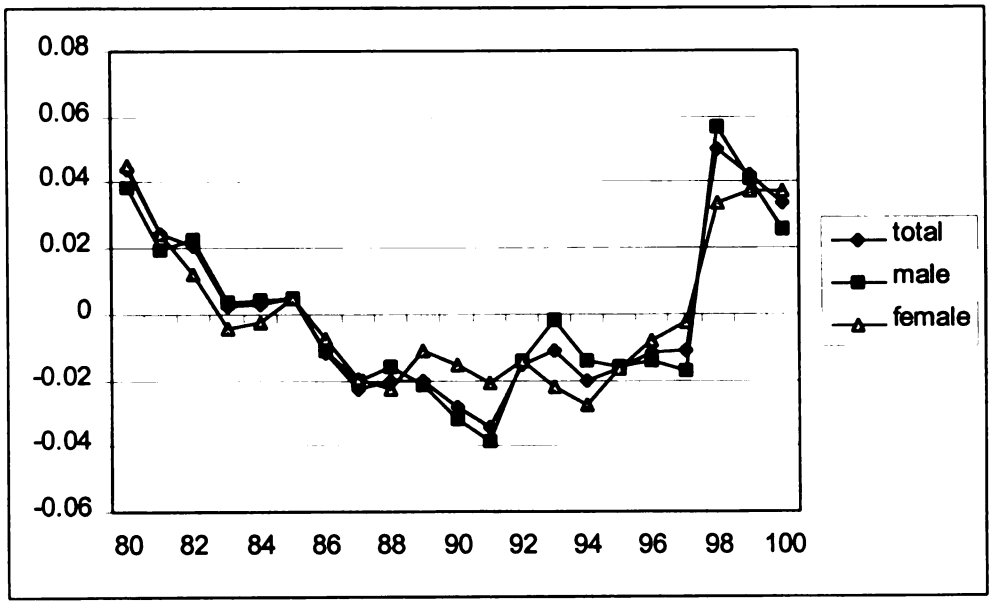
X axis: year, Y axis: ratio

Figure II-4: Actual Relative Supply of College vs. High School Graduates (All Workers)



X axis: year, Y axis: ratio

Figure II-5: Detrended Relative Supply of College vs. High School Graduates (All Workers)



X axis: year, Y axis: ratio