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Gender Differences in Demography and Labor Markets

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Gender Differences in Demography and Labor Markets

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To my mom,
whom I miss.

To my dad,
for his invaluable support.

To my beloved wife,
for being my best friend.

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Gender Differences in Demography and Labor Markets

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Gender differences in labor markets and within households have been investigated by researchers for a long time. This dissertation adds new findings to the body of gender-related empirical studies on labor markets and demographic decisions.

The first essay deals with the firm size selection behavior of workers and the firms' employment patterns by size in the United States. Using the Current Population Survey, I find that the changes in firm size distribution show different trends by gender between 1987 and 2001. While the percentage of female workers

in large firms has increased gradually, that of male workers has hardly changed over time. These trends are not explained by changes in the distribution of demographic and job characteristics alone. I also find that the gender gaps in size-wage premia of workers in large firms decline over the period studied. Using these results, I show that gender wage convergence is partly accounted for by the changes in size distribution and size premia.

The second essay examines how internet use affects job search and match outcomes of young workers in South Korea. Using the Youth Panel surveyed in 2001, I find that workers successfully employed through internet search have a significant wage premium over those employed through traditional methods, except for referrals or social networks. The positive wage effect is pronounced among women and previously unemployed workers. I also find that new employees who have ever searched online for jobs are more likely to search for other jobs.

The third essay focuses on an idiosyncratic social norm and its effects on demographic outcomes. South Koreans have traditionally considered that the year of the *Horse* bears inauspicious implications for the birth of daughters. Using monthly longitudinal data at the region level between 1970 and 2003, I find that in the year of the *Horse*, the sex ratio at birth significantly increases while fertility decreases.

The last essay examines how family cultural values, proxied by lunar calendar use for birthday, affect young individuals' marriage and fertility decisions in South Korea. Employing the Youth Panel, I find that young people with lunar birthdays, regardless of gender, are more likely to be married. More interestingly, young married men with lunar birthdays are more likely to have children, while young married women are not influenced by the tradition. These results are consistent with the hypotheses that young men from more traditional families enter into early marriages and that they are more likely to have offspring at earlier ages.

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Chapter 1

Introduction

This dissertation examines gender differences in labor markets and demographic decisions. Gender-related issues have been studied by both labor economists and demographers for a long time. This study, which adds new findings to previous research, is organized as follows. The first essay deals with the firm size selection behavior of workers and the firms' employment patterns by size in the United States. Gradual changes in the size distribution of firms occurred during the last two decades. Assuming that firms introduce different production technologies by their characteristics, the changes in size distribution affect the demand side of the labor market. On the other hand, workers' demographics also changed during that period. This chapter combines two well-established empirical findings, size-wage premium and gender wage convergence, and studies the effect of the changes in firm size distribution and size premium on the decline of gender wage inequality. Using the Current Population Survey, the changes in firm size distribution show different trends by gender. While the percentage of female workers employed by large firms has gradually increased, that of male workers has hardly changed over time. The gender differences in size-

wage premia of workers in large firms also steadily declined over the period. Using these results, I show that a portion of the gender wage convergence is explained by the changes in firm size distribution and size premia.

The second essay mainly focuses on the job search activities and their outcomes of young workers in South Korea. Recent developments of computer and internet technologies have changed our economic lives considerably. The internet has become a very important and widely used job search channel during the last decade. The internet not only allows job seekers to search for more jobs almost without cost in a shorter time period, but also employers to find better-fitted workers without paying expensive advertising costs. Furthermore, the internet may affect job search behaviors and match outcomes by enhancing communication among job seekers. To test these rosy expectations, first I examine whether the internet increases the probability of employment for job seekers on the market. More importantly, I test whether an internet job search affects workers' match quality in terms of initial wages as well as on-the-job search and early termination probabilities. The positive wage effect is evident among women and previously unemployed workers, who have disadvantages in using effective informal search methods such as social networks.

The third essay analyzes son preference and its effects on demographic outcomes in South Korea, exploiting an idiosyncratic belief originating in the traditional East Asian zodiac system. Koreans have long believed that a person's destination is determined by specific characteristics according to the sign of the zodiac under which he or she was born. In particular, it is believed that the year of the *Horse* bears inauspicious implications for the birth of girls. This cultural belief provides

a unique opportunity to study the effects of cultural gender preferences on demographic outcomes such as sex ratio at birth and fertility. Since the zodiac system has a twelve-year cycle, inauspicious years come every twelfth year, causing fluctuations in son preferences. This variation, along with the development of contraception and abortion technologies, may yield changes in the sex ratio at birth and in the fertility rate during the year of *Horse*. The estimates using monthly longitudinal data at the region level show that the sex ratio at birth significantly increased while fertility decreased in the year of the *Horse*.

The last essay also examines demographic outcomes in South Korea, focusing on how family cultural values, proxied by lunar calendar use for birthday, affect young individuals' marriage and fertility outcomes. The lunar calendar, widely used along with the western calendar in everyday life, is expected to represent family cultures well. Since Korea is considered a homogeneous society in culture and ethnic diversity is very limited, demographic researchers interested in cultural changes have focused only on the fertility variations over time due to modernization and economic development. In this context, the indicator of lunar calendar use helps us to capture cultural variations at the micro level. It can also allow researchers to control for family background more rigorously in various empirical settings employed in the demographic and labor market studies. Using the young workers' sample, I find that traditional values represented by the lunar calendar use for birthdays have significant impacts on early marriage decisions. Childbearing decisions differ notably by gender, as would be expected from patriarchal traditions.

Chapter 2

Gender Differences in Employment Patterns by Firm Size and Wage Inequality

2.1 Introduction

Different employment patterns by firm size and their changes over time have not been discussed much, despite the importance of size wage premium. The relative wage premium of workers in large firms has been studied for a long time, and many empirical studies have examined the existence and size of the premium using cross-sectional analysis (Garen, 1985; Brown and Medoff, 1989; Oi and Idson, 1999). The size wage gap has been explained empirically by various factors such as differences in quality of workers, inferior working conditions, avoidance of unionization, ability to pay high wages, and monitoring costs.

Another well-known empirical finding is that the size wage gap is as large as the gender wage gap. To the extent that the size wage premium prevails, additional

empirical questions emerge. Who is employed by large firms? Have the demographics and job characteristics in large firms changed over time? What can explain these changes? More importantly, are these changes related to the observed trends in wage inequality?

A goal of this study is to elucidate changes in firm size selection behavior of workers, different patterns in labor demand by firm size, and changes in both over time. In particular, I focus on an empirical finding that the changes in firm size distribution show different trends by gender. Workers' selection into different workplaces and demand patterns by different firms have been investigated in various studies. For example, occupational segregation by gender or race has been under scrutiny for a long time (Bergmann, 1974; Blau and Hendricks, 1979; Kuhn, 1993; Blau et al., 1998). However, no research except a brief description by Oi and Idson (1999) has focused on the employment patterns by firm size and their changes over time, although the importance of the size wage premium has been emphasized for several decades, as mentioned above.

Small firms and large firms are different in many aspects such as firm age, location, and so forth. Moreover, they may adopt different production technologies or organize the production process in different ways, including division of labor. As Hamermesh (1993) points out, large firms may increase efficiency by using a more capital-intensive process than small firms. These distinct firm characteristics by size lead to different labor force needs and resources. If different-size firms choose their best production technologies, and thus the labor demand changes by firm size, then the firm size distribution may also change by gender over time.

Some empirical studies find that the relative demand for female labor has increased since the mid-1970s (O'Neill and Polachek, 1993; Blau and Kahn, 1997). On the one hand, if the technological changes represented by automation and computerization are adopted differently by firm characteristics, and they tend to favor workers with a certain demographic characteristic, then firms will show different labor demand patterns by their characteristics. Weinberg (2000) examines the effect of computer use on the demand for female workers, focusing on the changes in physical requirements of jobs. His research concludes that an increase in computer use can account for over half the growth in demand for female workers. In a similar context, the difference in firms' relative labor demand by size is worthy of investigation. On the other hand, firms' reaction to certain institutional environments may lead to changes in demand patterns. Considering the extent to which the union-avoiding behavior explains the wage premium by firm size, firms' preference for workers who are less likely to be unionized may cause changes in the relative demand for female labor.

Looking into the supply side, an increase in both female labor force participation and employment during the past several decades are also well-known facts about the U.S. labor market (Blundell and MaCurdy, 1999). Additionally, the demographic and personal characteristics of the female labor force have changed dramatically. For instance, the educational attainments of the overall labor force have largely increased, but those of female workers have changed faster than those of male workers.[1] If larger

[1] According to the U.S. Census Bureau, the growth of the female population with higher education has been more rapid than that of the male population. The fraction of women with college degrees or more was 12.9 percent in 1979, and has increased to 24.3 percent in 2001. In the case of men, it was 20.4 percent in 1979, and 28.2 percent in 2001.

firms prefer more educated workers than smaller firms, the increase in women's educational attainment would lead to an increase in the fraction of large firm employees among women. Also, larger firms may become more attractive workplaces for certain types of employees, due to changes in certain characteristics such as noncash benefits.

This chapter also examines the relationship between the changes in size-wage premia as well as firm size distribution and the gender wage convergence since the late 1980s. Heterogeneous changes in labor demand and supply by firm characteristics and labor force demographics will accompany comparable changes in wages and size premia. According to Dunne and Schmitz (1995), the inclusion of variables indicating the use of advanced technology in the manufacturing sector reduces the size premia by up to 60 percent depending on size categories, even though they do not use firm size variables, but rather plant size variables.

The remaining part of the chapter proceeds as follows. In Section 2, I describe the data used in the research. Then, the facts and trends found in the firm size distribution are briefly discussed. Section 3 is devoted to analyzing firm size selection behavior by workers and its changes over time between the late 1980s and early 2000s, using probability models and the Blinder-Oaxaca decomposition method. In Section 4, possible explanations of these trends are reviewed, such as unionization, employee benefits, and changing equilibria. Section 5 examines the effects of changes in size distribution and size premium on the gender wage gap, based on the estimated results. Section 6 summarizes and concludes the discussion.

2.2 Data and Trends in Firm Size Distribution

Even though the Current Population Survey (CPS) started to collect data much earlier, the question about firm size was not asked regularly until 1988.[2] The question, "Counting all locations where this employer operates, what is the total number of persons who work for ...'s employer?", has been added to the CPS March Income Supplement since 1988, and five size categories were given initially. They are Under 25, 25-99, 100-499, 500-999, and 1,000 or more. In 1992, the smallest size category, Under 25, was divided into two categories, Under 10 and 10-24.

For analysis using the CPS data, I restrict the sample for private workers between the ages of 15 and 64.[3] Table 2.1 shows the descriptive statistics, of which all values are weighted by the sample weights of CPS March Supplements. Well-known trends in demographic characteristics of the labor force are confirmed here. First of all, the average educational attainment of the labor force increases between 1987 and 2001. For example, the proportion of workers with college degrees increases by about 6 percent. Second, the proportion of female workers remains constant over the period. Additionally, the proportions of married and white workers decrease slightly.

Referring to the business data by the U.S. Census Bureau, Figure 2.1 shows a gradual increase in workers at large firms with five hundred or more employees until

[2]Some CPS May Pension Supplements asked about firm and establishment sizes before 1988. Earlier versions of this paper also used 1979 and 1983 May Supplement files. However, since May Pension Supplements targeted a half of the CPS sample (surveying only 3, 4, 7, and 8 rotation groups), sample sizes of the 1979 and 1983 data are much smaller than those of the March Supplements.

[3]If we include public workers, the trends become even more prominent.

the early 2000s. The opposite trend appears in small firm employees. After the early 2000s, both trends change their directions. This tendency is also found in the CPS. Figure 2.2 depicts changes in the fraction of workers in large firms and small firms by gender.[4] Interestingly, the changes in firm size distribution show considerably different trends by gender. As illustrated in the first graph of Figure 2.2, while the fraction of female workers employed by large firms has increased considerably, that of male workers has hardly changed over time. The percentage of female workers employed by large firms increases steadily in the 1990s, and drops slightly in the early 2000s. Nevertheless, the gap between male and female workers expands continuously. The second graph shows the other side of the firm size distribution. It depicts the fraction of workers employed by firms with less than a hundred workers. The proportion of male workers employed by small firms remains constant in the 1990s, and then the changes become more prominent in the early 2000s. The fraction of female workers decreases slightly in 1990s and increases in the early 2000s. Once again, the gap between male and female workers expands continuously over the period, but in the opposite direction. These trends are more easily confirmed if we look at the employment share of female workers in each size category. Figure 2.3 shows that the female workers' share in large size firms increases gradually over the period, while that in small size firms declines slightly despite some fluctuations.

Much empirical evidence shows that women's educational attainment has increased rapidly during the period, thus narrowing the gap between men and women. If larger firms prefer more educated workers than smaller firms, the increase in

[4]These figures use the CPS March Files between 1988 and 2006. However, since the industry and occupation classifications of CPS changed since 2002, the recent data are not used for analysis.

women's educational attainment would lead to an increase in the fraction of large firm employees among women. Figure 2.4 shows the changes in large firm employment by gender and by educational group. Women's distributions show that the fraction of female workers employed by larger firms has increased steadily, regardless of education group. Even the percentage of female workers who did not complete high school education follows the exact same trend of female workers with college degrees or more. In the case of male workers, we also find that changes in the fraction of workers employed by large firms show the same patterns in all education groups. The fraction employed by large firms declines slightly over time.

Table 2.2 shows more specific changes in size distribution. While the large firm employment of female workers is not statistically different from that of male workers in 1987, the fraction of female workers in large firms exceeds that of male workers by about 2.4 percent in 2001. In the case of small firm employment, although there is no significant gender gap in 1987, it becomes significant in 2001. The fraction for female workers drops from 44 percent to 41 percent, while that the fraction for male workers remains at around 43 percent during the period.

2.3 Workers' Firm Size Selection

2.3.1 Probability Model

In this section, I examine whether changes in the observable characteristics of workers and their jobs can account for the difference in employment patterns by gender. At first, to investigate whether there are any differences in size-employment patterns by

demographic and job characteristics between 1987 and 2001, I estimate probability models for each year separately. Table 2.3 reports the estimation results of sample-weighted probit models for workers in the private sector. The dependent variable in each regression is the dummy for being employed by large firms with five hundred or more workers. The estimations are done for 1987 and 2001 separately, using the observations from the CPS March Income Supplements, as seen in the previous section.[5] Each regression also includes region, occupation, and industry dummies as well as various demographic variables shown in the table. Yearly employment status is likewise considered in two ways. First, a dummy variable indicating full-year status, and an interaction term of full-time and full-year status, are added. Another model exploits usual working hours per week, and weeks worked during the year.

The estimation results show that there are not only many common patterns but also some differences between two years. First of all, the effect of age on the probability of being employed by large firms is nonlinear and very small in any year, ranging between -0.2 and 0.3 percent in 1987 and between -0.3 and 0.2 percent in 2001. For younger workers, additional age reduces the incidence of working for large firms in both years. For older workers, the opposite trends appear. Looking into education dummies, the probability increases as a worker becomes more educated. For instance, college graduates are more likely to work for large firms by 12 percent in both years than workers who do not complete high school education. Workers with only high school diplomas or some college experience are also more likely to be employed by large firms than are workers in the reference group.

[5]Data in the CPS March files are collected in 1988 and 2002, respectively, about jobs in the previous year.

Another interesting finding is that the effect of gender on the probability of being employed by large firms shows different patterns by marital status. Unmarried female workers are about 3 percent more likely to be employed by large firms than are unmarried male workers in any year and specification, while married female workers are 4 percent less likely to be employed by large firms than are married male workers in 1987. In 2001, the difference between unmarried women and unmarried men remains at 3 percent, but the difference reduces to 1 or 2 percent between married women and married men. This result implies that there have probably been some changes in the labor market activities of married female workers between the two periods. The racial effect is also noteworthy. White workers are 7 percent less likely to work for large firms than are nonwhites in any year and specification.

Differences in size-employment patterns may also be related to various job characteristics. Full-time jobs lasting the whole year are more likely to be offered by large firms than other temporary or part-time jobs in 1987. Specifically, full-time full-year workers are 7 percent more likely to work for large firms than are part-time temporary workers. Full-time full-year workers are also 6 and 7 percent more likely to be employed than are part-time full-year workers and full-time temporary workers, respectively. Among part-time workers, yearly employment status does not make any difference in the probability. Similarly, full-time status has no effect on the probability among workers who are not employed during the whole year. However, these effects change dramatically. In 2001, regardless of yearly employment status, full-time workers are 4-6 percent more likely to be employed by large firms. Similar results are also found when using "working hours per week" and "weeks

worked during the year." While working hours per week and working weeks are both significant in 1987, only working hours have a significant effect on the probability of working for large firms. These results show that job characteristics have changed by firm size during the period.

Similar analysis can be applied to the probability of being employed by small firms. The estimation results reported in Table 2.4 contrast well with the above results. For instance, the more educated workers are, the less likely it is that they will be employed by small firms with less than a hundred employees. Gender differences by marital status appear again. Unmarried female workers are about 4-5 percent less likely to be employed by small firms than are unmarried male workers in both years. However, married female workers are 13-14 percent more likely to be employed by small firms than are married male workers in 1987, and the difference still remains large in 2001 although it declines to 8 percent. Also, white workers are 8 percent more likely to work for large firms than are nonwhites in both years.

To examine gender differences in employment patterns, previous probability models are estimated separately by gender. The first four columns of Table 2.5 report the sample-weighted probit estimation results separated by gender, using the probability of being employed by large firms as the dependent variable. The effect of additional age turns out to be very small in 1987, ranging between -0.3 and 0.1 percent for female workers and between 0.1 and 0.3 percent for male workers. The estimates using 2001 data also show that additional age has a small effect on probability, ranging between -0.2 and 0.2 percent for both male and female workers.

Education effect varies by gender. In both years, female workers with college

degrees are more likely to be employed by large firms than are the least-educated workers. The difference is 8 percent in 1987 and increases to 9 percent in 2001. The education gap for male workers is prominently larger. Male workers with college degrees are 16 percent more likely to be employed by large firms in both years. Similar effects are also found in other education levels, compared to workers who did not complete high school education.

Marital status also has different effects on large firm employment by gender. In the case of female workers, marriage is insignificant in 1987, and negatively affects the probability of being employed by large firms in 2001. However, married male workers are 4 percent more likely to be employed by large firms than are singles in 1987, and the difference is still significant in 2001. Racial effects are more notable in the case of female workers. White female workers are 8-9 percent less likely to work for large firms than are those from other ethnic groups, while white male workers are 3-5 percent less likely to be employed by large firms than are nonwhite counterparts.

The last four columns in Table 2.5 estimate the probabilities of being employed by small firms with less than a hundred workers. Age effects are very small in both years, and more educated workers are less likely to be employed by small firms in both years. Education effects are greater in the case of male workers. Examining the gender differences by marital status, married female workers do not significantly differ in the probability from unmarried ones in 1987, and are 3 percent more likely to be employed by small firms than are unmarried ones in 2001. However, married male workers are 3-5 percent less likely to work for small firms than are unmarried ones. Similarly, regardless of gender, white workers are more likely to be attached to

large firms. The racial gaps are 10 percent for female workers, and 4-5 percent for male workers.

2.3.2 Decomposition Analysis

Based on the probit estimations reported above, changes in the aggregate fractions of workers employed by larger firms can be decomposed into two components: the expected changes from changes in individual characteristics of workers and the unexpected changes depending on changes in coeffcients. The original decomposing method by Blinder (1973) and Oaxaca (1973) can be extended to nonlinear settings such as probit or logit models (Even and Macpherson, 1990, 1993; Nielsen, 1998; Yun, 2004; Fairlie, 2003). While the usual decomposition in wage equations is used for identifying the effects of differences in demographic characteristics and differences in returns between two groups of workers, the decomposition in this research is done for workers observed in two different years.[6]

In the probit model, the mean of observed probabilities is equivalent to that of predicted probabilities:

$$\overline{\Pi}_t = \overline{\widehat{P}}_t = \overline{\Phi(X_t \widehat{\alpha}_t)} \tag{2.1}$$

where $\overline{\Pi}_t$ and $\overline{\widehat{P}}_t$ are the sample-weighted means of observed probability and predicted probability at time t respectively. Φ represents a standard normal distribution function, while X_t and α_t represent independent variables and coefficients. In this

[6]Farber (1990) and Hamermesh (2002) use the same technique.

specification, the difference in observed (predicted) probabilities between two periods can be decomposed as follows:[7]

$$\overline{\Pi}_{t+1} - \overline{\Pi}_t = \left\{ \overline{\Phi\left(X_{t+1}\widehat{\alpha}_t\right)} - \overline{\Phi\left(X_t\widehat{\alpha}_t\right)} \right\} + \left\{ \overline{\Phi\left(X_{t+1}\widehat{\alpha}_{t+1}\right)} - \overline{\Phi\left(X_{t+1}\widehat{\alpha}_t\right)} \right\} \tag{2.2}$$

Or,

$$\overline{\Pi}_{t+1} - \overline{\Pi}_t = \left\{ \overline{\Phi\left(X_{t+1}\widehat{\alpha}_{t+1}\right)} - \overline{\Phi\left(X_t\widehat{\alpha}_{t+1}\right)} \right\} + \left\{ \overline{\Phi\left(X_t\widehat{\alpha}_{t+1}\right)} - \overline{\Phi\left(X_t\widehat{\alpha}_t\right)} \right\} \tag{2.3}$$

The first difference on the right-hand side is interpreted as the expected change due to changes in observable characteristics of workers and their jobs. The second difference represents the unexpected change due to changes in coefficients.

The results of the decomposition analysis between 1987 and 2001 are presented in Table 2.6. The first panel reports the results from probit estimations using the large firm employment dummy as dependent variable. Observed changes in the fractions employed by large firms show a 3.3 percent increase for all private workers. Examining the changes separately by gender, observed increases in the fractions of female workers are 4.7 percent, and the changes are much smaller for male workers (1.9 percent). However, most of these changes are rarely explained by variations in the demographic characteristics of workers and their job characteristics. The

[7]While the overall effects of the changes in observable characteristics of workers and their jobs are analyzed through decompositions, the effects could also be separated out by each independent variable in a nonlinear setting. Yun (2000) presents a linearization technique using Taylor expansions, and Fairlie (2003) suggests a nonparametric way generating virtual distributions.

expected changes range between -0.1 percent and 0.1 percent for all private workers, between 0.1 percent and 0.6 percent for female workers, and between -0.1 percent and 0.1 percent for male workers. In other words, in the case of female workers, only less than 14 percent of the total observed changes can be explained by changes in the demographic characteristics of workers and their job characteristics. More notably, the changes of male workers between 1987 and 2001 cannot be expected from the changes in the demographic characteristics of workers and their job characteristics. Most variations seem to be driven by the unexpected changes from the changes in coefficients for both female and male workers.

The decomposition of the probability of being employed by small firms is reported in the second panel of Table 2.6. The changes for female workers between 1987 and 2001 are explained partly by the changes in demographics and job characteristics, but a large part of the changes is still due to the shift in estimated coefficients. The observed changes show a 1.9 percent decline for all private workers. When examining the changes separately by gender, the differences are notable. For female workers, the observed probability drops to 3.2 percent. The observed probability barely changes over time in the case of male workers, showing a 0.8 percent decrease. Again, these changes cannot be fully explained by differences in the demographic characteristics of workers and their job characteristics. The expected changes range up to a 0.1 percent increase for all workers, between a 0.3 percent and 0.9 percent decrease for female workers, and between a 0.2 percent and 0.4 percent increase for male workers. An interesting finding is that, in the case of male workers, the changes in demographics and job characteristics expect to yield increases in the probability,

while the observed changes are not notable.

2.4 What Can Explain These Trends?

2.4.1 Unionization

The decline in unionization over this period is a well-known characteristic in the U.S. labor market (Farber, 1990; Even and Macpherson, 1993). Empirical studies also report that workers in large firms are more likely to be unionized than those in small firms (Hirsch and Berger, 1984; Doyle, 1985; Moore and Newman, 1988; Even and Macpherson, 1990). Additionally, Farber (1990) shows that there are different patterns of unionization by gender over time. While the fraction of female workers unionized increases between 1977 and 1984, that of male workers drops considerably during the period.[8] Thus, changes in firms' resistance to unionization over time are expected to affect the demand for certain types of workers, as well as their willingness to work in firms with those characteristics.

Unfortunately, data on the union status of workers are not available in the CPS March Income Supplements, but the March CPS files of Outgoing Rotation Group (ORG) have variables on union membership and on whether jobs are covered by union in the case of nonunion workers. However, questions in the ORG files are asked about a worker's job during the previous week, while the Supplements survey jobs in the previous year. Assuming that workers did not change their jobs between

[8] According to the Bureau of Labor Statistics, the gender gap in unionization has become smaller over time. The percentage of unionized male workers was 24.7 in 1983 and declined to 15.2 in 2000, while that of female workers was 14.6 in 1983 and 11.5 in 2000.

the two periods, a merged file allows us to control union effects in the probability models. Another problem is that the use of union variables reduces the sample size to a quarter of the original because the ORG includes only two rotation groups among eight CPS rotation groups.

The sample-weighted fractions of unionized workers in the private sector are reported in the Table 2.7. While the union membership of female workers employed by large firms decreases by 3.5 percent between 1988 and 2002, the fraction of unionized male workers employed by large firms drops dramatically from 25.0 percent to 17.0 percent. Looking at union coverage of jobs, the fraction of female workers with unionized jobs in large firms drops by 4.6 percent, from 15.0 percent to 10.4 percent. However, that of male workers declines from 26.5 percent to 18.0 percent. In the case of workers in small firms, no big change occurs during the period. For both variables on unionization, the decreasing trend is not clear for female workers between 1988 and 2002. The percentage of unionized male workers declines by about 1.6 during the period, and that of workers with unionized jobs also decreases by 1.8.

Estimation results of the probability models are quite similar to the original results, even after controlling for union effects.[9] As expected, coefficients of the union coverage variable are very large and highly significant for both male and female workers, when the dummy variable indicating whether or not workers are employed by large firms is used as the dependent variable. Looking at only private workers, the marginal effects are 0.61 in 1987 and 0.49 in 2001 for female workers, while they are 0.63 and 0.50 for male workers. As seen in Table 2.8, the decomposition results using

[9]The results are not reported here, but are available upon request.

this subsample confirm the previous findings again, showing that the demographic changes of workers and their job characteristics hardly explain the changes in the probability of being employed by large firms over time.

2.4.2 Employee Benefits

Another factor that may possibly affect employment patterns by firm size is nonpecuniary compensation and other employee benefits. Concerning employee benefits, the CPS March files collect various information.

As reported above in the estimation results of probability models, the likelihood of being employed by large firms depends significantly on marital status as well as gender. While unmarried female workers are more likely to be employed by large firms than are unmarried male workers, married female workers are less likely than married male workers. Because large firms usually provide more generous employment benefit packages, this finding suggests that unmarried workers who do not have other alternatives for benefits such as health insurance may select into the employment at firms providing better benefit packages. Married workers might find other options available through their spouses' employment. In addition, married female workers might need more flexible working conditions if they have children to be taken care of.

The fractions of workers with health insurance benefits are reported in Table 2.9, separately by firm size. The fraction of workers with health insurance plans paid at least partly by their employers or unions declines slightly, from 54 percent to 53 percent during the period. More strikingly, the fraction in the largest firms drops

almost 6 percent during the period, while that in the smallest firms increases about 2 percent. Most of these changes are explained by the decline in the percentage of workers with fully-paid insurance plans. And again, it is more notable in the case of workers in large firms. Thus, in 2001, large firms turn out to be less attractive to workers in terms of employment benefits than before. These statistics suggest that changes in employee benefits are less likely to cause the trends in employment patterns over the period.

2.4.3 Changing Equilibria and Size Premia

Along with the changes on the supply side, different demand shifts by firm size may cause the changes in equilibria in the system of relative demand and supply, thus generating different employment patterns by gender over time. Weinberg (2000) finds female-biased demand shifts driven by computer use and automation, focusing on required physical strength on the job. If a firm's adoption of new technology is associated with its size, then heterogeneous changes in demand by firm size are also expected. Dunne and Schmitz (1995) also report that advanced technology use explains up to 60 percent of the size premium. This finding implies that firms may use different technologies by their size in the production process. Thus, it would be expected that demand shifts and changing equilibria may yield different changes in the size premium by gender over time.

Table 2.10 shows the results of sample-weighted log wage regressions including various size dummies in selected years. The size premium of each large-size category decreases since the late 1980s, regardless of gender. However, the size premium

gap between male and female workers narrows steadily during the whole period. More specifically, in 1987, male workers working at a firm with a thousand or more employees earn 29.3 percent higher wages than those working at a firm with less than twenty five employees, while female workers in the same large firms earn only 20.4 percent higher wages. Thus, the size premium gap between male and female workers is about 7.0 percent in 1987. This gap declines to about 4.4 percent in 2001. Examining the size premium of workers in a firm sized between 500 and 999, I find similar results. The premium gap between male and female workers is 3.5 percent in 1987 and 1.8 percent in 2001.

2.5 Firm Size and Gender Wage Gap

To examine the effects on gender wage gap of the changes in size distribution and size premium, a decomposition analysis is introduced following O'Neill and Polachek (1993). Pooled wage regressions by gender are initially estimated, which include interaction terms of all independent variables with the time trend:

$$\ln w = \alpha_1 Size + \alpha_2 T + \alpha_3 Size \cdot T + \beta_1 \mathbf{X} + \beta_2 \mathbf{X} \cdot T + \epsilon \tag{2.4}$$

where $Size$ and T represent the firm size variable and the time trend respectively. When using detailed firm size categories, the size variable can easily be transformed into a vector format. $\mathbf{X}$ is a vector of control variable, which includes various demographic variables and job characteristics. From this equation, each gender's average

annual change of size premium is estimated by $\hat{\alpha_3}$.

The gender wage gap on average between 1987 and 2001 declined by about 0.7 percent per year, as reported in Table 2.11. Looking at the probability of being employed by each categorized firm, the previous findings are confirmed again. The fraction of female workers in large firms is close to that of male workers on average in 1987. However, the difference between male and female workers in the probability of being employed by large firms becomes smaller over time, because the probability of female workers increases rapidly while that of male workers does not. For instance, the probability of female workers employed by firms with a thousand or more employees increases by about 0.3 percent per year, while that of male workers increases slightly by less than 0.1 percent per year. Therefore, the difference in probability increases by more than 0.2 percent annually. As a result of these gender differences, the mean probability of female workers in large firms is slightly greater than that of male workers during the whole period.

The gender difference in the annual changes in size premium is also interesting. While the size premium of female workers in large firms with a thousand or more employees decreases only by about 0.4 percent per year, that of male workers declines by 0.6 percent per year. This different change rate brings the size premium of male and female workers closer over time. The average size premium of female workers in the largest firms is 18.6 percent between 1987 and 2001. Male workers earn 24.4 percent higher wages than do those in the smallest firms.

The decomposition results show that a part of the changes in the gender wage gap is explained by the changes in size distribution and premium. They explain up

to about 17 percent of the gender wage convergence during the period. Specifically, as shown in Panel B of Table 2.11, about 6 percent of the wage convergence is due to the change in size distribution after 1987. Changes in size premium also play an important role in the gender wage convergence. The convergence in size premium between male and female workers accounts for about 11 percent of the gender wage convergence.

2.6 Discussion

This study examines changes in firm size distribution and size premium since the late 1980s. The firm size distribution shifts differently by gender over the study period. While the fraction of female workers employed by large firms has increased considerably, that of male workers has hardly changed over time. Applying decomposition analysis to probit models, I find that the changes over time in women's probability of being employed by large firms are not fully explained by changes in the distribution of demographic characteristics and job characteristics.

Gender differences in the size premia of workers in large firms decline steadily over the period. Along with changes in size distribution, these findings are helpful to understand the wage gap between male and female workers. The results of decomposition analysis on the gender wage gap show that a part of the changes in this gap is explained by changes in firm size distribution and size premium. The decline in the size premium gap between male and female workers explains a larger part of the gender wage convergence than do the changes in size distribution by gender.

Table 2.1: **Descriptive Statistics of Major Variables**[1]

	1987		2001	
	Mean	Std. Dev.	Mean	Std. Dev.
Firm Size 500+	0.4033	0.4906	0.4360	0.4959
Firm Size 1-99	0.4362	0.4959	0.4169	0.4931
Age	34.52	12.40	37.25	12.46
High School	0.3704	0.4829	0.3169	0.4653
Some College	0.2497	0.4328	0.2922	0.4548
College	0.1738	0.3790	0.2348	0.4239
Female	0.4687	0.4990	0.4688	0.4990
Married	0.5441	0.4981	0.5288	0.4992
White	0.8668	0.3398	0.8301	0.3756
FT (full-time)	0.7827	0.4124	0.8126	0.3902
FY (full-year)	0.6663	0.4715	0.7492	0.4335
Hours Worked	37.98	11.76	38.88	11.22
Weeks Worked	43.50	14.47	45.84	12.70
N	58,851		83,510	

[1] The sample is restricted to private workers, and all values are weighted using CPS March Supplement sample weights in 1987 and 2001.

Table 2.2: **Sample-Weighted Firm Size Distribution**[1]

	1-99	**100-499**	**500+**
	Private Workers		
1987			
Female	0.4393	0.1590	0.4017
Male	0.4335	0.1617	0.4048
Gap	-0.0058	0.0026	0.0032
(t-stat)	(1.42)	(0.87)	(0.79)
2001			
Female	0.4071	0.1440	0.4488
Male	0.4256	0.1498	0.4246
Gap	0.0184	0.0057	-0.0242
(t-stat)	(5.39)	(2.34)	(7.03)
Changes (2001-1987)			
Female	-0.0322	-0.0150	0.0472
(t-stat)	(8.47)	(5.45)	(12.41)
Male	-0.0079	-0.0119	0.0198
(t-stat)	(2.17)	(4.45)	(5.45)

[1] All values are weighted using CPS March Supplement sample weights in 1987 and 2001.

Table 2.3: **Sample-Weighted Probit Estimates of Private Workers (*Dep. Var.* = Working at Large Firms 500+)**[1]

	1987		2001	
	(1)	(2)	(3)	(4)
Age	-0.0038	-0.0034	-0.0041	-0.0038
	(0.0012)	(0.0012)	(0.0010)	(0.0010)
$Age^2/100$	0.0053	0.0048	0.0049	0.0045
	(0.0015)	(0.0015)	(0.0013)	(0.0013)
High School	0.0557	0.0544	0.0508	0.0499
	(0.0063)	(0.0063)	(0.0060)	(0.0060)
Some College	0.0893	0.0858	0.0818	0.0792
	(0.0070)	(0.0070)	(0.0062)	(0.0062)
College	0.1228	0.1204	0.1246	0.1205
	(0.0085)	(0.0085)	(0.0071)	(0.0071)
Female	0.0336	0.0334	0.0346	0.0354
	(0.0066)	(0.0066)	(0.0054)	(0.0054)
Married	0.0550	0.0581	0.0213	0.0202
	(0.0065)	(0.0065)	(0.0054)	(0.0054)
Female*Married	-0.0691	-0.0751	-0.0498	-0.0493
	(0.0084)	(0.0083)	(0.0071)	(0.0071)
White	-0.0654	-0.0665	-0.0691	-0.0711
	(0.0064)	(0.0064)	(0.0048)	(0.0048)
FT	0.0017	-	0.0578	-
	(0.0080)	-	(0.0075)	-
FY	0.0085	-	-0.0056	-
	(0.0095)	-	(0.0084)	-
FTFY	0.0673	-	0.0131	-
	(0.0109)	-	(0.0097)	-
Hours Worked	-	0.0008	-	0.0021
	-	(0.0002)	-	(0.0002)
Weeks Worked	-	0.0016	-	0.0002
	-	(0.0002)	-	(0.0002)
Log Likelihood	-35,979.4	-36,034.9	-52,977.4	-52,992.9
Psuedo R^2	0.0934	0.0920	0.0738	0.0735
N	58,851	58,851	83,510	83,510

[1] Reported values are marginal effects (dF/dX) and standard errors. Each regression also includes region, industry, and occupation dummies.

Table 2.4: **Sample-Weighted Probit Estimates of Private Workers (*Dep. Var.* = Working at Small Firms 1-99)**[1]

	1987		2001	
	(1)	(2)	(3)	(4)
Age	0.0033	0.0034	0.0043	0.0040
	(0.0012)	(0.0012)	(0.0010)	(0.0010)
Age^2/100	-0.0046	-0.0047	-0.0049	-0.0045
	(0.0015)	(0.0016)	(0.0013)	(0.0013)
High School	-0.0409	-0.0385	-0.0486	-0.0467
	(0.0062)	(0.0063)	(0.0057)	(0.0057)
Some College	-0.0712	-0.0660	-0.0799	-0.0757
	(0.0067)	(0.0067)	(0.0058)	(0.0058)
College	-0.1015	-0.0969	-0.1171	-0.1110
	(0.0081)	(0.0081)	(0.0065)	(0.0066)
Female	-0.0449	-0.0457	-0.0448	-0.0463
	(0.0067)	(0.0067)	(0.0054)	(0.0054)
Married	-0.0620	-0.0639	-0.0320	-0.0301
	(0.0067)	(0.0066)	(0.0053)	(0.0053)
Female*Married	0.0829	0.0881	0.0637	0.0626
	(0.0089)	(0.0089)	(0.0073)	(0.0073)
White	0.0782	0.0806	0.0781	0.0810
	(0.0063)	(0.0062)	(0.0046)	(0.0046)
FT	-0.0408	-	-0.0906	-
	(0.0080)	-	(0.0076)	-
FY	-0.0060	-	0.0126	-
	(0.0095)	-	(0.0081)	-
FTFY	-0.0715	-	-0.0191	-
	(0.0109)	-	(0.0095)	-
Hours Worked	-	-0.0022	-	-0.0032
	-	(0.0002)	-	(0.0002)
Weeks Worked	-	-0.0019	-	-0.0003
	-	(0.0002)	-	(0.0002)
Log Likelihood	-36,000.8	-36,055.2	-52,168.4	-52,199.2
Psuedo R^2	0.1069	0.1056	0.0804	0.0798
N	58,851	58,851	83,510	83,510

[1] Reported values are marginal effects (dF/dX) and standard errors. Each regression also includes region, industry, and occupation dummies.

Table 2.5: **Sample-Weighted Probit Estimates: Separated by Gender**[1]

	Prob(Working at Larger Firms 500+)				*Prob*(Working at Smaller Firms 1-99)			
	Female		Male		Female		Male	
	1987	2001	1987	2001	1987	2001	1987	2001
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Age	-0.0043	-0.0032	0.0005	-0.0033	0.0062	0.0035	-0.0029	0.0033
	(0.0017)	(0.0015)	(0.0018)	(0.0015)	(0.0017)	(0.0014)	(0.0018)	(0.0015)
Age^2/100	0.0040	0.0036	0.0021	0.0041	-0.0063	-0.0036	0.0009	-0.0039
	(0.0022)	(0.0018)	(0.0022)	(0.0018)	(0.0022)	(0.0018)	(0.0022)	(0.0018)
High School	0.0353	0.0284	0.0766	0.0738	-0.0338	-0.0335	-0.0525	-0.0675
	(0.0094)	(0.0089)	(0.0087)	(0.0081)	(0.0094)	(0.0086)	(0.0085)	(0.0076)
Some College	0.0530	0.0568	0.1249	0.1091	-0.0441	-0.0591	-0.0990	-0.1058
	(0.0103)	(0.0091)	(0.0097)	(0.0084)	(0.0101)	(0.0087)	(0.0091)	(0.0078)
College	0.0846	0.0937	0.1616	0.1584	-0.0645	-0.0982	-0.1375	-0.1388
	(0.0128)	(0.0104)	(0.0116)	(0.0099)	(0.0123)	(0.0096)	(0.0108)	(0.0091)
Married	-0.0035	-0.0247	0.0449	0.0241	0.0060	0.0255	-0.0486	-0.0338
	(0.0067)	(0.0056)	(0.0072)	(0.0058)	(0.0069)	(0.0056)	(0.0074)	(0.0058)
White	-0.0863	-0.0802	-0.0346	-0.0530	0.1047	0.0989	0.0395	0.0511
	(0.0091)	(0.0067)	(0.0091)	(0.0069)	(0.0088)	(0.0064)	(0.0090)	(0.0068)
FT	0.0363	0.0761	-0.0518	0.0238	-0.0703	-0.1194	0.0023	-0.0442
	(0.0104)	(0.0098)	(0.0132)	(0.0120)	(0.0105)	(0.0099)	(0.0127)	(0.0121)
FY	0.0266	0.0049	-0.0070	-0.0092	-0.0180	0.0017	-0.0074	0.0145
	(0.0114)	(0.0102)	(0.0176)	(0.0147)	(0.0114)	(0.0098)	(0.0175)	(0.0144)
FTFY	0.0511	0.0174	0.0845	0.0034	-0.0641	-0.0075	-0.0716	-0.0227
	(0.0139)	(0.0125)	(0.0186)	(0.0162)	(0.0139)	(0.0122)	(0.0192)	(0.0161)
Log Likelihood	-17,410.7	-26,026.9	-18,299.8	-26,777.0	-17,509.6	-25,352.1	-18,186.4	-26,555.7
Psuedo R^2	0.079	0.0573	0.1194	0.0945	0.0901	0.0653	0.1368	0.1024
N	28,062	40,133	30,789	43,377	28,062	40,133	30,789	43,377

[1] Reported values are marginal effects (dF/dX) and standard errors. Each regression also includes region, industry, and occupation dummies.

Table 2.6: **Decomposition Analysis of Changes in Employment: 1987-2001**[1]

	All Workers	Female Workers	Male Workers
	Panel A. *Large Firm Employment (500+)*		
Observed Probabilities:			
1987	0.4036	0.4016	0.4054
2001	0.4361	0.4489	0.4248
Observed Changes:			
$\overline{\Pi}_{01} - \overline{\Pi}_{87}$	0.0325	0.0473	0.0193
Expected			
$\overline{\widehat{P}}^{*}_{01} - \overline{\widehat{P}}_{87}$	-0.0007	0.0010	0.0006
$\overline{\widehat{P}}_{01} - \overline{\widehat{P}}^{*}_{87}$	0.0013	0.0064	-0.0009
Unexpected			
Using $\widehat{\alpha}_{87}$ $(\overline{\widehat{P}}_{01} - \overline{\widehat{P}}^{*}_{01})$	0.0331	0.0462	0.0187
Using $\widehat{\alpha}_{01}$ $(\overline{\widehat{P}}^{*}_{87} - \overline{\widehat{P}}_{87})$	0.0312	0.0408	0.0202
	Panel B. *Small Firm Employment (1-99)*		
Observed Probabilities:			
1987	0.4360	0.4394	0.4331
2001	0.4168	0.4072	0.4255
Observed Changes:			
$\overline{\Pi}_{01} - \overline{\Pi}_{87}$	-0.0192	-0.0322	-0.0076
Expected			
$\overline{\widehat{P}}^{*}_{01} - \overline{\widehat{P}}_{87}$	0.0005	-0.0027	0.0017
$\overline{\widehat{P}}_{01} - \overline{\widehat{P}}^{*}_{87}$	-0.0003	-0.0089	0.0044
Unexpected			
Using $\widehat{\alpha}_{87}$ $(\overline{\widehat{P}}_{01} - \overline{\widehat{P}}^{*}_{01})$	-0.0197	-0.0295	-0.0093
Using $\widehat{\alpha}_{01}$ $(\overline{\widehat{P}}^{*}_{87} - \overline{\widehat{P}}_{87})$	-0.0189	-0.0233	-0.0120

[1] Reported values are calculated from probit estimations separated by gender.

Table 2.7: **Changes in the Fraction of Unionized Workers in the Private Sector**[1]

Panel A. ***Size 500+***

	Union Membership			*Covered by Union*[2]		
	All	Female	Male	All	Female	Male
1988	0.1970	0.1303	0.2499	0.2141	0.1497	0.2652
2002	0.1352	0.0956	0.1704	0.1440	0.1040	0.1796
Change	-0.0618	-0.0347	-0.0795	-0.0701	-0.0458	-0.0855

Panel B. ***Size 1-99***

	Union Membership			*Covered by Union*[2]		
	All	Female	Male	All	Female	Male
1988	0.0627	0.0272	0.0950	0.0712	0.0337	0.1052
2002	0.0543	0.0278	0.0786	0.0616	0.0338	0.0871
Change	-0.0084	0.0005	-0.0163	-0.0096	0.0001	-0.0181

[1] Reported values are sample-weighted. 1988 and 2002 data are from merged files of the CPS Basic Files and March Income Supplements.

[2] Reported numbers represent the percentage of workers with union membership and that of nonunion workers with a job covered by union.

Table 2.8: **Decomposition Analysis of Changes in Large Firm Employment (500+): 1987-2001, Using Subsample with Union Variable**[1]

	All Workers	Female Workers	Male Workers
Observed Probabilities:			
1987	0.4200	0.4057	0.4318
2001	0.4427	0.4405	0.4445
Observed Changes:			
$\overline{\Pi}_{01} - \overline{\Pi}_{87}$	0.0227	0.0348	0.0128
Expected			
$\overline{\widehat{P}}^{*}_{01} - \overline{\widehat{P}}_{87}$	-0.0067	-0.0032	-0.0060
$\overline{\widehat{P}}_{01} - \overline{\widehat{P}}^{*}_{87}$	-0.0074	-0.0003	-0.0097
Unexpected			
Using $\widehat{\alpha}_{87}$ $(\overline{\widehat{P}}_{01} - \overline{\widehat{P}}^{*}_{01})$	0.0294	0.0380	0.0188
Using $\widehat{\alpha}_{01}$ $(\overline{\widehat{P}}^{*}_{87} - \overline{\widehat{P}}_{87})$	0.0301	0.0351	0.0225

[1] Reported values are calculated from probit estimations. Controlling for union effects, the variable of whether the jobs are covered by union is used in each probit estimation.

Table 2.9: **Firm Size and Changes in Health Insurance Coverage by Employer or Union**[1]

	1987			2001		
	Fully Paid	Partly Paid	Paid Total	Fully Paid	Partly Paid	Paid Total
1-24	0.1493	0.1343	0.2836	0.1188	0.1867	0.3054
25-99	0.2235	0.2889	0.5123	0.1483	0.3702	0.5185
100-499	0.2388	0.3793	0.6180	0.1346	0.4701	0.6048
500-999	0.2591	0.4085	0.6676	0.1292	0.4989	0.6281
1000+	0.2721	0.4265	0.6986	0.1286	0.5132	0.6419
Total	0.2259	0.3189	0.5448	0.1300	0.3998	0.5298

[1] Reported values are sample-weighted and represent the fraction of workers in each firm size category.

Table 2.10: **Changes in Size Premia, 1987-2001**[1]

	Female Workers	Male Workers	Gender Gap
Size 1000+			
1987	0.2235	0.2933	0.0698
2001	0.1600	0.2041	0.0441
Size 500-999			
1987	0.1783	0.2131	0.0348
2001	0.1164	0.1347	0.0183

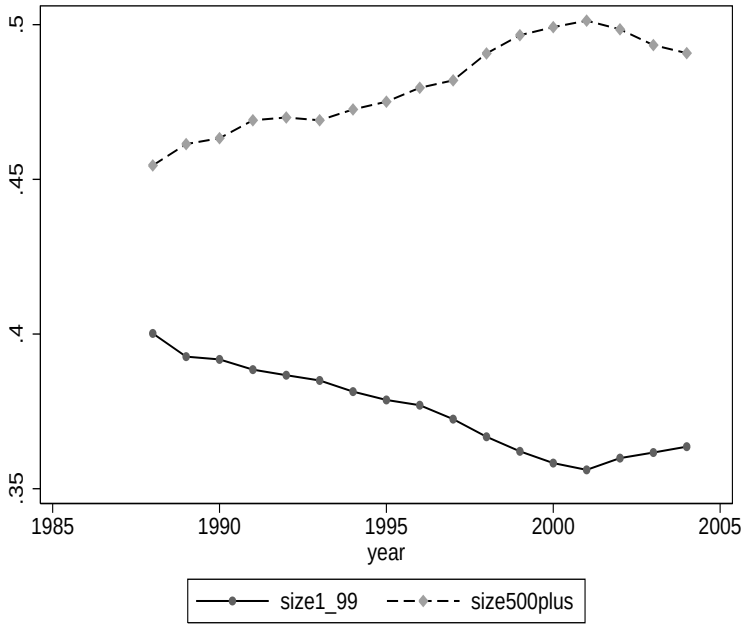
[1] Size premia are against the smallest firms with less than 25 employees. All estimates are statistically significant at 5% level.

Table 2.11: **Contribution to Gender Wage Convergence of Changes in Size Distribution and Size Premium, 1987-2001**[1]

	Private Workers	
	Female Workers	Male Workers
Annual rate of wage convergence (logs)	0.0065	
A. Underlying components of convergence:		
1.Average annual change in probability		
Size 25-99	-0.0007	-0.0008
Size 100-499	-0.0011	-0.0008
Size 500-999	0.0002	0.0005
Size 1000+	0.0031	0.0008
2.Average size premium		
Size 25-99	0.0440	0.1042
Size 100-499	0.0935	0.1438
Size 500-999	0.1555	0.1831
Size 1000+	0.1857	0.2441
3.Average annual change in size premium		
Size 25-99	-0.0016	-0.0014
Size 100-499	-0.0028	-0.0026
Size 500-999	-0.0043	-0.0040
Size 1000+	-0.0042	-0.0064
4.Mean probability		
Size 25-99	0.1464	0.1652
Size 100-499	0.1548	0.1588
Size 500-999	0.0628	0.0571
Size 1000+	0.3692	0.3620
B. Effect of change in:		
1. Size distribution on wage growth (logs)	0.0005	0.0001
Difference (female-male)	0.0004	
Contribution to wage convergence (percent)	5.7	
2. Size premium on wage growth (logs)	-0.0025	-0.0032
Difference (female-male)	0.0007	
Contribution to wage convergence (percent)	10.8	

[1] 1988-2002 CPS March Files.

Figure 2.1: **Changes in Employment Distribution by Firm Size, 1988-2004: Business Data**



Source: Office of Advocacy, U.S. Small Business Administration, based on data provided by the U.S. Census Bureau, Statistics of U.S. Businesses and Nonemployer Statistics.

Figure 2.2: **Sample-Weighted Changes in Firm Size Distribution by Gender, 1987-2006**

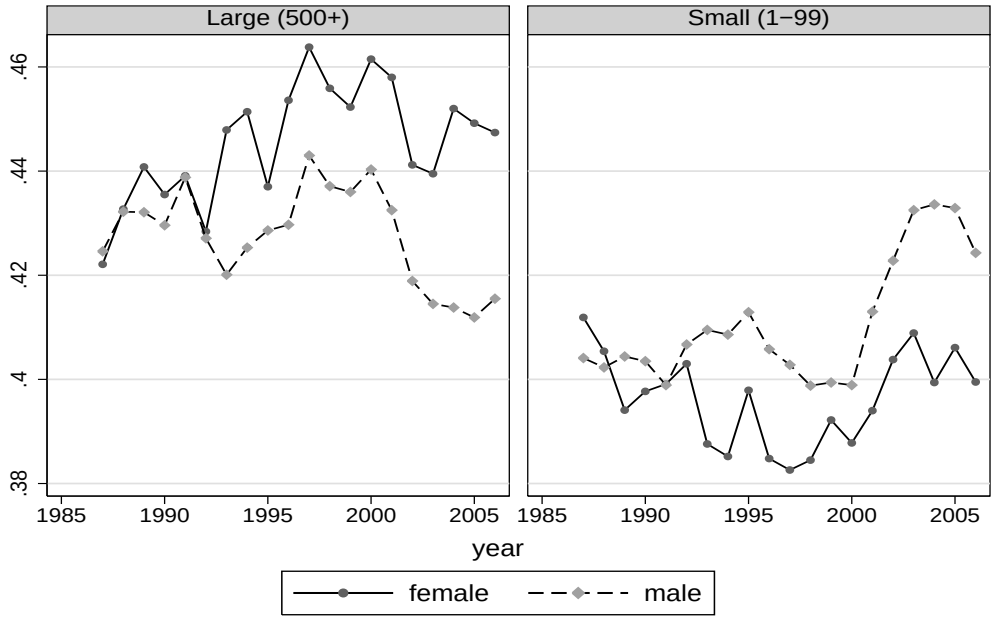


Figure 2.3: **Sample-Weighted Changes in the Employment Share of Female Workers by Size, 1987-2004**

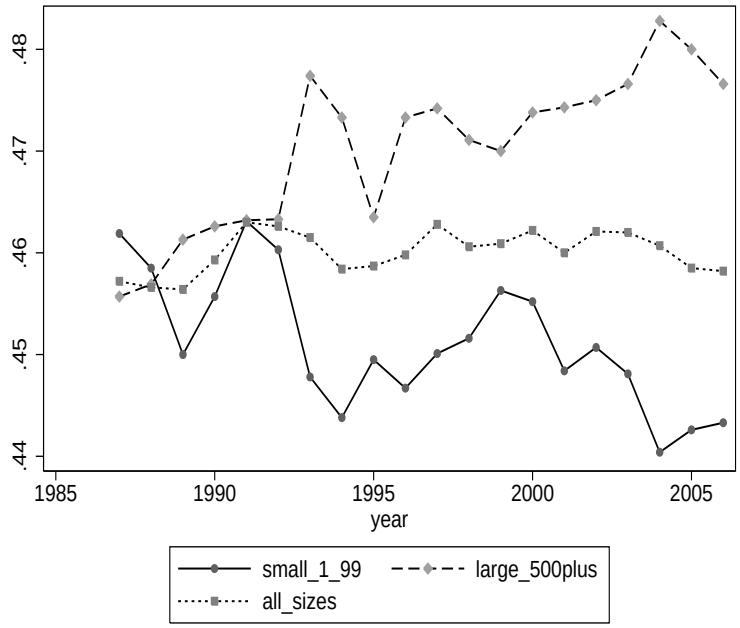
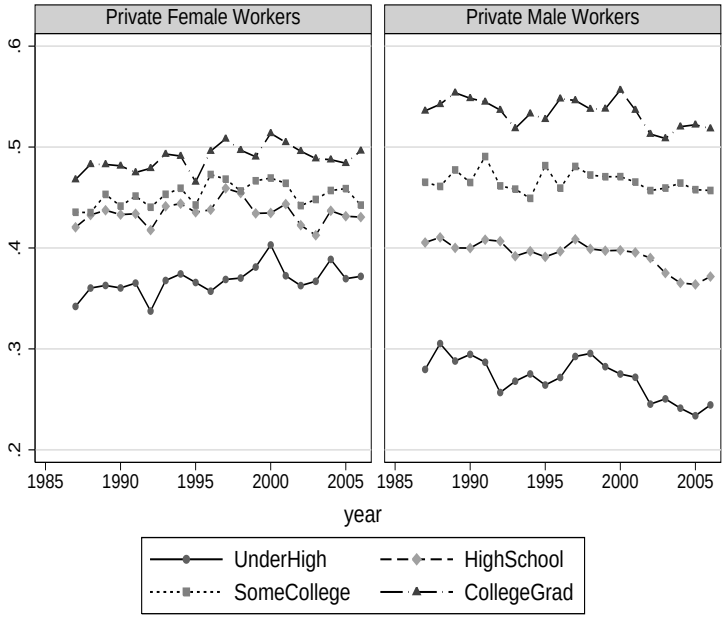


Figure 2.4: **Sample-Weighted Changes in Large Firm Employment (500+) by Education**



Chapter 3

Internet Job Search and Match Quality of Young Workers

3.1 Introduction

Recent developments in computer and internet technologies have changed our economic lives in many respects. These new technologies allow consumers to shop all over the country and compare product prices, thus generating "e-commerce" as a new trading method in the product market. A similar phenomenon called "e-recruiting" is also witnessed in the labor market, as well described by Krueger (2000). A notable influence of internet technology on the labor market is found in the widespread internet job boards that allow job seekers to gather information about job opportunities or to post their resumes.[1] Recent research by Kuhn and Skuterud (2004) shows that job finding through the internet becomes more and more important in the United States, although many job seekers still use traditional job search methods. Using the internet to search for jobs or find new employees to fill vacancies seems to benefit

[1] "Monster.com" is a frequently cited example of internet job boards in the United States.

both job seekers and recruiters, compared to traditional job search channels such as direct contact with employers, friends or alumni, family or relatives, public or private employment agencies, advertisements, or school employment centers. The internet not only allows job seekers to search for more jobs almost without cost in a shorter time period, but also lets employers find better-fitted workers without paying expensive advertising costs (Krueger, 2000; Autor, 2001). Furthermore, the internet may affect job search behaviors and match outcomes by enhancing communication among job seekers. They can exchange their own experiences in the job market, thus increasing both the quantity and quality of information about places where they want to work.

The internet has become a part of everyday life during the last decade in South Korea, which is well known as one of the most networked countries. As shown in Table 3.1, the number of internet users reached close to 20 million in 2000, and further increased to about 30 million in 2004, more than 60 percent of the total population. Considering only young workers, the numbers would be much higher because the number of high-speed internet subscribers came to more than 70 percent of total households. In addition, the internet is widely accessible from almost everywhere, not only at home. Internet cafes providing high-speed internet service at cheap prices are easily found even in the countryside. Thus, the "digital divide" may hardly be an issue for young job candidates in South Korea.

The labor market in South Korea is also under the influence of this new development. Similar to the U.S. online job boards described by Krueger (2000) and Autor (2001), the internet is also widely used by job seekers and employers in South

Korea. A government agency, the Korea Employment Information Service under the Ministry of Labor, has administrated a Web site for job seekers and employers since 1998.[2] As of April 18, 2006, 117,189 jobs were posted by 62,043 employers, and 381,879 job seekers were registered.[3] There is also a volume of internet job boards and communities managed by private businesses or organized by individual members. For instance, an internet community of job seekers opened in 2002 has more than a half-million registered members who exchange job information and personal experiences in the job market, such as what was asked in the job interview.[4] Communication with other job seekers or recent employees may help job seekers gather information on job characteristics such as salary and workplace environment, thus possibly increasing match quality.

Although the usefulness and importance of the internet as a new job search and match method have been emphasized by many labor economists, there are only a few empirical studies that examine the effects of the internet on the labor market. Initial empirical research by Kuhn and Skuterud (2000, 2004) focuses on search outcomes such as unemployment spells and employment probability. Contrary to various positive expectations, they find that internet job search is not effective in reducing unemployment duration, and suggest the possibility of self-selection of job seekers. Lacking available data, they leave unexamined the match quality of jobs searched through the internet. Their findings do not imply that the match quality of jobs through internet search is not as good as those located through traditional

[2]The online address is http://www.work.go.kr.

[3]According to the National Statistical Office, the estimated number of unemployed workers in April 2006 is approximately 790,000 in South Korea.

[4]The online address is http://cafe.daum.net/breakjob.

methods. On the one hand, if internet job searchers are picky and have higher reservation wages than others, using the internet is not expected to reduce unemployment duration. Matches through the internet, however, would result in higher wages and longer tenure. On the other hand, severe competition in the internet job market may yield good matches, although it reduces the employment probability per application of job seekers. Another study by Stevenson (2003) examines internet effects on job search activities and job mobility using state-level aggregate data. She finds that job seekers search more than before in states where the internet is adopted rapidly, and concludes that job mobility of young and educated workers increases due to expansion of the internet.

Initially, this paper examines whether internet job search affects the probability of being employed, separately for unemployed workers and students, and compares the results with the conclusions of previous studies. In South Korea, more than 70 percent of young job seekers used the internet to look for job openings in the early 2000s - compared to about 10 percent in the United States in 2000.[5] Considering the easy access to the internet, as well as the dominance of internet job search among various methods, the results from the South Korea case might be more interesting. I find, similar to the research by Kuhn and Skuterud (2004), that there is no notable effect of internet job search on the employment probability of both unemployed workers and students. One exception is that student job seekers who actively post their job-seeking information online are more likely to be employed one year later, compared to other students.

[5]The data are not restricted to young workers in the United States (Kuhn and Skuterud, 2000).

The more interesting questions of this chapter are associated with the match quality of jobs searched online. An analysis of match quality requires incorporating well-established empirical evidence on the relative advantages and disadvantages among various traditional job search methods. Firstly, a volume of theoretical and empirical research examines the benefits of using social networks or employee referrals (Montgomery, 1991; Simon and Warner, 1992; Mortensen and Vishwanath, 1994; Kugler, 2003). Social networks may not only increase the probability of getting job offers, but also enable job seekers to collect more detailed information on workplaces and help them find well-matched jobs. The employers' benefit from using referrals includes more accurate information about job candidates and lower monitoring costs. Examining the effect of "old boy networks" on job match quality, Simon and Warner (1992) find that referrals from current employees reduce employers' uncertainty about worker productivity, thus boosting the initial wages of workers hired by old boy networks, lowering subsequent wage growth, and having them stay longer on the job than would otherwise comparable workers. A majority of these studies concentrate on the comparative advantage of jobs searched by personal or social networks against those found by formal job search methods. Osberg (1993) also suggests that workers with fewer "social contacts" may select formal job search methods such as public employment agencies. In addition, as a reflection of the internet's prevalence, some human resource studies note the benefits of online job search. For instance, Feldman and Klaas (2002) examine the experiences of managers and professionals searching for jobs through the internet. They report that internet use for job search is perceived as less effective than personal networking, but much superior to searching for

jobs through newspaper advertisements and "cold calling."

Considering previous research, empirical questions on the match quality of internet job search are examined by comparisons with traditionally used formal search methods, separated from "referrals" or "social networks." Mainly, I look into the effect of internet job search on wages, analyzing a recently employed workers' sample. Firms can have more applications when using the internet for recruiting, thus increasing the possibility of getting better workers. Since the direct search cost is very low when using the internet, workers can also wait for, or search around more intensively to get, a better job offer. I find that workers successfully employed through internet search have up to a 6 percent wage premium over those employed by traditional methods except referrals or social networks, even after the selectivity issue is addressed. This positive wage effect is prominent among women and previously unemployed workers, showing that the effects of internet search might not be equal for all workers. Additionally, I estimate probability models of searching on the job and being terminated in the following year. While a good match will reduce a worker's desire to get a better job, the lower cost of internet job search activity may increase the probability of searching other jobs. Workers with previous experience of internet job search may also tend to look for better employment opportunities. Notably, I find that new employees who have ever searched online to look for a job are more likely to search for other jobs, while the probability of leaving their current jobs is not different from that of non-internet searchers.

The remaining part of the chapter proceeds as follows. In Section 2, I describe the data used in the research, focusing on the use of each job search method. Section 3

is devoted to analyzing internet search outcomes of unemployed workers and students using probability models. In Section 4, the match quality of internet job search is examined in terms of initial wages, subsequent wage growth, on-the-job search, and early termination. Section 5 summarizes and concludes the discussion.

3.2 Data

The data used in this research are five waves of the Youth Panel between 2001 and 2005, constructed by the Work Information Center in the Human Resources Development Service of Korea. The Youth Panel is a longitudinal data set, and initially surveyed more than eight thousand young individuals aged 15-29 from about ten thousand households in 2001. Since the research focuses on labor market behaviors, the observations of continuing students not looking for a job are not included for analysis.

The survey asks two different questions related to efforts and activities in finding jobs. First, it asks all job seekers, "What kinds of activities do you do for (re)employment?," and suggests several activities for "yes" or "no" answers, including "post job seeking information on internet," "attend job fairs," "send resume to employers," "ask relatives/alumni/friends," "consult with public employment agency," and "consult with job placement teacher,"[6] However, this information is collected only from current job seekers who are students or unemployed workers. Second, the survey also asks a traditional question about job search channels, "How do you get

[6]Other activities not directly related to the job search are also asked, such as "take occupational aptitude tests" and "take training for job interview."

job opening information?," and gives choices of "internet or PC-communication," "school or teacher," "ads on newspaper or TV," "ads on local information magazine," "parents or relatives," "friends or alumni," "public employment agency," "private employment agency," "contact employers directly," "job fairs," "job training academy," "internship," and "other methods," up to three of which are chosen by job seekers. Unlike the first question, this one is also asked of all employed workers regarding their current jobs. Additionally, each surveyee needs to indicate the successful (or determinant) search method used to obtain his or her current job.

Table 3.2 presents how frequently each job search method is used by students, unemployed job seekers, and employed workers (for their current job), respectively. The samples of students and unemployed workers are pooled across the five-year period, and restricted to individuals identifying themselves as job seekers. The sample of employed workers includes only new employees who found their jobs after the previous year's survey. Thus, in most observations, the tenure on current job is less than a year.

Internet job search prevails in South Korea, as expected from the rapid growth of infrastructure and service subscribers. As shown in Table 3.2, more than 70 percent of students and unemployed workers use the internet to look for job openings in the early 2000s.[7] In the case of employed workers looking for another job, the fraction increases to about 80 percent. These large proportions seem to reflect the lower costs and smaller time consumption of internet job search. However, the percentage of job seekers who actively post their personal information on the internet is much

[7]According to Kuhn and Skuterud (2004), the proportion of internet searchers is about 10 percent in the United States in 2000, although it is not restricted to young workers.

lower than that of internet job searchers. Only 26 percent of students, 51 percent of unemployed workers, and 42 percent of employed workers post their information online. Another interesting finding is that student job seekers rely greatly on "school or teachers." In South Korea, many employers or recruiters tend to ask schools or teachers for referrals of well-qualified alumni on the job market, instead of advertising job vacancies in a formal way. This method may also help recruiters acquire more credible information on job candidates - thereby reducing employers' uncertainty about worker productivity, which "social networks" or "employee referrals" do.

Workers' job search behavior can also be examined by using the questions asked of employed workers. This sample provides more information and observations for the analysis of match quality, since it covers all new employees regardless of whether they are identified as job seekers in the previous year's survey. Since the Youth Panel surveys individuals only once a year, a considerable proportion of workers not identified as job seekers end up getting new jobs in the following year. Thus, their search activities are only observed retrospectively in the employed workers' sample. As mentioned above, new employees with less than one year of tenure are included in the sample. The percentage of internet searchers in the new-employee sample is much lower than that of students or unemployed workers. Only about 50 percent of new employees answered that they had searched online before getting their current jobs. However, this proportion is still the highest among thirteen job search methods, along with "friends or alumni" also used by half of new employees. Half of internet job searchers found their current jobs successfully through the internet, as reported in the fourth column of Table 3.2. Similarly, a quarter of new employees

report that "friends or alumni" was the determinant search method for their current jobs. About 10 percent of new employees successfully searched for their jobs by "school or teachers," and about 11 percent of them were employed by "parents or relatives."

3.3 Internet Job Search and Employment

In spite of rosy prospects on internet technology in searching for jobs, some empirical evidence shows that internet job searchers do not have any advantage over job seekers not using this new technology (Kuhn and Skuterud, 2004). On the one hand, as some researchers suggest, job seekers who cannot search for jobs effectively using traditional methods may choose internet job search. On the other hand, internet job seekers are pickier and more likely to decline job offers, and thus their job search duration may be no different from that of job seekers using only traditional search methods. The employment probability of a job seeker i can be written as follows:

$$Pr(E_i|\mathbf{X}_i) = \sum_{j \in J} Pr(E_i|S_{ij}, \mathbf{X}_i) Pr(S_{ij}|\mathbf{X}_i), \tag{3.1}$$

where E_i indicates a job seeker i's employment outcome, S_{ij} represents a job search method j used by i, and $\mathbf{X}_i$ is a vector of individual characteristics. Following previous studies, the probability that each job search method leads to employment can be expressed by two probabilities as follows:

$$Pr(E_i|S_{ij}, \mathbf{X}_i) = (1 - F(w_i^r)) \cdot O(A_j(c_{ij}), q_i), \tag{3.2}$$

where the first component, $1 - F(w_i^r)$, is the probability of acceptance. The assumptions that a job seeker accepts an offer if $w \geq w^r$ and that the acceptance rate does not vary across job search methods are used here. In addition, $F(\cdot)$ is the cumulative distribution function of wage offer, and does not depend on individuals and job search methods. The second component, O_{ij}, is the probability of getting an offer. It is defined as a function of search intensity (for example, number of applications), A_{ij}, which is a decreasing function of direct search cost, c_{ij}, and a worker's quality unobserved to researchers, q_i.

The positive expectation of internet job search stems mainly from its effect on lowering direct search cost, c_{ij}, which determines i's search intensity. Since internet technology enables job seekers to search more jobs in a given period, internet searchers may be more likely to get offers than others not using the internet. However, internet job openings will have more applicants per vacancy, and result in lower offer probability per application to job seekers. Table 3.3 shows that there exist quite different job search patterns between internet users and nonusers. The sample is restricted to new employees surveyed in 2005, since the related questions are not asked in earlier years.[8] Internet job searchers send out more résumés to employers on average. In addition, 60 percent of internet searchers have experienced a failure in getting offers after applications or job interviews, while only 28 percent of non-internet searchers have ever failed in getting an offer before signing their current employment contracts. The job offer rate could also be affected by a worker's quality, q_i, if recruiters effectively screen out adversely selected workers.

[8]For this reason, the information on search intensity cannot be included in the analysis of search outcomes.

Positive effects of internet use in finding a job may also not be clear in the data due to the difference in probability of declining an offer. As also shown in Table 3.3, 40 percent of internet searchers have declined offers, while only 14 percent of non-internet searchers have. Considering only workers with the experience of declining offers, the average number of declined offers of internet searchers is also greater than that of non-internet searchers. This finding implies that the reservation wage of internet searchers would be higher than that of non-internet searchers if the wage offer distribution does not vary across search methods, as specified in the equation (3.2).

These complicated characteristics of internet job search can make it difficult to estimate correctly the effects of this new technology on employment outcomes. As mentioned earlier, Kuhn and Skuterud (2004) also report that they cannot find any empirical evidence of its positive effects on employment duration. Table 3.4 briefly reports the estimation results of the probability model for both unemployed workers' and students' samples, in which the dependent variable is the indicator of whether a job seeker gets a job during the following year after each survey. In all estimates, basic demographics, years, regions, and previous occupations are controlled.[9] Additionally, the retrospective job search period (months) and its squared term are also included for the unemployed workers' sample.

To capture the differences in employment probability, two types of internet search variables described in the previous section are used separately and together.

[9]The unemployed workers with no previous job records are categorized as a group for analysis. Although wanted occupations are used for the student sample, the results are not different from those without any occupation controls.

Looking at the coefficients of the unemployed workers' sample, neither internet job search variable has any significant effect on the probability of becoming employed in the following year. If we estimate a similar probability model for the student job seekers' sample, the same result is obtained for the job seekers who use the internet to search for job information. However, as shown in columns (7) and (8), the students who post job-seeking information online are more likely to get a job during the following year. The probability is about 11 percent higher for students who actively post personal information on the Web site than for those who do not. Although access to the internet does not seem to be a barrier for young people in South Korea, additional regressions are estimated using the subsample of job seekers who utilize the internet to search for job information. The results confirm the previous findings. The unemployed sample does not show any significant difference in the employment probability, and is not dependant on the posting of job seeking information online. However, students posting personal information on the Web site are about 12 percent more likely to be employed in the following year, as reported in columns (9) and (10).

This result partly shows the positive influence of the internet for job seekers, although there might be concern about individual heterogeneity. Since some students looking for jobs may also consider alternative career paths instead of participating in the labor force, job seekers who actively post their information online may have stronger intentions of joining the labor force than others. In South Korea, many well-paying employers such as government and mass-communication companies recruit employees through various written and oral tests. Job seekers who take these examinations usually spend a couple of years in preparation after graduation, while at

the same time trying to find other alternatives due to the competitiveness and uncertainty of test results. Thus, because about 85 percent of observations in the sample are college students or graduate students, the sample might include a considerable number of students who think about other careers – thus resulting in a self-selection of posting personal information online.[10] Unfortunately, this information cannot be identified in the data.

Additionally, the difference between unemployed workers and students in the effect of posting personal information online may be related to the strong preference of firms toward new graduates in South Korea. The job markets for new graduates and experienced workers are separated. In the market for new graduates, workers spending one or more years unemployed are not preferred over those coming directly from school. Their lengthy unemployment spell may be a signal of their ability level, or perceived by firms as having been screened out in the previous year's job market. Thus, firms may utilize this additional information on unemployed workers for screening.

3.4 Match Quality of New Jobs

In the job search literature, match quality is related to the information on potential jobs and/or job candidates (Jovanovic, 1979; Simon and Warner, 1992). Jovanovic's labor turnover theory shows that a worker's productivity in a particular job is not known initially, but becomes known more precisely as the worker's job tenure in-

[10]The percentage of students with higher education seems greater than usual, which is caused by the fact that many high school graduates need to serve in the army after graduation while most college students tend to fulfill their mandatory military service before graduation.

creases. However, many studies also pay attention to the possibility that referrals by current employees give more accurate information on workers' productivity to the employer and reduce screening costs, and that the jobs searched through social networks such as "friends or alumni" may yield higher wages at the initial career stage and longer tenures (Montgomery, 1991; Simon and Warner, 1992; Mortensen and Vishwanath, 1994).

Internet job search has a different aspect from job search through social networks. Firstly, internet job search is characterized by the possibility of shopping around a broader range of potential jobs. Its low cost enables a job seeker to search more jobs for a better offer. If this effect is dominant, the wages of internet job searchers would be higher than those of other job seekers, regardless of the successful methods leading current employment contracts. Similarly, the large pool of internet job seekers gives employers an opportunity to employ better-matched workers. These characteristics can result in higher wages for workers employed successfully through the internet. However, as Autor (2001) emphasizes, there exists the possibility of adverse selection, which requires more intense screening for employers to get better-matched workers. If employers could acquire more accurate information on candidates' productivity through internet recruiting, or have effective methods to sort out workers by their quality, then there would be wage differences between workers employed through internet search and those employed through other methods. This wage gap by successful search method would exist even among internet job searchers. Lastly, in terms of labor turnover, the results of internet job search are more ambiguous. Although the turnover theory says that well-matched jobs last

longer, the low costs of internet job search may attract many employees to look for better jobs.

In this section, I first test whether the internet job seekers are paid more at the initial stage. More importantly, I try to find the wage differences by successful search method, especially among internet job seekers. Next, the wage premium of internet job search is scrutinized by previous employment status and gender. Third, I test whether subsequent wage growth differs by the successful job search method. Lastly, I also test whether there is any difference among workers in the probability of on-the-job search and employment termination.

3.4.1 Initial Wage Premium

The influences of internet job search on workers' wages can be captured by two variables in the data. First, the wage difference between internet job searchers and nonusers of the internet is estimated by a conventional wage regression with a dummy variable indicating whether an employed worker has searched jobs online. If the extensive search of internet job seekers (thanks to its low cost) results in better offers, then the internet users would be more likely to be paid more than nonusers – regardless of the successful search method by which they become employed. Next, the question of successful search method for a worker's current job gives us another opportunity to examine wage variations by job search behavior. The wage difference can be interpreted as the difference in job or match quality. Since only one successful search method should be reported, the dummy variables related to "referrals" or "social networks" are also included in each regression using successful search methods, in

order to separate out the well-known wage effects of "referrals" or "social networks" and to compare wages by internet search directly with those by traditional formal search methods.

Table 3.5 reports the log wage regression results of new employees who are employed between two consecutive years' surveys – mostly within a twelve-month period before the second survey. Nevertheless, since tenure on the current job may vary by workers, I include actual months on the job and their squared terms, as well as various demographic, occupation, and industry variables.[11] I also control for firm heterogeneity using firm size dummies, because firm characteristics are a major source of wage variations.

There is no significant wage premium for workers who search online to find job information, even after controlling for other job search methods used by workers. However, the wages of jobs found successfully by internet search are 5 percent higher than those found by other traditional search methods except referrals, "school or teacher," "parents or relatives," and "friends or alumni," as reported in the third column. These results imply that employers may effectively screen out workers with low match quality. Among referrals, workers employed through "school or teacher" earn 10 percent higher wages than those employed through traditional formal methods. In both wage regressions, other control variables show the expected coefficients. For example, there exists a size premium as large as 20 percent for workers in a firm with five hundred or more employees. Age turns out to be nonlinear, and college graduates also earn 22 percent more than the less educated. The gender wage gap

[11]The control variables not reported include 3 year, 5 occupation, 10 industry, and 14 region dummies.

is about 12 percent, while marriage wage premium is not apparent.

To look at whether or not success in internet search makes any wage difference among internet job seekers, I estimate the wage premium using only the internet job searchers' sample. As reported in the fourth column, there still exists a significant wage premium against workers employed by traditional search methods, except using personal or social networks ("school or teacher," "parents or relatives," and "friends and alumni"). Considering the possibility of self-selection into internet search, a sample selection model is additionally estimated using the whole sample. The selection equation of internet job search is identified by including an additional dummy variable indicating the type of residence and by using past occupation dummies instead of current ones.

Specifically, the apartment/villa variable indicates whether a worker lives in an apartment/villa or resides in a single family house.[12] Apartments are usually preferred by people who desire a more convenient and modernized lifestyle. In addition, high-speed internet services are easily set up in apartments or townhome complexes, while residents in family houses sometimes experience technical difficulty in connecting or have fewer options among various providers.[13] In the sample, 46 percent of workers live in an apartment/villa. The percentage of internet job searchers living in an apartment/villa is about 54 percent, while it is 6 percent lower for others.

[12]A small-sized apartment or condominium is referred to as a villa in South Korea, while an apartment often indicates a type of high-storied building residence in a large-scale complex. Most of these residences are individually owned and rented like a single-family house. Officetel residents are also included in the apartment/villa category.

[13]According to the National Internet Development Agency of Korea, about 10 percent of high-speed internet subscribers are using apartment LAN services in 2004. This implies that apartment residents have more alternative service providers.

The fifth and sixth columns of Table 3.5 report the maximum-likelihood estimation results of the selection model.[14] The selection equation shows that the residents of apartments/villas are about 10 percent more likely to search online after controlling for various individual characteristics. It also shows that highly educated workers, and workers in metropolitan areas, are more likely to use internet job search, while married workers are less likely to search online. The estimated wage premium in the selection model is similar to those in the original regression. Both report that workers employed through internet search earn about 6 percent more than internet searchers employed by traditional methods except referrals or networks. Internet searchers eventually employed through "friends or alumni" also earn 10 percent higher wages, while the wage premium of "school or teachers" disappears.

3.4.2 Wages by Previous Employment Status and Gender

A worker's job search strategy may vary by labor market status, and thus yield different outcomes. Workers who have previous job market experience may be more efficient in finding good jobs. Since the sample consists of young workers, all new employees can be separated into three major groups by employment status in the previous year. Roughly a third of new employees move directly from student status, and the rest are almost equally divided by whether or not they were working at the time of the previous year's survey. Table 3.6 reports the coefficients of internet search variables estimated from each subsample. An interesting finding is that the wage premium of internet search is only significant in the sample of workers who

[14]Heckman's two-step procedure gives a very similar result, which is available upon request.

were neither working in the previous year nor attending school. Even the wage of internet searchers is 7 percent higher than that of non-internet searchers. Workers successfully employed by internet search have about a 14-percent wage premium over those employed by traditional formal search methods, and the size of the internet search premium decreased to 10 percent, but still remains statistically significant even if the sample selection is corrected. Job changers do not seem to benefit from new internet technology. Internet searchers who had different jobs in the previous survey do not earn higher wages than other job changers.

Job search strategy may also vary by gender, considering such things as the gender wage gap and job segregation. Employer preference or discrimination may lead to variations in job search strategy by gender.[15] The second panel of Table 3.6 reports the coefficients of internet search variables separately estimated by gender. The effects of internet search differ by gender. While male workers do not benefit from internet search, female workers employed through internet search have at least a 7-percent wage premium over those employed by other traditional methods except referrals. Even the wage of internet users is about 5 percent higher than that of non-internet users, when restricting the sample to female workers. The positive wage effect of successful internet search is still significant, and its size becomes greater if the sample is restricted to internet searchers or if the sample selection is addressed.

These variations by labor market status and demographics in the effects of internet technology on job match outcomes imply that the introduction of internet

[15]According to a recent news article, a third of large firms in South Korea still set male quotas when recruiting new employees, although the surveyed firms are limited (August 8, 2007, *Dong-A Daily*).

technology may affect workers differently, depending on their status. Because the internet is likely to be more beneficial to job seekers with fewer social networks, or who are less efficient at searching for jobs, the new technology seems to play a positive role in the labor market of South Korea. Figure 3.1 shows the various wage gaps by successful search method. The gender wage gap among workers employed through the internet is much smaller than that of workers employed by traditional methods. In addition, the percentage of female workers among workers employed through the internet is no lower than that of workers employed by other traditional search methods except "friends or alumni," as depicted in Figure 3.2. Similarly, previously unemployed workers have no significant wage gap against previously employed workers when employed through the internet.

3.4.3 Subsequent Wage Growth of Stayers

Research on the effect of referrals or social networks on job match quality also reports that workers employed by those methods experience lower subsequent wage growth on the job (Simon and Warner, 1992). Although more accurate initial information on a worker's productivity yields a higher initial wage, referred workers may experience lower wage growth than nonreferred workers, whose productivity is revealed to employers after they start to work. Employers' extensive search using the internet may lead to more accurate information on the relative productivity of job candidates on the market, resulting in a different wage growth rate of their employees.

Table 3.7 reports the wage growth regression results, after controlling for the current wage level. The dependent variable is the logarithm of the wage difference

between the current survey and the following year's survey. Thus, only continuing workers who have the same job are considered for analysis. The same demographic and job characteristic variables for initial wage regressions are also used as controls. There is no significant effect of successful search method on subsequent wage growth rate, compared with other traditional methods not included in each regression. Even comparing the internet job search with referrals, I could not find any significant difference in the influence on wage growth rate. This result may be affected by short time span in measuring the wage growth rate.

3.4.4 On-the-Job Search and Early Termination

Another way to examine workers' match quality is to look into whether workers try to find other employment opportunities and eventually make turnover decisions. As Jovanovic (1979) suggests, match quality is related to a worker's tenure. In other words, a good match lasts longer than a bad match. To address match quality in this respect, two probability models are estimated.

First, a worker who wants a better job will try to search other employment opportunities. Table 3.8 reports the estimation results of the probability model of searching on the job. If internet job search increases match quality, workers employed through internet job search will be less likely to search for other jobs. However, the lower costs of internet job search activity will increase the probability of searching for other jobs. In addition, workers with experience in internet job search may be more likely to search other jobs, since they are probably more efficient in terms of monetary cost and time consumption in searching jobs. The first column shows that

new employees who have ever searched online for their current job are 6 percent more likely to search for other jobs, regardless of successful search methods used for their current jobs. The effect of the low cost of internet search seems dominant. New employees hired successfully through internet job search also show a slightly significant difference in on-the-job search activity when including non-internet searchers for current job, as reported in the second column. However, restricting the sample to workers who have ever used the internet for searching their current jobs, there is no significant effect, as shown in the third column. This result implies that, in terms of on-the-job search, matches through the internet are at least as good as those made through other traditional methods.

Among other search methods, "school or teacher" has a significant negative effect on searching other jobs. Workers employed through "school or teacher" are 4 percent less likely to seek other employment opportunities than are workers employed by other traditional methods except personal or social networks. Considering only internet searchers, the probability difference becomes larger – up to 8 percent. Looking at the effects of other control variables on the probability of searching other jobs, large firms' employees are less likely to search for other jobs. This result is consistent with the research of Winter-Ebmer and Zweimuller (1999) on job mobility by firm size. Married workers and students in the previous survey also tend not to search for other jobs. Married workers may be more reluctant to change jobs, since their reservation wages are more likely to be greater than those of nonmarried workers. The popularity of student job candidates may yield better matches for student job seekers, compared with unemployed workers.

The second indicator of match quality associated with longer tenure is the probability of early termination. The last three columns of Table 3.8 report the estimation results of the probability model of being terminated (or leaving current jobs) within a year. Since the survey is given annually, the observations of new employees in the 2005 survey should be dropped. As reported, there is no significant effect of internet search on early termination. This result implies that on-the-job search activities are not directly related to termination of current employment. Although lower cost and easy access to internet job search can lead to a higher probability of on-the-job search, higher opportunity cost of turnover can make workers pickier or more reluctant to change careers. Among a variety of job search methods, the use of "school or teacher" is negatively related to job termination probability. Workers who have ever used it are 8 percent less likely to leave their current jobs. This situation seems related to the fact that the majority of those workers were student job seekers. Again, job mobility has a negative relationship with firm size. The largest-firm employees (500+) are 20 percent lower in the probability of termination than the smallest-firm employees (1-29). Among demographic controls, the education effect on match quality turns out significant and strong. For instance, college graduates are 12 percent less likely to leave their current jobs within the following year. There also exists a difference in job termination probability between job changers and other workers. Students and unemployed workers in the previous survey are less likely to end their current employment than are job changers.

3.5 Discussion

The rapid transition of our economic life caused by the development of internet technology also accompanies changes of workers' activities in the labor market. Despite promising discussions on the consequences brought about by the new technology, there have been only a few studies examining its effects on labor market outcomes. This research not only finds new empirical evidence of the positive wage effects of internet job search, but also shows that the wage effects may vary by workers' labor market status and other demographics such as gender. There might be a tradeoff between shorter unemployment spells and higher wages. The low direct cost of internet job search does not seem to shorten job search duration, but probably inspires workers to search and compare more job opportunities for better matches. To the extent that the use of internet technology is more beneficial to job seekers with fewer social networks or less efficiency in searching for jobs through traditional methods, the new technology seems to play a positive role in the labor market in South Korea.

Since South Korea has a well-established networking infrastructure, and young people are very familiar with internet use, this research could suggest meaningful policy implications on the introduction of internet technology in the labor market, especially for policymakers of economies witnessing the rapid development of internet technology.

Table 3.1: **Internet Usage in South Korea, 2000-2004 (unit: thousands)**[1]

	Internet Users	Service Subscribers				Demographics	
		Dial-Up	High-Speed	.kr domains	IP addresses	Households	Population
2000	19,040	1,018	4,104	517	18,922	14,609	47,008
2001	24,380	623	8,333	457	22,985	14,834	47,354
2002	26,270	480	10,336	515	27,180	15,064	47,615
2003	29,220	259	11,091	612	30,981	15,298	47,849
2004	31,580	n.a.	11,921	591	34,228	15,539	48,297

[1] Sources: Monthly Internet Statistics, National Internet Development Agency of Korea (Korea Network Information Center) and Korea National Statistical Office.

Table 3.2: **Used Job Search Methods, 2001-2005**[1]

	Student	**Unemployed**	**New Employees**		
			Used Method for Current Job	Successful Method for Current Job 2002-2005	On-the-Job Search 2002-2005
Job Search Methods					
school or teacher	0.602	0.093	0.193	0.103	0.091
ads on newspaper or TV	0.323	0.325	0.233	0.052	0.310
ads on local info magazine	0.155	0.446	0.295	0.090	0.313
parents or relatives	0.159	0.197	0.238	0.109	0.139
friends or alumni	0.458	0.545	0.497	0.265	0.537
public employment agency	0.083	0.192	0.101	0.022	0.119
private employment agency	0.014	0.028	0.021	0.006	0.028
internet or PC-comm	0.696	0.714	0.498	0.251	0.803
contact directly employers	0.054	0.110	0.138	0.043	0.105
job fairs	0.073	0.055	0.036	0.004	0.050
job training academy	0.058	0.027	0.031	0.014	0.047
internship	0.065	0.003	0.026	0.008	0.019
other	0.041	0.041	0.066	0.033	0.086
Activities Related to Job Seeking					
consult with public employment agency	0.107	0.324			0.119
attend job fairs	0.207	0.233			0.208
send resume to employers	0.392	0.747			0.485
post job-seeking info on internet	0.258	0.509			0.421
ask relatives, alumni, or friends	0.356	0.708			0.519
Observations	1,545	1,330	3,885	3,007	361

[1] The question on successful search method for current job is not asked in 2001.

Table 3.3: **Search Intensity of New Employees by Internet Use in 2005**[1]

	mean	s.d.	min	median	max	observations
Internet Search = 1						
No. of resumes sent	5.71	11.87	0	3	100	303
1 if ever failed in getting an offer	0.60	0.49	0	1	1	303
No. of unsuccessful applications (conditional on ever failed = 1)	5.54	7.25	1	3	50	181
1 if ever declined an offer	0.40	0.49	0	0	1	303
No. of declined offers (conditional on ever declined = 1)	2.25	1.76	1	2	10	122
Internet Search = 0						
No. of resumes sent	1.76	4.40	0	1	50	395
1 if ever failed in getting an offer	0.28	0.45	0	0	1	395
No. of unsuccessful applications (conditional on ever failed = 1)	3.29	4.65	1	2	40	112
1 if ever declined an offer	0.14	0.35	0	0	1	395
No. of declined offers (conditional on ever declined = 1)	1.87	1.16	1	2	7	55

[1] Notes. These questions are only available in the 2005 survey, and the observations of employed workers who found a job during the past one-year period before the survey are used.

Table 3.4: **Probability of Getting Employed One Year Later, 2001-2004**[1]

	Unemployed					Student				
				Internet Searcher					Internet Searcher	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Job Search Methods										
internet or	-0.019		-0.025			0.027		-0.017		
PC-comm.	(0.053)		(0.055)			(0.058)		(0.056)		
Activities Related to Job Seeking										
post job-seeking		0.022	0.022	0.022	0.001		0.105	0.110	0.121	0.121
info on internet		(0.040)	(0.042)	(0.048)	(0.049)		(0.043)**	(0.045)**	(0.048)**	(0.050)**
other methods	Yes	No	Yes	No	Yes	Yes	No	Yes	No	Yes
other activities	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes
Log-likelihood	-482.8	-487.0	-479.1	-350.2	-339.3	-387.6	-380.5	-372.9	-280.5	-273.5
Pseudo-R^2	0.083	0.075	0.090	0.093	0.121	0.074	0.091	0.109	0.090	0.113
Observations	809	809	809	588	588	677	677	677	499	499

[1] Notes. Estimated coefficients are marginal effects (dF/dX), and robust standard errors are reported in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%. Other "Job Search Methods" include school or teacher, ads on newspaper or TV, ads on local info magazine, parents or relatives, friends or alumni, public employment agency, private employment agency, contact employers directly, job fairs, job training academy, internship, and other methods. Other "Activities Related to Job Seeking" include attend job fairs, send resume to employers, ask relatives/alumni/friends, consult with public employment agency, and consult with job placement teacher. All regressions are controlled for various demographic variables (age, age squared, college attended, college graduate, female, marital status, metropolitan city, year, and fourteen region dummies). Previous occupations and wanted occupations are also controlled, respectively, for unemployed workers and students. Regressions for unemployed workers also include retrospective job search month and its squared term.

Table 3.5: **Initial Wages of New Employees, 2002-2005**

	Used Search Methods		Successful Search Methods			
				internet searcher	Heckman MLE	selection
	(1)	(2)	(3)	(4)	(5)	(6)
internet or PC-comm	0.026	0.015	0.051	0.066	0.063	
	(0.017)	(0.018)	(0.023)**	(0.031)**	(0.031)**	
school or teacher		0.050	0.101	0.050	0.051	
		(0.030)	(0.031)***	(0.047)	(0.046)	
ads on newspaper/TV		-0.003				
		(0.019)				
ads on info magazine		-0.058				
		(0.019)***				
parents or relatives		-0.062	-0.024	-0.013	-0.013	
		(0.019)***	(0.027)	(0.054)	(0.053)	
friends or alumni		-0.014	0.034	0.098	0.102	
		(0.017)	(0.024)	(0.043)**	(0.042)**	
public empl. agency		-0.083				
		(0.033)**				
private empl. agency		-0.028				
		(0.054)				
contact directly		-0.027				
		(0.023)				
job fairs		0.076				
		(0.045)*				
job training academy		-0.038				
		(0.065)				
internship		-0.143				
		(0.068)**				
other methods		-0.029				
		(0.036)				
apartment/villa						0.106
						(0.052)**
firm size 30-99	0.091	0.084	0.085	0.068	0.071	
	(0.021)***	(0.021)***	(0.021)***	(0.027)**	(0.027)***	
firm size 100-499	0.140	0.127	0.132	0.121	0.122	
	(0.025)***	(0.025)***	(0.025)***	(0.034)***	(0.033)***	
firm size 500+	0.220	0.202	0.212	0.189	0.189	
	(0.030)***	(0.030)***	(0.030)***	(0.040)***	(0.040)***	
age	0.120	0.124	0.133	0.120	0.093	0.515

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	(1)	(2)	(3)	(4)	(5)	(6)
	(0.031)***	(0.031)***	(0.031)***	(0.049)**	(0.049)*	(0.101)***
age^2/100	-0.185	-0.194	-0.211	-0.194	-0.143	-1.006
	(0.062)***	(0.063)***	(0.062)***	(0.097)**	(0.096)	(0.201)***
somecoll	0.068	0.062	0.068	0.083	0.060	0.411
	(0.021)***	(0.021)***	(0.021)***	(0.029)***	(0.031)**	(0.068)***
collgrad	0.233	0.218	0.228	0.257	0.222	0.633
	(0.025)***	(0.025)***	(0.026)***	(0.034)***	(0.039)***	(0.080)***
female	-0.120	-0.119	-0.120	-0.086	-0.090	0.016
	(0.019)***	(0.019)***	(0.019)***	(0.027)***	(0.027)***	(0.058)
married	0.007	0.009	0.004	0.043	0.060	-0.253
	(0.026)	(0.026)	(0.026)	(0.037)	(0.038)	(0.084)***
metro	0.177	0.158	0.172	0.111	0.148	1.197
	(0.082)**	(0.083)*	(0.081)**	(0.081)	(0.089)*	(0.171)***
prev. student	-0.004	-0.025	-0.014	-0.007	-0.003	-0.142
	(0.023)	(0.024)	(0.024)	(0.033)	(0.032)	(0.110)
prev. not working	-0.078	-0.075	-0.075	-0.034	-0.033	-0.028
	(0.019)***	(0.018)***	(0.019)***	(0.025)	(0.025)	(0.067)
tenure (months)	0.014	0.015	0.015	0.017	0.016	
	(0.009)	(0.009)*	(0.009)*	(0.013)	(0.013)	
tenure^2/100	-0.060	-0.072	-0.067	-0.103	-0.099	
	(0.061)	(0.061)	(0.061)	(0.086)	(0.085)	
Constant	6.481	6.496	6.296	6.508	6.868	-7.736
	(0.393)***	(0.396)***	(0.395)***	(0.633)***	(0.624)***	(1.264)***
ρ					-0.217	
σ					0.406	
λ					-0.088	
					(0.034)	
R^2	0.289	0.300	0.293	0.249		
Observations	2,761	2,761	2,761	1,396	2,776 (1,383)	

Notes. Robust standard errors are reported in parentheses,
* significant at 10%; ** significant at 5%; *** significant at 1%.
Dependent variable is the natural logarithm of real hourly wage.
The reference group of successful search methods is *all other methods*.
All regressions also include 3 year, 5 occupation, 10 industry, and 14 region dummies.

Table 3.6: **Wage Premia of Internet Job Search**[1]

	Used	Successful		
			internet searcher	Heckman MLE
	(1)	(2)	(3)	(4)
By Employment Status in the Previous Year				
Student	-0.016	0.038	0.070	0.067
	(0.036)	(0.050)	(0.073)	(0.069)
	$N = 809$	$N = 809$	$N = 414$	$N = 810$
Not Working	0.068	0.138	0.111	0.104
	(0.033)**	(0.039)***	(0.062)*	(0.058)*
	$N = 896$	$N = 896$	$N = 454$	$N = 903$
Employed	-0.021	-0.022	0.018	0.015
	(0.029)	(0.038)	(0.045)	(0.043)
	$N = 1{,}056$	$N = 1{,}056$	$N = 528$	$N = 1{,}063$
By Gender				
Male	-0.021	0.009	-0.001	0.000
	(0.026)	(0.033)	(0.042)	(0.041)
	$N = 1{,}282$	$N = 1{,}282$	$N = 633$	$N = 1{,}284$
Female	0.046	0.072	0.087	0.081
	(0.026)*	(0.032)**	(0.046)*	(0.045)*
	$N = 1{,}479$	$N = 1{,}479$	$N = 763$	$N = 1{,}492$

[1] Notes. Robust standard errors are reported in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%. All regressions use the same specifications with columns (2)-(5) in Table 5. Thus, the estimates in column (1) imply the wage premia of internet searchers against nonusers, and those in other columns are wage premia against the workers whose successful search method is other traditional methods except "internet," "school or teacher," "friends or alumni," and "parents or relatives."

Table 3.7: **Subsequent Wage Growth of Job Stayers**[1]

	Dep. Var. = Log Wage Difference *(After − Current)*	
Successful Search Method for Current Job	all workers (1)	internet searcher (2)
internet or PC-comm	0.033	0.038
	(0.028)	(0.038)
school or teachers	0.049	0.027
	(0.034)	(0.052)
parents or relatives	0.002	-0.043
	(0.039)	(0.065)
friends or alumni	0.042	0.028
	(0.029)	(0.045)
R^2	0.496	0.559
Observations	1,000	553

[1] Notes. Robust standard errors are reported in parentheses: * significant at 10%; ** significant at 5%; *** significant at 1%. Regressions use similar specifications with columns (3)-(4) in Table 5. Thus, the reference group is workers employed by other traditional methods except "internet," "school or teachers," "friends or alumni," and "parents or relatives." Additionally, current hourly wage level is also controlled.

Table 3.8: **Probability Models of On-the-Job Search and Early Termination**

	Prob (Searching Other Jobs) (2002-2005)			*Prob (Leaving Current Job)* (2002-2004)		
	Used	Successful		Used	Successful	
			internet searcher			internet searcher
	(1)	(2)	(3)	(4)	(5)	(6)
internet or PC-comm	0.060	0.031	-0.012	0.035	0.042	0.037
	(0.013)***	(0.018)*	(0.027)	(0.028)	(0.036)	(0.046)
school or teacher	-0.023	-0.036	-0.079	-0.076	-0.065	-0.019
	(0.016)	(0.020)*	(0.034)**	(0.036)**	(0.047)	(0.077)
ads on newspaper/TV	0.006			-0.037		
	(0.014)			(0.031)		
ads on info magazine	0.009			0.007		
	(0.014)			(0.030)		
parents or relatives	-0.036	-0.026	0.004	0.003	0.071	0.093
	(0.013)***	(0.019)	(0.044)	(0.032)	(0.045)	(0.073)
friends or alumni	0.022	0.011	0.009	0.017	0.019	0.051
	(0.013)*	(0.017)	(0.033)	(0.027)	(0.034)	(0.055)
public empl. agency	0.004			-0.063		
	(0.022)			(0.046)		
private empl. agency	0.054			-0.041		
	(0.050)			(0.089)		
contact directly	0.001			-0.009		
	(0.018)			(0.037)		
job fairs	0.000			0.036		
	(0.033)			(0.066)		
job training academy	0.029			-0.018		
	(0.040)			(0.071)		
internship	0.067			-0.021		
	(0.050)			(0.080)		
other methods	-0.030			-0.055		
	(0.021)			(0.048)		
hourly wage	-0.098	-0.094	-0.220	0.013	0.013	0.073
	(0.043)**	(0.044)**	(0.085)***	(0.042)	(0.042)	(0.058)
hourly wage^2	0.028	0.027	0.073	-0.002	-0.002	-0.006
	(0.011)**	(0.011)**	(0.027)***	(0.003)	(0.003)	(0.004)*
firm size 30-99	-0.032	-0.032	-0.025	-0.098	-0.102	-0.087
	(0.014)**	(0.014)**	(0.025)	(0.031)***	(0.031)***	(0.042)**

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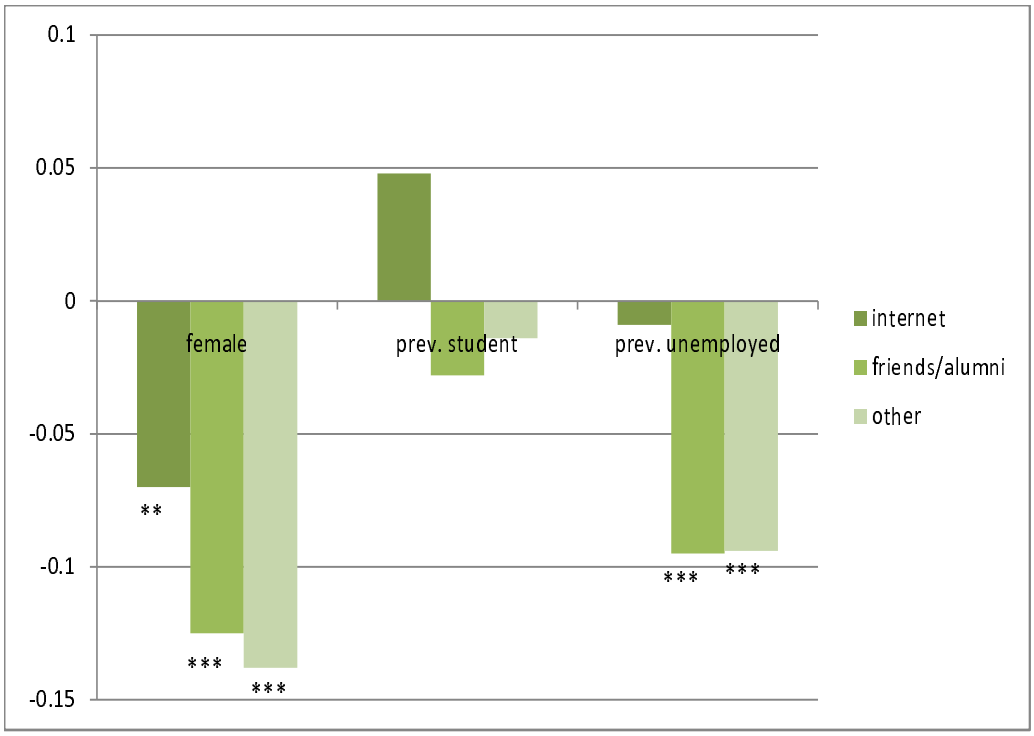
	(1)	(2)	(3)	(4)	(5)	(6)
firm size 100-499	-0.005	-0.004	0.012	-0.115	-0.123	-0.085
	(0.017)	(0.018)	(0.031)	(0.037)***	(0.037)***	(0.049)*
firm size 500+	-0.047	-0.044	-0.054	-0.200	-0.201	-0.175
	(0.016)***	(0.018)**	(0.029)*	(0.038)***	(0.038)***	(0.050)***
age	0.004	0.010	0.038	-0.083	-0.080	-0.075
	(0.025)	(0.025)	(0.047)	(0.053)	(0.053)	(0.079)
age^2/100	-0.007	-0.019	-0.080	0.134	0.129	0.125
	(0.049)	(0.050)	(0.092)	(0.105)	(0.104)	(0.155)
somecoll	0.026	0.030	-0.003	-0.102	-0.102	-0.093
	(0.017)	(0.018)*	(0.029)	(0.033)***	(0.033)***	(0.048)*
collgrad	0.037	0.040	0.015	-0.122	-0.123	-0.131
	(0.021)*	(0.022)*	(0.034)	(0.040)***	(0.039)***	(0.054)**
female	-0.015	-0.013	-0.005	0.030	0.030	0.054
	(0.014)	(0.014)	(0.023)	(0.030)	(0.030)	(0.041)
married	-0.033	-0.037	-0.031	0.031	0.033	-0.033
	(0.017)*	(0.017)**	(0.034)	(0.042)	(0.042)	(0.058)
metro	0.014	0.036	0.032	0.063	0.074	0.054
	(0.038)	(0.040)	(0.082)	(0.088)	(0.085)	(0.164)
prev. student	-0.033	-0.031	-0.043	-0.061	-0.064	-0.113
	(0.015)**	(0.016)**	(0.027)	(0.035)*	(0.034)*	(0.045)**
prev. not working	-0.017	-0.016	-0.018	-0.084	-0.083	-0.104
	(0.013)	(0.013)	(0.023)	(0.029)***	(0.029)***	(0.040)**
tenure (months)	0.009	0.009	0.018	-0.025	-0.027	-0.032
	(0.006)	(0.007)	(0.012)	(0.014)*	(0.014)**	(0.019)
tenure^2/100	-0.050	-0.049	-0.115	0.116	0.129	0.186
	(0.045)	(0.046)	(0.083)	(0.098)	(0.098)	(0.136)
Log Likelihood	-923.8	-940.6	-547.0	-1,107.8	-1,110.2	-600.6
Pseudo R^2	0.088	0.071	0.092	0.083	0.081	0.095
Observations	2,761	2,761	1,374	1,770	1,770	974

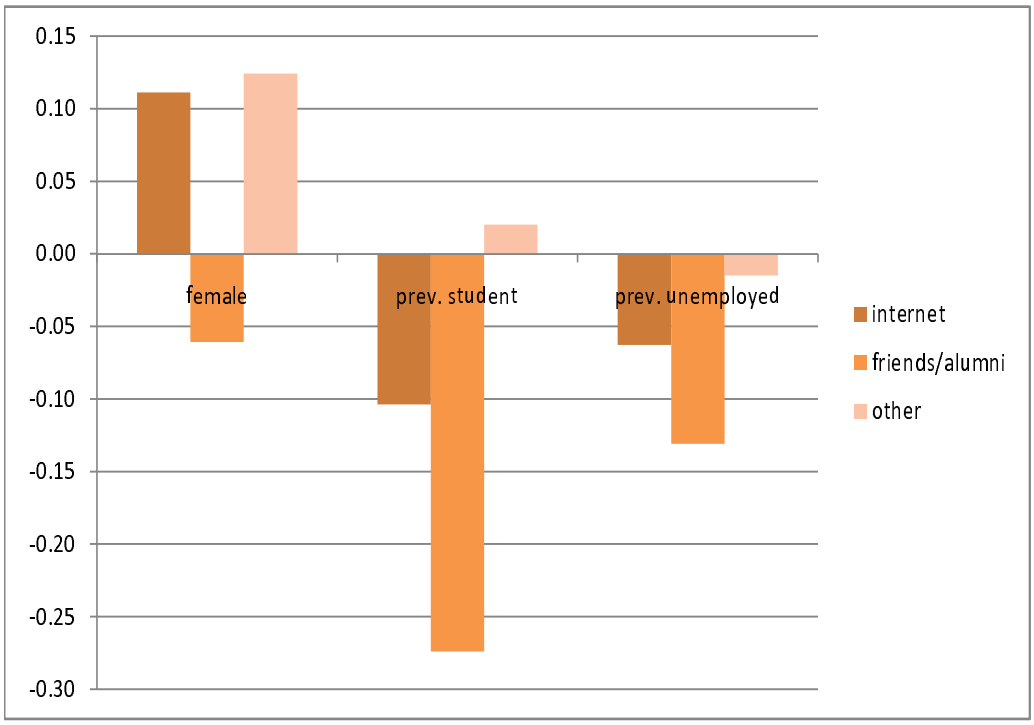
Notes. Robust standard errors are reported in parentheses,
* significant at 10%; ** significant at 5%; *** significant at 1%.
Dependent variables are the indicator of searching another job by the employed and that of leaving current job within a year, respectively.
The reference group of determinant search methods is *all other methods*.
All regressions also include 3 year, 5 occupation, 10 industry, and 14 region dummies.

Figure 3.1: **Wage Gaps by Successful Job Search Method**



Notes. * significant at 10%; ** significant at 5%; *** significant at 1%. Wage gaps are calculated after controlling for various demographic variables and job characteristics. The first set of bars depicts gender wage gap (female vs. male), and others are the wage differences against previously employed workers.

Figure 3.2: **Employment Gaps by Successful Job Search Method**



Note. The first set of bars depicts gender employment gap, and others are the employment differences against previously employed workers.

Chapter 4

Sex Preferences and Fertility in South Korea during the Year of the *Horse*

4.1 Introduction

Gender differences in demographic outcomes are a well-known social phenomenon in South Korea. This chapter investigates an idiosyncratic social norm in South Korea and its effects on demographic outcomes such as the sex ratio at birth and fertility.[1]

Since antiquity, people in several East Asian countries, such as China, Japan, and South Korea, have used the lunar calendar, in which each year is symbolized by a zodiacal sign according to a rotating cycle of 12 animals: Rat, Ox, Tiger, Rabbit, Dragon, Snake, Horse, Sheep, Monkey, Rooster, Dog, and Pig. The belief is that people are destined to possess specific personality traits or characteristics according to the sign of the zodiac under which they are born.[2]

[1] This chapter is based on an article co-authored with Jungmin Lee, and originally published in *Demography* 43(2): 269-292.

[2] Astrology is also popular in Western countries (Eysenck and Nias, 1982). Western astrology also implies that those who are born under the same zodiacal sign share specific characteristics. Bennett and Barth (1973) tested for whether people born under Aries and Scorpio, who are supposed to be

The contents and interpretation of zodiac astrology differ across countries and cultures. There is widespread documentation that the Japanese consider the year of the *Fire Horse (Hinoeuma)* ominous for the birth of girls (Aso, 1978; Kaku and Matsumoto, 1975).[3] The Chinese regard the year of the *Dragon* as auspicious for new business ventures, marriage, and childbearing, while they think of the *Tiger* and the *Sheep* as inauspicious.

South Koreans have traditionally thought that the year of the *Horse* bears inauspicious implications for the destiny of girls. According to zodiac astrology, the *Horse* is generally believed to symbolize masculinity. It is energetic and optimistic and has high spirits. As such, the *Horse* implies undesirable traits for women as wives. In patriarchal and Confucian society, women are expected to be subservient to men. Women born in the year of the *Horse* are believed to suffer unhappiness and misfortune. Similar though less strongly held beliefs extend to women born in *Tiger* and *Dragon* years.[4]

Although the origin in South Korea of this mythical faith is not exactly known, it is said that it was imported from Japan quite recently, during the colonial period (1910-1945). Various suggestions have been made concerning the origin of the *Hi-*

brave, militant, and aggressive according to astrology, are more likely to join the army. Mock and Weisberg (1992) investigated how a person's zodiac sign is correlated with partisanship. Neither study found any significant result.

[3]Combined with the five major elements (metal, water, wood, fire, and soil) of which the world is composed, 12 animal years form a complete 60-year cycle. Thus, the year of the *Fire Horse* comes every 60 years.

[4]The *Tiger* and *Dragon* are believed to have characteristics similar to those of the *Horse*, and they are also considered bad zodiacs for girls in South Korea. The origin of the belief for these two zodiacal signs is uncertain, although it has been said that the Korean War happened in the year of the *Tiger*. As we will see, zodiacal preferences are not as apparent during the years of the *Tiger* and Dragon as during the year of the Horse.

noeuma in Japan: a coincidence between the year of the *Fire Horse* and disastrous famines (1786 and 1846); or a famous tale of Yaoya-Oshichi, a woman born in a *Fire Horse* year, who burned down her house for love, a tale often depicted in Kabuki plays and Odori dances. The belief was transformed and modified as it crossed the sea. South Koreans consider the *White (Metal) Horse*, rather than the *Fire Horse*, inauspicious for girls. The reason for this transformation is not known, but people in South Korea consider white horses a rare breed. The social origins of the belief that girls born in *Tiger* or *Dragon* years will suffer misfortune are not clear; again, though, the Korean War occurred in the year of the Tiger. It is likely that the distaste is irrationally associated with the distaste for the *Horse*. However, the distaste for the *Tiger* and the *Dragon* is not as strong as for the *Horse*.

Zodiac astrology is widespread in South Korea. People read their fortunes in newspapers every day, and they often consult with fortune tellers for advice about their careers or family matters. In 2003, there were 13,929 establishments in astrological services (compared with 605,614 restaurants and 7,511 banks, for example), according to the *Census on Basic Characteristics of Establishment*. The antipathy for the *Horse* is often documented in the press. Women born in the year of the *Horse* report that they are told that they are too strong and argumentative, that they are likely to fail in their first marriage or to be widowed, and that they should marry later in life to avoid their bad luck (see, e.g., 'Bad Year for Girls', 1990; Choe, 2003; Kim, 2001; Lee, 1990).

Regardless of superstition, the culture of zodiac astrology in South Korea provides a unique opportunity to study the effects of cultural sex preferences on

demographic outcomes. If parents are concerned about their children's destinies, they would not want to give birth, in particular to daughters, during the year of the inauspicious *Horse*. In this study, we examine how parents' preferences and cultural values could influence their demographic decisions.

There are a few previous studies of the impact of zodiac astrology on demographic outcomes. For example, research suggests that the inauspicious *Hinoeuma* may have lowered fertility in Japan (Coleman, 1983). This pattern was most apparent in 1966, when fertility dropped by over 25%. Kaku and Matsumoto (1975) found that the fertility rate of Japanese Americans in California and Hawaii also dropped by 3.3% and 1.8%, respectively, in the same year. In a series of articles, Goodkind (1993, 1995, 1996*a*) examined how the culture of zodiac astrology affected fertility among the Chinese in Taiwan, Malaysia, and Singapore. He also made comparisons across countries, including Hong Kong and the People's Republic of China (PRC; Goodkind, 1991). The empirical regularity is that fertility is significantly higher among the Chinese in Taiwan, Hong Kong, Malaysia, and Singapore in the auspicious *Dragon* years. Goodkind revealed three interesting findings: (1) zodiacal preferences have not been visible in fertility until recently (1976 and 1988), (2) zodiacal preferences outside the PRC were apparent only among the Chinese, and (3) the effect of zodiacal preferences on fertility is not uniform across countries. As a result, Goodkind rejected a simple explanation that a fertility response to the traditional belief in the auspicious *Dragon* became feasible and evident with the help of modern contraceptive technology and birth timing. Rather, he argued that the phenomenon should be understood in a more comprehensive context of historical, political, social,

and cultural forces.

We believe that the study of zodiacal preferences in South Korea provides another unique case for two reasons. First, unlike in other countries, zodiacal preferences in South Korea were imported. It would be interesting to see how cultural values have changed as the country has undergone economic development and modernization. Second, zodiacal preferences in South Korea are closely related to a preference for sons. As a result, this study will shed light on the interaction between zodiacal preferences and son preferences.[5] Using monthly longitudinal data at the regional level from 1970 to 2003, we found that, during the year of the *Horse*, fertility significantly decreased and the sex ratio at birth increased, although the magnitude of the effects varied across regions and changed over the years.

4.2 Data

In this study, we use a regional-level panel data set constructed from monthly vital statistics.[6] Every birth must be reported because the birth registration is used for various purposes, such as school attendance and mandatory military service. However, the birth data have been known to be incomplete, especially in earlier years, due to problems of delayed registration. The completeness of registration of births in the year of occurrence was below 50% in the early 1970s (Choi, 1991; Kim, 1997); the rate increased substantially to 70% in the late 1970s and to more than 90%

[5]To our knowledge, there is no demographic study on zodiacal preferences in South Korea. Park and Cho (1995*a*) and Kim (1997) only briefly mentioned the effect of zodiacal preferences on the sex ratio in South Korea.

[6]The data on annual statistics are accessible online at http://www.nso.go.kr/eng/index.html.

in the late 1980s.[7] Fortunately, the delayed reports of births have been continuously reported by the National Statistical Office (NSO). In this article, we use the most updated data available from the NSO.

Considering delayed birth reports, the NSO waits for 10 years to finalize birth records. For example, the number of births in 1970 was updated during the 1970s and was finalized in 1979. We obtained the data directly from the NSO in January 2005. In a previous version of this article, we used the birth statistics published in *Annual Report on the Vital Statistics* from various years (1986, 1994, 1999, 2000). Each annual report shows the birth statistics in the past decade. We found that there are missing births in the published statistics, particularly in earlier years. In Appendix Table A.1 and Appendix Figure A.1, we compare the old data with the new data. As a check of data quality, survivorship ratios from birth to 2003 are calculated based on the 2003 civil registration data that identify all legal residents. The survivorship ratios are more reasonable for the new data, particularly since 1977. It is notable that the birth statistics in the late 1970s and early 1980s have been updated and improved substantially. However, there are still some defects in the new data. First, the survivorship ratio in 1980 is higher for males than for females. Second, the survivorship for males is abnormally low in 1975. Lastly, there exists an anomaly in the last year of the study period because some births in 2003 were not reported by parents or were not yet updated by the NSO. The completeness of birth registration in the year of occurrence is estimated at 96.4% in the early 1990s (Kim, 1997; Lee, 1998).

[7]The improvement is the result of various factors, such as improvements in the registration system, the beginning of a social security system (1977), and legal enforcement (Kim, 1997).

The units of observation are administrative regions (metropolitan cities and provinces). Five metropolitan cities were created as independent administrative units from the surrounding provinces during the study period. As of 2003, there were nine provinces and seven metropolitan cities. The maximum number of observations for a given year is 16. Each city has a population in excess of 1 million. Table 4.1 summarizes the regional composition of the data set, which consists of a total of 5,508 month×region observations. To supplement the monthly data, we constructed yearly data from the same source, producing an additional 459 year×region observations.

Table 4.2 shows long-term trends for population size and the sex ratio at birth (the ratio of male births to female births) in South Korea. The average sex ratio is 1.11, higher than the world or biological average of 1.06, indicating that South Korea is one of the countries with a strong preference for sons, as is well-documented by other researchers (Kim, 1997; Larsen et al., 1998; Park, 1978; Park and Cho, 1995*a*). The high sex ratio is evident across all regions during the 1990s, the period during which sex-selective abortion is thought to have been widespread. For instance, there were 152,425 births (79,818 boys and 72,607 girls) in the capital city of Seoul in 1996. If the sex ratio were normal (1.06), we could expect 2,693 additional girls. It is also notable that during the 1970s and 1980s, the sex ratio was high in such conservative southeastern regions as Taegu, Kyungbuk, and Kyungnam and that the ratios remained high in the 2000s, although less so than in the 1990s in all regions except one.

One noteworthy fact about our data is that parents in South Korea may report their child's birth date according to either the Western or lunar calendar, even though

they are supposed to report the date based on the Western calendar.[8] The mixed use of the Western and lunar calendar is important for the purpose of this article because a person's zodiac must be assigned by the lunar year of the birth. Unfortunately, because we cannot determine whether parents in our sample reported these births according to the Western or lunar calendar, our calculation of the number of births during the year of the *Horse* is subject to some imprecision.

We use two different measures to analyze the monthly data, each based on a different extreme assumption about the calendar use: (1) that all births were reported based on the lunar calendar, and (2) that all births were reported based on the Western calendar. Each assumption has its own advantages. The first assumption is advantageous because we are interested in revealing zodiacal preferences, and parents who have zodiacal preferences are likely to prefer the lunar calendar. The second assumption is likely to be more valid in recent years because more people have recently gravitated toward using the Western calendar.[9] Under the first assumption (lunar-calendar reporting), the *Horse* is assigned to all births registered in 1978, 1990, and 2002. Under the second assumption, we convert the Western birth dates to the equivalent lunar birth dates. In terms of the Western calendar, the lunar

[8] According to the NSO, vital statistics, including birth, death, marriage, and divorce, are to be reported using the Western calendar. However, there is no means to enforce this, and the report form does not ask about which type of calendar is used. To avoid this problem, the census has asked whether the birth date is based on the lunar calendar or on the Western calendar and has recoded the reported lunar birth date. Unfortunately, the vital statistics do not have this procedure, so we cannot ignore the possibility of the lunar-calendar reporting, especially in earlier years. Indeed, Kim (1997) pointed out that the lunar calendar has been widely used.

[9] Appendix Table A.2 shows that the calendar used depends on age and education. The younger and more educated tend to prefer the Western calendar. However, note that this shows that they use the Western calendar for their birth date. It does not imply that their official birth date in birth registration is based on the Western calendar. Some use the lunar calendar for their birthday, but their official birth date is in the Western calendar, and vice versa.

years of the *Horse* are from February 7, 1978, to January 28, 1979; from January 26, 1990, to February 14, 1991; and from February 11, 2002, to February 1, 2003. We treat the periods between February 1978 and January 1979, February 1990 and February 1991, and February 2002 and January 2003 as the year of the *Horse*. As an added precaution, we compare the results from the two measures. Although the true effects of zodiacal preferences will be somewhere between the two sets of estimates, we believe that the estimates based on the lunar-calendar assumption will be more accurate, for reasons explained later.

4.2.1 Comparison With Neighboring Years

Figures 4.1 and 4.2 show the yearly trends of the sex ratio at birth (defined as the ratio of male births to female births) and the general fertility rate (births per woman aged 15-49). Figure 4.1 shows that the sex ratio has increased since 1980. The ratio is highly unbalanced in the mid-1990s, clearly suggesting a strong preference for sons and widespread fetal sex determination (Park and Cho, 1995*a*). The ratio started to decrease in 1994, when the government strengthened the penalty for illegal abortions (Cho, 1998); however, the ratio is still higher than the value of 1.06 believed to be normal. Figure 4.2 shows that fertility has dropped rapidly over the past three decades.

If people attempted to avoid having daughters in the year of the *Horse*, one would expect to see a decline in fertility and an increase in the sex ratio. There are detectable peaks in the sex ratio in the years of the *Horse*. The sex ratio seems to vary randomly before 1976, which probably reflects low data quality. The sex ratio

also rises in the years of the *Tiger* and *Dragon*, which are also considered inauspicious zodiacs for girls.[10] Our analysis focuses on the *Horse*.

Unlike the sex ratio, the zodiacal cycle of fertility is less apparent in Figure 4.2 except for an abrupt drop in 1978. Nevertheless, we can observe that fertility decreases slightly in 1990 and 2002.[11] Detecting the zodiacal cycle of fertility is more difficult in part because fertility is significantly affected by other confounding variables, such as income. In addition, because fertility in South Korea has been very low since the mid-1980s, the effect of zodiacal preferences may not be distinguishable from the long-term trend, even though the effect may be quantitatively substantial. For example, suppose that there were 354,310 male births and 334,254 female births from 11,904,344 females of reproductive age in a year.[12] Had there been 10,000 missing girls, the sex ratio would have changed from 1.06 to 1.09. On the other hand, the general fertility rate would have changed only slightly, from 0.058 to 0.057.

In Tables 4.3 and 4.4, we compare the general fertility rate and sex ratio at birth between the year of the *Horse* and its neighboring years, the years of the *Snake* and *Sheep*. In this section, we assume the lunar-calendar reporting. We examine whether the demographic outcomes deviate from their trends in the year of the *Horse*. The trend value is calculated as an arithmetic average of the neighboring years' values, assuming that the three-year trend can be linearly approximated.

The general fertility rate in the year of the *Horse* is lower than the trend

[10]The years of the *Tiger* are 1974, 1986, and 1998, and the years of the *Dragon* are 1976, 1988, and 2000.

[11]On the other hand, fertility does not deviate from the trend in the years of the textitTiger and *Dragon*. In fact, it is higher in 2000, the year of the textitTiger, which seems to reflect the millennium baby boom.

[12]The example is close to the actual birth statistics in 1990.

value. The rate drops by about 11% in 1978, by 3.6% in 1990, and by 7.5% in 2002. In terms of number of births, our results imply that fertility decreased by about 93,000 births in 1978, by 23,700 in 1990, and by 30,700 in 2002.[13] This pattern holds across regions. As expected, the sex ratio at birth is higher than the predicted trend, especially in 1978 and 1990. Although in some cities and provinces the ratio is actually lower in 2002 compared with the neighboring years, the ratio is still higher at the national level than the predicted ratio. The ratio increases by about 6.4% in 1978, 3.9% in 1990, and 1.1% in 2002. In Figure 4.3, comparing across regions, we show that the effects of zodiacal preferences on the sex ratio are stronger where the effects on fertility are stronger. We can see from simple statistics that zodiacal preferences affect demographic outcomes.

4.2.2 Intentional Misreporting of Birth Date

One of the main reasons why couples might avoid having girls in the year of the *Horse* is that their daughters might have difficulty finding a marriage partner, even if parents themselves do not believe zodiac astrology (Lee, 2005). One might wonder whether births of girls are intentionally misreported in months before and after the year of the *Horse*. In doing so, parents can hide their daughters' inauspicious zodiac.

Figure 4.4 shows the sex ratio at birth by months. First, it is notable that there are spikes in the sex ratio (more boys or fewer girls) in January of 1978, 1990, and 2002. This implies that births, perhaps in particular those to parents with zodiacal preferences, are reported based on the lunar calendar: if they were reported on the

[13]The actual fertility drop in 2002 is larger than our estimate here because the reporting of some births in 2003 is delayed.

basis of the Western calendar, the January spikes cannot be reasonably explained because January in 1978, 1990, and 2002 is, in fact, in the year of the *Snake* in the lunar calendar. This finding is informative: although we cannot identify whether births are reported on the basis of the Western or lunar calendar, we expect that the assumption of the lunar-calendar reporting should be more valid. From this point, we will discuss mainly the results based on the lunar-calendar reporting.

In Figure 4.4, we show some evidence for parents' strategic misreporting. Note that the January spikes correspond to the preceding December dips in 1977, 1989, and 2001. This pattern cannot be found elsewhere, suggesting that the parents of some girls who were actually born in January backdated the month of birth to December in order to avoid the *Horse*. Suppose that the patterns in January and December are due totally to intentional misreporting. For simplicity, assume that the sex ratio for December should have been the same as that for November in the same year if there were no misreporting. Note that parents have no incentive to advance the month of male births. Now it is possible to predict the number of added female births that are reported as occurring in December but actually occurred in January. On the other hand, assuming that the sex ratio for January should have been the same as for February if there was no intentional misreporting, we can also predict the number of missing female births in January by using the sex ratio for February and the number of male births in January.

The comparison between added and missing girls supports the existence of intentional misreporting. The numbers of added and missing girls are very similar over all three periods. About 4,615 girls were added in December 1977, while 4,586

girls were missing in January 1978; about 4,460 girls were added in December 1989, and 4,656 were missing in January 1990; and about 775 were added in December 2001, with about 1,123 missing in January 2002. Intentional misreporting plays a significant role in the abnormal sex ratios. The number of misreported births amounts to about 0.5% of total births.

However, keep in mind that parents' misreporting alone cannot fully explain the higher sex ratios during the *Horse* years. First, we observe some spikes in December and January during the year of the *Horse*. If the December spikes were also due to misreporting (delayed registration), we should observe corresponding dips for the following January or February. There are actually some observable dips in January and February in 1979, but we cannot find any noticeable dips in 1991 and 2003. It is likely that misreporting was more prevalent in the late 1970s than after 1990. Also, notice that the sex ratio is higher for most of 1978, which cannot be satisfactorily explained by parents' misreporting because it is unlikely that parents misreport their children's birth date by more than one or two months; most parents register their children as soon as possible in order to obtain benefits from the national health insurance and social security system. In 1990, there are small but visible spikes in February, March, April, and November. In 2002, we can also observe small but discernible spikes throughout from May to August.

4.3 Multivariate Analysis

We estimate the effects of the *Horse* on the sex ratio (S) and the general fertility rate (F). The basic estimation equations are as follows:

$$lnS_{it} = \alpha_S HORSE_t + \epsilon_{SY} lnY_{it} + \mathbf{X_{it}}\beta_S + u_{Sit},$$
$$lnF_{it} = \alpha_F HORSE_t + \epsilon_{FY} lnY_{it} + \mathbf{X_{it}}\beta_F + u_{Fit},$$

where the subscripts represent region i at time t (year-month). The dependent variables, lnS_{it} and lnF_{it}, are the natural logarithm of the monthly sex ratio at birth and the monthly general fertility rate, respectively. lnY_{it} is the natural logarithm of the average annual wage/salary per employee in manufacturing in real terms. The coefficients, ϵ, represent income elasticities, each of which shows the size of percentage change in each demographic outcome caused by the percentage change in income. Unfortunately the data on per capita gross regional domestic product are not available for the years preceding 1985. A vector $\mathbf{X_{it}}$ is a set of control variables, including a constant, the number of females aged 15-49, variables for annual and monthly trends, and dummy variables for metropolitan cities and provinces. The number of females aged 15-49 is included to capture any effect of female cohort size on the demographic outcomes.[14] In addition, considering the nonlinearity of the effects of income, we include its squared term. The dummy variable $HORSE_t$ equals 1 if time t is the year of the *Horse* and equals 0 otherwise. Basically, α_S and

[14]Female cohort size could affect fertility through its impact on the marriage market or the demand for obstetrician services. It also might affect the sex ratio in that sex predetermination is more accessible in larger population centers. Yet, our results are qualitatively the same without controlling for number of females.

α_F capture the effects of zodiacal preferences. In order to assess whether zodiacal preferences have changed over years, we estimate

$$lnS_{it} = \alpha_{S,78}HORSE_{78} + \alpha_{S,90}HORSE_{90} + \alpha_{S,02}HORSE_{02} + \epsilon_{SY}lnY_{it} + \mathbf{X_{it}}\beta_S + u_{Sit},$$

$$lnF_{it} = \alpha_{F,78}HORSE_{78} + \alpha_{F,90}HORSE_{90} + \alpha_{F,02}HORSE_{02} + \epsilon_{FY}lnY_{it} + \mathbf{X_{it}}\beta_F + u_{Fit}.$$

As noted earlier, the effects of zodiacal preferences should appear in the form of deviations from long-term time trends. Thus, we include yearly trend variables. Figures 4.1 and 4.2 show that fertility has been declining steadily but at a decreasing rate, but the sex ratio reached its peak in the mid-1990s and decreased thereafter. Therefore, we allow for a cubic trend for the sex ratio and a quadratic trend for fertility. Lastly, we include dummy variables for region to control for any omitted time-invariant regional characteristics. For instance, it is likely that regions are heterogeneous in demographic characteristics. Fertility might be persistently different between urban and rural areas, and the accessibility of fetal sex determination and abortion could be higher for those in urban areas; on the other hand, those in urban areas are likely to be more highly educated.

Some econometric issues remain. First, the unit of observation is a *region* (metropolitan city or province). Because regions vary greatly in population size, we estimate the equations by using weighted least squares. This method ensures that our estimates are nationally representative. Specifically, the equation for the sex ratio is weighted by the number of monthly births, and the equation for fertility is weighted by the number of females of reproductive age in the population. Second,

because some explanatory variables, including $HORSE$, are constant within a year, we correct the standard errors by clustering for years. This problem is also avoided by using yearly data.

4.4 Estimation Results

4.4.1 Sex Ratio at Birth

Table 4.5 shows the results for the sex ratio at birth. The results from the multivariate regressions are consistent with our expectations. Based on the lunar-calendar reporting, the sex ratio rises by 3.7% in the year of the *Horse*. The effect is the strongest and robust to the assumption of the lunar or Western calendar in 1990, when the *Horse* is associated with an increase in the sex ratio of about 4.1%. This is in part because 1990 is the year of the *White Horse*, the most hated year in South Korea. Our estimates suggest that the sex ratio should have been about 111.9 without zodiacal preferences, implying that about 12,500 girls are missing because of zodiacal preferences. Recall that about 4,500 girls who were born in 1990 were likely to be registered in 1989 by intentional misreporting. Even after we take misreported births into account, the results imply that an excess of about 8,000 female fetuses were aborted in 1990.[15] The number amounts to 1.1% of the number of pregnancies that should have resulted in a birth in 1990.

[15]We control for the possibility of intentional misreporting by including the indicator for neighboring years. By misreporting, the sex ratio in the years that neighbor the inauspicious *Horse* should be lower. Suppose that a girl's birth date is changed from 1978 to 1977 or 1979. Then, statistically, we lose one female birth in 1978, but gain one in 1977 or 1979. We already considered the possibility of misreporting in the multivariate regression analysis, even though it is not significant. As a result, the actual number of aborted female fetuses should be greater than our estimates here.

The effect is also substantial in 1978. The *Horse* is associated with an increase in the sex ratio of about 3.9%. This means that an excess of about 13,800 girls were either aborted or had misreported birth dates. Because about 4,600 girls are likely to have been misreported and transferred to 1977, an excess of about 9,200 female fetuses may have been aborted in 1978, corresponding to 1.1% of the number of pregnancies that should have been born in 1978 in the absence of prejudice associated with the *Horse*. If we take the assumption of the Western-calendar reporting, the effect in 1978 becomes insignificant. Thus, we need to be cautious about these results, even though the assumption of the lunar-calendar reporting is more reasonable for the purpose of this paper and the lunar calendar was more widely used in the late 1970s than more recently.

Our findings suggest that sex-selection technology, such as ultrasound scanning and amniocentesis, enabled doctors and parents to identify and select the sex of their children through selective abortion. This is not surprising at all for 1990 because it is well known that child-sex detection and sex-selective abortion have been available and widely practiced since the late 1980s. What is surprising here is that sex-selective abortion was possible and was practiced as early as 1978. Anecdotal evidence is documented in the press. Ultrasound scanning was first introduced in 1969, and the number of ultrasound machines steadily increased to about 1,000 in the 1980s. More important, amniocentesis was accessible and quite widespread in the late 1970s. In fact, amniocentesis and its misuse were often mentioned in newspapers. It has been reported that some obstetricians in large cities advertised prenatal sex detection at a very low price in 1974 ('Fetus Sex Determination, Prenatal Test,

Abused in Hospitals' (in Korean), 1974). Finally, the government recognized sex predetermination by amniocentesis as a social problem in 1980 and prohibited it in 1984 ('Prohibit Amniocentesis for Fetus Sex Determination' (in Korean), 1980). Evidence suggests that the technology for fetal sex determination was available for those parents whose zodiacal preferences were strong enough to demand such technology.[16] Chronic villi sampling and amniocentesis were widely used even in the 1990s, when ultrasound scanning was available, although they carried a fairly high risk of complications and were not covered by health insurance (Cho, 1998); chronic villi sampling and amniocentesis can determine the fetus's sex earlier than ultrasound scanning.

This effect becomes smaller in 2002. This positive result seems to be due, in part, to the government's effort. The government revised the Medical Law in 1987 and passed the Presidential Decree of Medical Administration Measure Standard in 1990 (Kim, 1997), making it illegal for a doctor even to inform parents of their baby's sex before the child's birth. The government continued to strengthen its position against sex-selective abortion in the 1990s (Cho, 1998). As a consequence, the sex ratio at birth has stabilized around 110 since 1996. However, the legal restriction alone is not sufficient to explain the success in 2002. Since the law was enacted, only about 30 doctors have lost their licenses (Carmichael et al., 2004). The apprehension rate is very low, and even when the practice is caught, doctors are rarely prosecuted or otherwise penalized (Jeon and Seo, 2003).

Social commentators and major newspapers have criticized the phenomenon

[16]Modern methods for determining the sex of a fetus have been available in India since the 1970s (Arnold et al., 2002) and in China since the 1980s (Coale and Banister, 1994). It has been reported that preventing doctors from revealing the sex of the fetus to the client is, in practice, difficult ('Bad Year for Girls', 1990; Carmichael et al., 2004).

of the *Horse* year because they have recognized low fertility as a serious social problem. In this regard, it is interesting to draw comparisons with Singapore, where the government stimulated the folk belief in the auspicious *Dragon* in order to boost fertility (Goodkind, 1996*a*). In South Korea, social commentators and civil organizations, such as Prolife and Korea Women's Association United, are strictly against zodiacal preferences, and they sometimes even appeal to patriotism as a reason for opposing it, pointing out that the tradition was actually imported from Japan and is a shameful colonial heritage to be liquidated (Lee, 1990). The worry about energetic and strong daughters appears to be fading as more married women are now working for pay and people recognize the social equality between men and women.

Other findings are worth noting. First, the larger the number of women aged 15-49, the higher the sex ratio. This may be explained in part by the greater accessibility of sex-determination technology when there is potentially higher demand. Second, the income elasticity of the sex ratio at birth-that is, the percentage change in the sex ratio divided by the percentage change in income-is insignificant. Lastly, the sex ratio is, on average, higher in urban areas and varies substantially across regions. As expected, it is very unbalanced in the southeastern regions, such as Taegu, Kyungbuk, and Kyungnam.[17] These regions are known to be relatively conservative, where traditional values, such as patriarchy and Confucianism, are still strong. However, our results do not show that zodiacal preferences are stronger in these regions than elsewhere.

[17]The estimates for regions other than the southeastern regions are available on request.

4.4.2 Births

Table 4.6 presents the results for fertility. The general fertility rate is significantly lower, by 8.9% in the inauspicious year of the *Horse*. The effect is the smallest (6.7%) in 1990 and the largest (14.2%) in 1978. It is interesting that the effect on fertility is the smallest when the effect on the sex ratio is the largest. This shows that birth timing and sex-selective abortion are two alternative options for parents with zodiacal preferences.

There are at least three reasons why fertility is lower in the year of the *Horse*. First, fertility is lower as a result of misreporting date of birth. In the previous section, we showed that some girls born in the year of the Horse are registered in the previous year. Second, parents may advance or delay their childbearing to avoid the inauspicious zodiac by changing coital behavior or contraception. Lastly, fertility decreases because of abortion. Using our estimates, it is possible to decompose the effects of the *Horse* on fertility into these three causes. First, we can predict the fertility rate that should have been without zodiacal preferences. The fertility rate decreased by 14.2% in 1978 and 6.7% in 1990. This implies that the fertility rate should have been 0.0933 in 1978 and 0.0589 in 1990. The number of missing births amounts to 124,900 in 1978 and 47,500 in 1990. In the previous section, we estimated that, due to either misreporting or sex-selective abortion, there were about 13,800 missing girls (i.e., 4,600 misreported + 9,200 aborted) in 1978 and 12,500 missing girls (i.e., 4,500 misreported + 8,000 aborted) in 1990. Therefore, the number of advanced or delayed births by birth timing is 111,100 (i.e., 124,900 - 13,800) in 1978

and 35,000 (i.e., 47,500 - 12,500) in 1990.[18] Using the trend average of the sex ratio, we estimate that about 54,300 and 16,500 female pregnancies were strategically timed to avoid the *Horse* in 1978 and 1990, respectively.[19]

Table 4.7 summarizes our main results. There were approximately 68,100 missing girls or female pregnancies in 1978 and 29,000 in 1990. Among these, for 1978, 79.7% can be explained by birth timing, and about 6.8% can be explained by intentional misreporting. The remaining 13.5% can be ascribed to sex-selective abortion. For 1990, about 56.8% of missing girls can be explained by birth timing, 15.7% by misreporting, and 27.5% by induced abortion. The number of abortions due only to zodiacal preferences is estimated at about 8,000.[20] It is notable that birth timing is the favored strategy to avoid the *Horse*. Parents would and could schedule childbearing strategically to avoid the inauspicious zodiac by measures, like the use of contraception, that cost less both monetarily and psychologically than abortion. Also, it is interesting that sex-selective abortion explains relatively more in 1990. This is reasonable because fetal sex determination and abortion became more available in 1990, as is clear from the sharp rise in sex ratios starting in the mid-1980s.

While the effect on the sex ratio is the weakest in 2002, the effect on fertility that year is quite large. Furthermore, about 5% of births in 2003 are not yet registered. As a result, the decrease in fertility in 2002, relative to the neighboring

[18] According to Donaldson et al. (1982), about 46% of women used contraception in 1974.

[19] The trend average is the average of the sex ratios of the two neighboring years. It is 1.05 for 1978, 1.12 for 1990, and 1.09 for 2002. Based on these estimates, there were 56,800 missing boys in 1978, 18,500 in 1990, and 28,000 in 2002.

[20] Kim (1997) estimated that there were 22,626 abortions per year, on average, between 1989 and 1991.

years, is actually larger than our estimate. The decrease in fertility in 2002 is, by and large, due to birth timing. There are approximately 29,900 missing girls or female pregnancies: 86% by birth timing, 3% by misreporting, and 11% by abortion. The large effect in 2002 has an important implication: zodiacal preferences have not disappeared, indicating that zodiacal preferences survive rapid social changes accompanied by economic development and social propaganda against the culture of the *Horse*.

Other findings are also worth noting. The income effect on fertility is significantly negative but not linear. An increase in income would decrease fertility, especially at lower income levels; after a certain level, income does not affect fertility. Regions are heterogeneous in fertility level. The fertility rate for Seoul is significantly lower than the average, and fertility is generally lower in urban areas than in rural areas. The size of the population of women of reproductive age does not affect fertility. An interesting finding is that fertility was abnormally high in January and February (24% higher than in December). This is a well-known phenomenon in South Korea, where parents prefer to report their children's birth date in January or February for those born in March or later so that their children may start school a year earlier. The reason for this unusual phenomenon is that college entrance exams are very competitive and many students fail to enter colleges at their first attempt and have to wait another year for a second chance. The same phenomenon is also observed in Japan, where the educational system is similar (Kaku, 1972).

Lastly, the yearly data are used to test robustness because most of our key explanatory variables do not vary by month. Table 4.8 shows the results. The

estimation model is the same as the monthly-data regression model but with monthly dummy variables dropped. The results confirm our previous findings. One notable difference is that the effect on the sex ratio in 2002 becomes statistically significant, although the effect is still weaker than in the previous years. The results from the yearly data actually strengthen our conclusion that zodiacal preferences have not yet disappeared. Using the assumption of the Western calendar reporting does not change the results significantly.

4.5 Discussion

This study examines the effects of zodiacal preferences on the sex ratio at birth and fertility. In the year of the *Horse*, the fertility rate drops significantly, while the sex ratio at birth increases, indicating that parents try to avoid having daughters with the inauspicious zodiacal sign. We found evidence from the sex ratio at birth that child sex determination and sex-selective abortion were available and affordable to South Korean households as early as the late 1970s, before the unbalanced sex ratio became widely recognized as a social problem. We also found that zodiacal preferences have different behavioral implications over time. First, birth timing has been the most common strategy to avoid childbirth during the year of the *Horse* over the past three decades. The importance of intentional misreporting has decreased over time as the national birth registration system has become better institutionalized. Sex-selective abortions were more widely used in 1990.

Although the effects were reduced, zodiacal preferences still had significant

impacts on fertility and the sex ratio in 2002. A positive change is that induced abortions were substantially reduced. However, a large number of births were still affected by zodiacal preferences. In fact, the number of timed births was significantly larger than that in 1990. This finding is in contrast with the notion that traditional values will be gradually weakened by modernization. On the contrary, our findings show that zodiacal preferences have survived rapid economic development and legal sanction and will potentially appear again in the future.

The finding that a cultural belief significantly affects demographic outcomes suggests that cultural reform or popular education by government and civil organizations should play an important role for population policymakers. Zodiacal preferences have no reasonable socioeconomic root in South Korea. Nevertheless, if the folk belief is socially embedded, it works autonomously and self-reinforces its existence. Studies on culture and belief systems will lead us to a better understanding of demographic behaviors and policymaking (Hammel, 1990).

Table 4.1: **Data Availability by Regions**[1]

Region	Available Years	No. of Observations (Yearly)	No. of Observations (Monthly)
Seoul	1970–2003	34 years	34 years×12 months = 408
Pusan	1970–2003	34 years	34 years×12 months = 408
Taegu	1981–2003	23 years	23 years×12 months = 276
Incheon	1981–2003	23 years	23 years×12 months = 276
Gwangju	1987–2003	17 years	17 years×12 months = 204
Daejon	1989–2003	15 years	15 years×12 months = 180
Ulsan	1997–2003	7 years	7 years×12 months = 84
9 Provinces	1970–2003	34 years×9 provinces = 306	34 years×12 months×9 provinces = 3,672
Total		459	5,508

[1] The nine Provinces are Gyungki, Gangwon, Choongbuk, Choongnam, Chonbuk, Chonnam, Kyungbuk, Kyungnam, and Cheju. Metropolitan cities except Seoul and Pusan are separated from provinces during the sample periods.

Table 4.2: **Regional Distribution of Population and the Sex Ratio at Birth**[1]

	Population				Sex Ratio			
	1970s	1980s	1990s	2000s	1970s	1980s	1990s	2000s
Metropolitan								
Seoul	6,905,110	9,524,536	10,292,583	10,051,220	1.088	1.084	**1.103**	1.079
Pusan	2,582,711	3,588,557	3,814,412	3,708,935	1.089	1.081	**1.155**	**1.103**
Taegu	n.a.	2,117,478	2,432,005	2,538,287	n.a.	**1.179**	**1.198**	**1.130**
Incheon	n.a.	1,538,018	2,242,656	2,570,421	n.a.	1.072	**1.103**	1.077
Gwangju	n.a.	1,082,304	1,250,742	1,405,902	n.a.	1.069	1.099	**1.103**
Daejon	n.a.	n.a.	1,234,732	1,430,210	n.a.	n.a.	**1.135**	1.091
Ulsan	n.a.	n.a.	1,021,855	1,051,235	n.a.	n.a.	**1.144**	**1.143**
Province								
Gyungki	4,084,502	4,783,321	7,513,881	9,502,590	1.064	1.064	**1.104**	1.084
Gangwon	1,888,649	1,743,385	1,512,293	1,519,885	1.064	1.064	**1.109**	1.093
Choongbuk	1,520,096	1,412,831	1,420,213	1,507,483	1.065	1.089	**1.130**	**1.102**
Choongnam	2,982,104	2,926,824	1,868,401	1,894,231	1.088	1.085	**1.127**	1.092
Chonbuk	2,467,015	2,226,407	1,961,202	1,920,175	1.074	1.071	1.090	1.079
Chonnam	4,030,986	3,454,087	2,193,679	2,015,162	1.055	1.081	**1.108**	1.091
Kyungbuk	4,883,494	3,169,488	2,733,275	2,775,701	**1.108**	**1.153**	**1.198**	**1.128**
Kyungnam	3,185,967	3,426,688	3,532,250	3,058,073	**1.147**	**1.104**	**1.175**	**1.129**
Cheju	416,250	490,042	513,474	529,461	1.054	1.080	**1.117**	**1.115**

[1] All values are averages of all available yearly data during each 10-year period."n.a." indicates that data are not available in most years. The sex ratios above 1.1 are emphasized in boldface.

Table 4.3: **Comparison with Neighboring Years: Fertility (annual data)**[1]

	1977	1978	1979	1989	1990	1991	2001	2002	2003
	Snake	Horse	Sheep	Snake	Horse	Sheep	Snake	Horse	Sheep
Seoul	0.0732	0.0667	0.0799	0.0526	0.0527	0.0562	0.0369	0.0324	0.0324
Pusan	0.0752	0.0703	0.0818	0.0503	0.0486	0.0517	0.0321	0.0276	0.0275
Taegu				0.0487	0.0485	0.0505	0.0371	0.0323	0.0329
Incheon				0.0600	0.0636	0.0714	0.0401	0.0347	0.0350
Gwangju				0.0504	0.0539	0.0601	0.0434	0.0388	0.0388
Daejon				0.0504	0.0529	0.0587	0.0403	0.0365	0.0365
Ulsan							0.0434	0.0364	0.0366
Gyungki	0.0811	0.0736	0.0884	0.0663	0.0679	0.0733	0.0458	0.0401	0.0403
Gangwon	0.0975	0.0881	0.0937	0.0488	0.0477	0.0494	0.0421	0.0372	0.0354
Choongbuk	0.1032	0.0887	0.0964	0.0496	0.0501	0.0539	0.0425	0.0377	0.0363
Choongnam	0.1009	0.0886	0.0938	0.0451	0.0434	0.0462	0.0466	0.0391	0.0383
Chonbuk	0.1073	0.0927	0.0944	0.0462	0.0463	0.0482	0.0450	0.0377	0.0364
Chonnam	0.1138	0.0962	0.1004	0.0484	0.0464	0.0502	0.0478	0.0390	0.0383
Kyungbuk	0.0891	0.0765	0.0843	0.0549	0.0531	0.0558	0.0426	0.0361	0.0363
Kyungnam	0.1002	0.0908	0.1029	0.0607	0.0602	0.0659	0.0440	0.0374	0.0373
Cheju	0.0912	0.0744	0.0805	0.0461	0.0482	0.0575	0.0522	0.0433	0.0439
					Deviations from Trend				
Seoul		-0.0098			-0.0017			-0.0023	
Pusan		-0.0082			-0.0024			-0.0023	
Taegu					-0.0011			-0.0027	
Incheon					-0.0021			-0.0028	
Gwangju					-0.0014			-0.0023	
Daejon					-0.0017			-0.0019	
Ulsan								-0.0036	
Gyungki		-0.0112			-0.0019			-0.0029	
Gangwon		-0.0075			-0.0014			-0.0016	
Choongbuk		-0.0112			-0.0017			-0.0017	
Choongnam		-0.0087			-0.0022			-0.0033	
Chonbuk		-0.0081			-0.0010			-0.0030	
Chonnam		-0.0109			-0.0029			-0.0040	
Kyungbuk		-0.0102			-0.0023			-0.0033	
Kyungnam		-0.0107			-0.0031			-0.0033	
Cheju		-0.0115			-0.0036			-0.0048	

Table 4.4: **Comparison with Neighboring Years: Sex Ratio (annual data)**[1]

	1977	1978	1979	1989	1990	1991	2001	2002	2003
	Snake	Horse	Sheep	Snake	Horse	Sheep	Snake	Horse	Sheep
Seoul	1.0388	1.1261	1.0577	1.0959	1.1327	1.1009	1.0757	1.0873	1.0654
Pusan	1.0300	1.1285	1.0461	1.1115	1.1842	1.1594	1.1050	1.0814	1.0968
Taegu				1.2175	1.2968	1.2489	1.1108	1.1497	1.1252
Incheon				1.0688	1.1195	1.0814	1.0849	1.0720	1.0628
Gwangju				1.0815	1.1327	1.1084	1.0882	1.1026	1.1210
Daejon				1.2271	1.2266	1.1345	1.0852	1.1289	1.0775
Ulsan							1.1592	1.1317	1.1558
Gyungki	1.0398	1.0987	1.0532	1.0747	1.1134	1.0940	1.0786	1.0879	1.0763
Gangwon	1.0387	1.0681	1.0619	1.0973	1.1296	1.0968	1.1144	1.0744	1.0761
Choongbuk	1.0571	1.1027	1.0885	1.1165	1.1703	1.1242	1.0995	1.0927	1.0895
Choongnam	1.0448	1.0865	1.0396	1.0996	1.1663	1.1248	1.0703	1.1134	1.0835
Chonbuk	1.0309	1.0824	1.0510	1.0826	1.1376	1.0718	1.0666	1.1063	1.0625
Chonnam	1.0472	1.1213	1.0234	1.0957	1.1406	1.1042	1.0860	1.0864	1.0991
Kyungbuk	1.0551	1.1545	1.0550	1.2717	1.3074	1.2267	1.1193	1.1455	1.1094
Kyungnam	1.0364	1.0995	1.0460	1.1718	1.2466	1.1711	1.1192	1.1318	1.1375
Cheju	1.0646	1.1342	1.0592	1.1266	1.1880	1.0367	1.1119	1.1842	1.1059
				Deviations from Trend					
Seoul		0.0779			0.0343			0.0167	
Pusan		0.0905			0.0488			-0.0195	
Taegu					0.0636			0.0317	
Incheon					0.0444			-0.0018	
Gwangju					0.0378			-0.0020	
Daejon					0.0458			0.0475	
Ulsan								-0.0258	
Gyungki		0.0522			0.0290			0.0104	
Gangwon		0.0178			0.0326			-0.0209	
Choongbuk		0.0298			0.0499			-0.0018	
Choongnam		0.0443			0.0541			0.0365	
Chonbuk		0.0415			0.0604			0.0417	
Chonnam		0.0860			0.0406			-0.0062	
Kyungbuk		0.0995			0.0582			0.0311	
Kyungnam		0.0583			0.0751			0.0035	
Cheju		0.0723			0.1064			0.0753	

Table 4.5: **Regression of Sex Ratio at Birth by Weighted Least Squares, 1970-2003**

	Lunar Calendar Reporting			Western Calendar Reporting		
	(1)	(2)	(3)	(4)	(5)	(6)
Horse	0.037			0.019		
	(0.006)			(0.007)		
Horse 1978		0.042	0.039		0.019	0.019
		(0.009)	(0.010)		(0.015)	(0.017)
Horse 1990		0.042	0.041		0.026	0.026
		(0.005)	(0.005)		(0.005)	(0.005)
Horse 2002		0.021	0.017		0.012	0.012
		(0.009)	(0.012)		(0.011)	(0.011)
Neigboring years			-0.007			0.000
			(0.009)			(0.009)
Per capita income	-0.002	-0.005	-0.003	0.000	-0.001	-0.001
	(0.024)	(0.025)	(0.025)	(0.024)	(0.025)	(0.025)
Per capita inc. squared	0.003	0.003	0.004	0.003	0.003	0.003
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Taegu	0.062	0.061	0.062	0.063	0.062	0.062
	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)	(0.013)
Kyungbuk	0.034	0.033	0.034	0.035	0.034	0.034
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Pusan	0.006	0.005	0.007	0.007	0.007	0.007
	(0.009)	(0.010)	(0.010)	(0.009)	(0.009)	(0.010)
Ulsan	0.032	0.032	0.029	0.031	0.031	0.031
	(0.022)	(0.022)	(0.022)	(0.022)	(0.022)	(0.021)
Kyungnam	0.038	0.038	0.038	0.038	0.038	0.038
	(0.020)	(0.020)	(0.019)	(0.020)	(0.020)	(0.019)
Fecund female population	0.002	0.002	0.002	0.002	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Fecund fem. pop. squared	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
January	0.061	0.061	0.061	0.060	0.061	0.061
	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)	(0.012)
February	0.017	0.017	0.017	0.016	0.017	0.017
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
March	0.007	0.007	0.007	0.007	0.007	0.007
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
April	0.029	0.029	0.029	0.029	0.029	0.029
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
May	0.035	0.035	0.035	0.035	0.035	0.035
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
June	0.045	0.045	0.045	0.046	0.046	0.046
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)

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	(1)	(2)	(3)	(4)	(5)	(6)
July	0.039	0.039	0.038	0.039	0.039	0.039
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
August	0.035	0.035	0.035	0.035	0.035	0.035
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
September	0.039	0.039	0.039	0.040	0.040	0.040
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
October	0.030	0.030	0.030	0.030	0.030	0.030
	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)	(0.010)
November	0.024	0.024	0.024	0.024	0.024	0.024
	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)	(0.009)
Year	-0.479	-0.466	-0.432	-0.453	-0.443	-0.442
	(0.102)	(0.105)	(0.117)	(0.099)	(0.102)	(0.107)
Year squared	0.006	0.006	0.005	0.005	0.005	0.005
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Year cubed	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.287	0.288	0.289	0.276	0.272	0.272

Notes. Robust standard errors are in parentheses.The dummy variables for cities and provinces are included, and the reference region is Seoul.

Table 4.6: **Regression of General Fertility Rate by Weighted Least Squares, 1970-2003**

	Lunar Calendar Reporting			Western Calendar Reporting		
	(1)	(2)	(3)	(4)	(5)	(6)
Horse	-0.089			-0.077		
	(0.020)			(0.019)		
Horse 1978		-0.132	-0.142		-0.104	-0.113
		(0.033)	(0.036)		(0.042)	(0.045)
Horse 1990		-0.062	-0.067		-0.064	-0.069
		(0.019)	(0.019)		(0.019)	(0.020)
Horse 2002		-0.083	-0.105		-0.068	-0.083
		(0.019)	(0.030)		(0.019)	(0.033)
Neigboring years			-0.034			-0.031
			(0.028)			(0.027)
Per capita income	-0.300	-0.295	-0.292	-0.302	-0.298	-0.296
	(0.071)	(0.068)	(0.066)	(0.071)	(0.067)	(0.064)
Per capita inc. squared	0.123	0.123	0.128	0.124	0.124	0.129
	(0.027)	(0.027)	(0.027)	(0.026)	(0.026)	(0.026)
Pusan	0.217	0.219	0.225	0.218	0.219	0.224
	(0.053)	(0.053)	(0.054)	(0.052)	(0.052)	(0.053)
Taegu	0.341	0.344	0.351	0.342	0.344	0.350
	(0.076)	(0.076)	(0.076)	(0.076)	(0.076)	(0.075)
Ulsan	0.383	0.382	0.370	0.379	0.379	0.367
	(0.109)	(0.110)	(0.112)	(0.109)	(0.109)	(0.111)
Kyungbuk	0.400	0.401	0.404	0.399	0.400	0.403
	(0.061)	(0.061)	(0.061)	(0.061)	(0.061)	(0.061)
Kyungnam	0.476	0.476	0.474	0.475	0.475	0.472
	(0.075)	(0.075)	(0.076)	(0.075)	(0.075)	(0.076)
Fecund female population	0.015	0.015	0.015	0.015	0.015	0.015
	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)	(0.006)
Fecund fem. pop. squared	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
January	0.235	0.235	0.235	0.235	0.235	0.234
	(0.018)	(0.018)	(0.018)	(0.018)	(0.019)	(0.019)
February	0.222	0.222	0.222	0.224	0.224	0.225
	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)	(0.025)
March	0.051	0.051	0.051	0.051	0.051	0.051
	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
April	-0.023	-0.023	-0.020	-0.023	-0.023	-0.023
	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)	(0.019)
May	-0.028	-0.028	-0.025	-0.028	-0.028	-0.028
	(0.017)	(0.017)	(0.016)	(0.017)	(0.017)	(0.017)
June	-0.108	-0.108	-0.103	-0.108	-0.108	-0.108
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)

(*continued on next page*)

(*continued from previous page*)

	(1)	(2)	(3)	(4)	(5)	(6)
July	-0.053	-0.053	-0.049	-0.053	-0.053	-0.053
	(0.016)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)
August	-0.027	-0.027	-0.024	-0.027	-0.027	-0.027
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)
September	-0.007	-0.007	-0.002	-0.007	-0.007	-0.007
	(0.016)	(0.016)	(0.015)	(0.016)	(0.016)	(0.016)
October	0.049	0.049	0.050	0.049	0.049	0.049
	(0.015)	(0.015)	(0.014)	(0.015)	(0.015)	(0.015)
November	0.008	0.008	0.009	0.008	0.008	0.008
	(0.019)	(0.019)	(0.017)	(0.019)	(0.019)	(0.019)
Year	15.221	16.017	21.065	15.132	15.629	14.699
	(3.756)	(4.155)	(4.302)	(3.699)	(3.997)	(3.970)
Year squared	-0.272	-0.286	-0.372	-0.270	-0.279	-0.262
	(0.065)	(0.072)	(0.074)	(0.064)	(0.069)	(0.069)
Year cubed	0.002	0.002	0.003	0.002	0.002	0.002
	(0.000)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Year quartic	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
R^2	0.877	0.878	0.879	0.876	0.876	0.877

Notes. Robust standard errors are in parentheses.The dummy variables for cities and provinces are included, and the reference region is Seoul.

Table 4.7: **Summary**[1]

	Number of Missing Girls			% of Predicted Pregnancies		
Year	Timing	Misreporting	Abortion	Timing	Misreporting	Abortion
1978	54,284	4,601	9,214	6.19	0.52	1.11
1990	16,501	4,558	7,979	2.34	0.65	1.13
2002	25,738	949	3,171	4.66	0.17	0.57

[1] The number of missing girls due to birth timing is based on the average of the sex ratios of neighboring years. The number of missing girls due to misreporting is calculated by comparing the numbers of girls born in January in the year of the *Horse* and in December in the previous year, the year of *Snake*.

Table 4.8: **Regression Analysis Using Yearly Data: Lunar Calendar Reporting**[1]

	Sex Ratio at Birth			Fertility		
	(1)	(2)	(3)	(4)	(5)	(6)
Horse	0.037			-0.088		
	(0.005)			(0.020)		
Horse 1978		0.041	0.038		-0.134	-0.144
		(0.009)	(0.009)		(0.024)	(0.025)
Horse 1990		0.042	0.041		-0.057	-0.063
		(0.009)	(0.009)		(0.032)	(0.032)
Horse 2002		0.022	0.020		-0.082	-0.094
		(0.006)	(0.007)		(0.038)	(0.040)
Neigboring years			-0.008			-0.032
			(0.005)			(0.018)
Per capita income	-0.003	-0.006	-0.005	-0.263	-0.257	-0.264
	(0.029)	(0.029)	(0.029)	(0.057)	(0.056)	(0.057)
Per capita inc. squared	0.003	0.003	0.005	0.108	0.108	0.117
	(0.010)	(0.010)	(0.009)	(0.021)	(0.021)	(0.022)
Pusan	0.005	0.004	0.006	0.262	0.263	0.267
	(0.013)	(0.013)	(0.013)	(0.056)	(0.057)	(0.057)
Taegu	0.060	0.059	0.061	0.413	0.415	0.420
	(0.018)	(0.018)	(0.018)	(0.064)	(0.064)	(0.065)
Ulsan	0.030	0.030	0.025	0.527	0.525	0.500
	(0.029)	(0.029)	(0.028)	(0.083)	(0.083)	(0.086)
Kyungbuk	0.033	0.032	0.033	0.497	0.498	0.497
	(0.015)	(0.015)	(0.015)	(0.059)	(0.059)	(0.059)
Kyungnam	0.036	0.037	0.036	0.573	0.572	0.566
	(0.019)	(0.019)	(0.019)	(0.090)	(0.090)	(0.090)
Fecund female population	0.002	0.002	0.002	0.025	0.025	0.025
	(0.002)	(0.002)	(0.001)	(0.008)	(0.008)	(0.008)
Fecund fem. pop. squared	0.000	0.000	0.000	0.000	0.000	0.000
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year	-0.479	-0.466	-0.432	15.717	16.598	15.563
	(0.059)	(0.061)	(0.066)	(2.984)	(3.167)	(3.174)
Year squared	0.006	0.006	0.005	-0.280	-0.295	-0.276
	(0.001)	(0.001)	(0.001)	(0.052)	(0.055)	(0.055)
Year cubed	0.000	0.000	0.000	0.002	0.002	0.002
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Year quartic				0.000	0.000	0.000
				(0.000)	(0.000)	(0.000)
Observations	459	459	459	459	459	459
R^2	0.449	0.452	0.455	0.924	0.925	0.925

[1] Robust standard errors are in parentheses. The dummy variables for cities and provinces are included, and the reference region is Seoul.

Figure 4.1: **Yearly Trend of the Sex Ratio at Birth, 1970-2003**

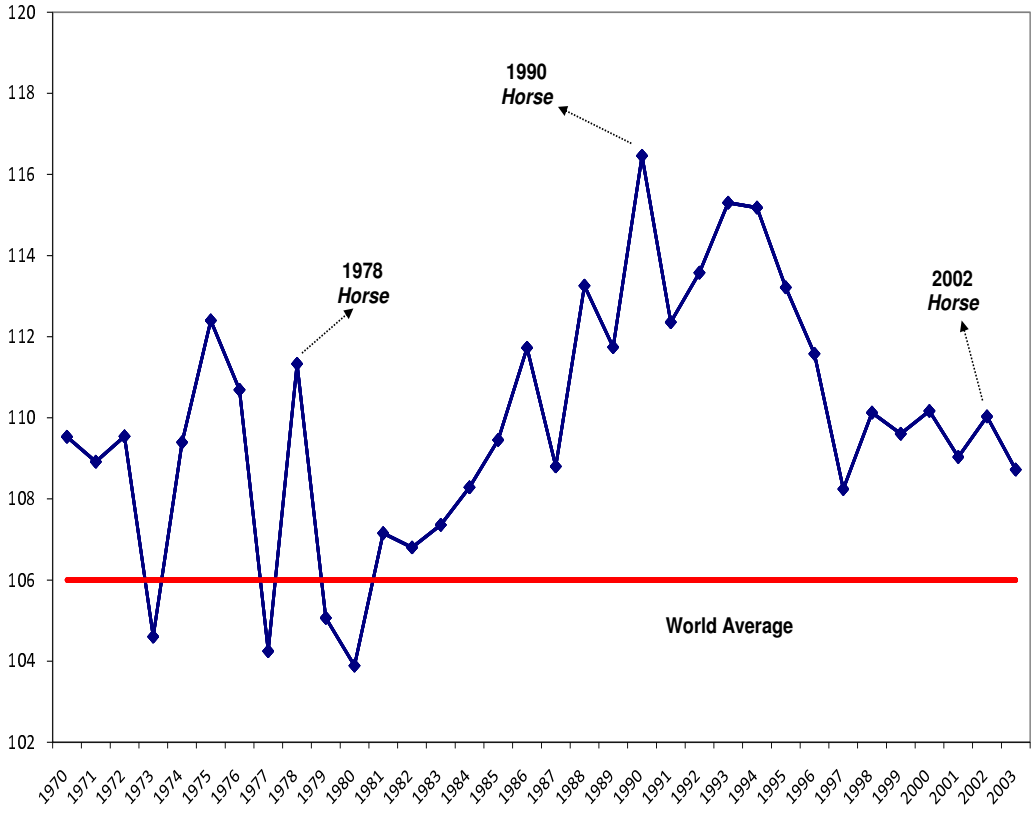


Figure 4.2: **Yearly Trend of the General Fertility Rate, 1970-2003**

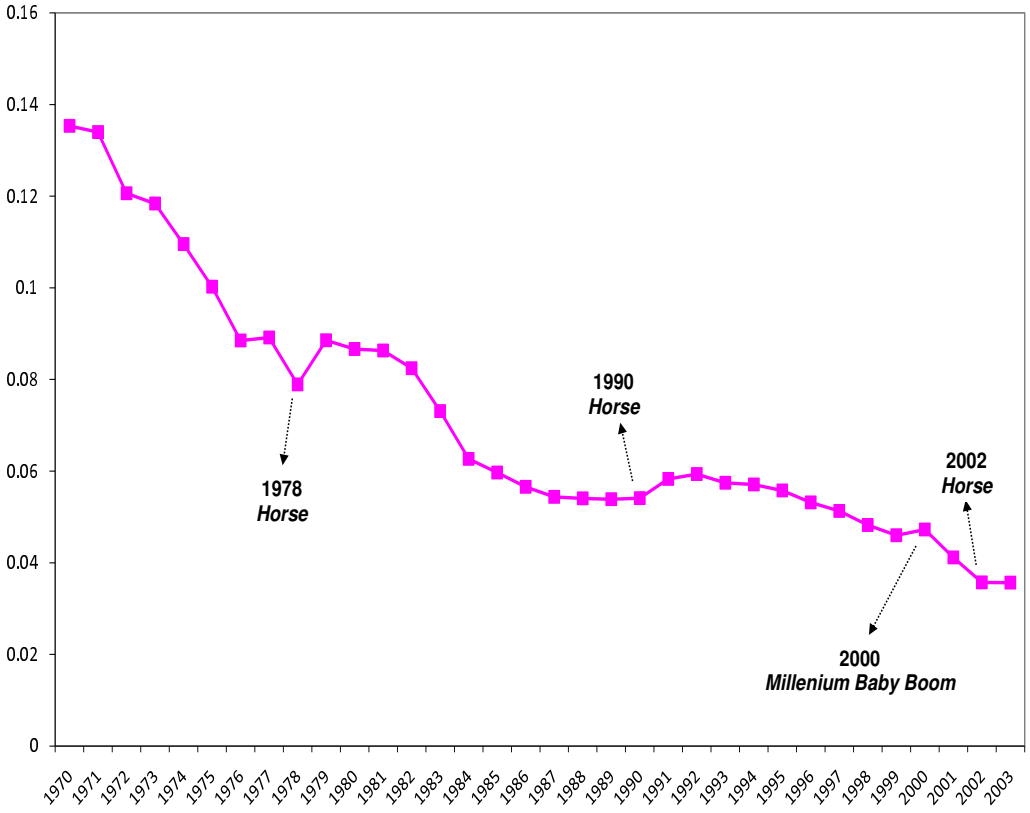


Figure 4.3: **Effects of the Horse Year on Fertility and Sex Ratio at Birth From a Comparison With Neighboring Years**

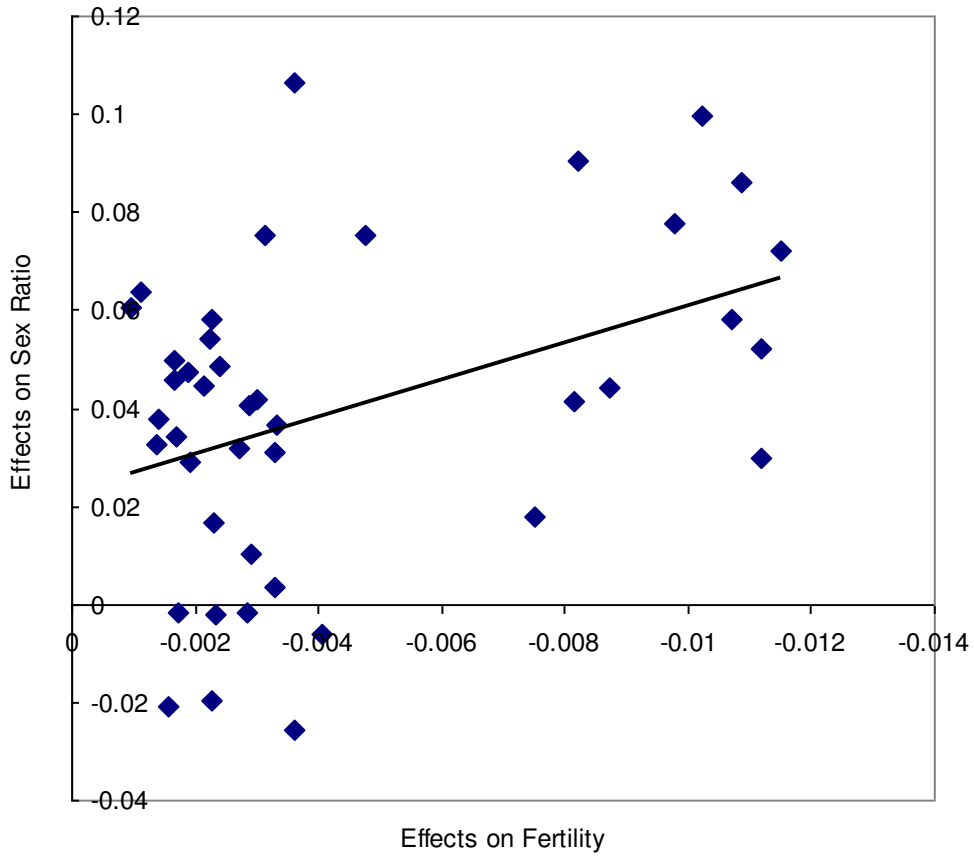
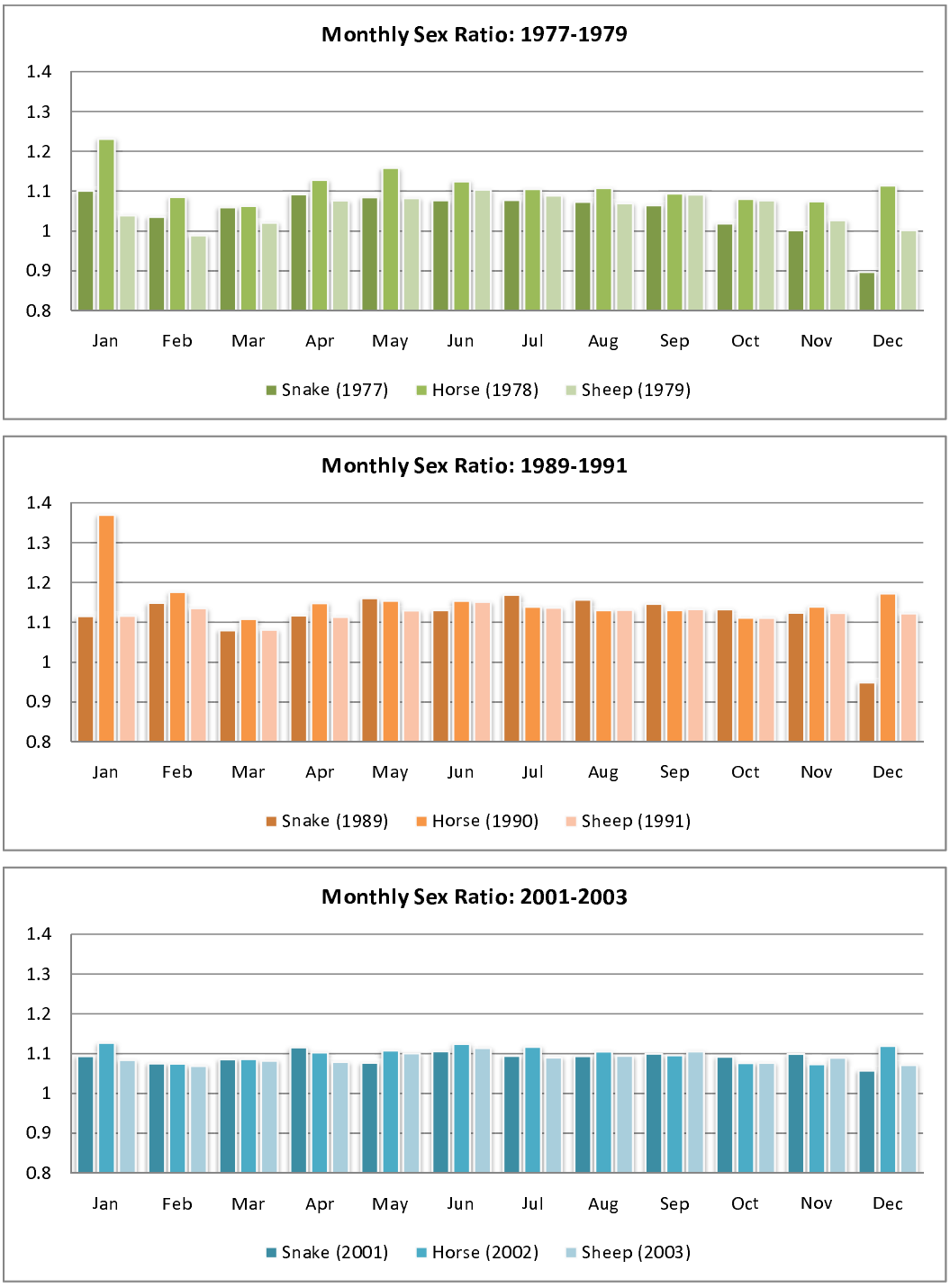


Figure 4.4: **Monthly Sex Ratios before and after the Year of *Horse***



Chapter 5

Effects of Lunar Calendar Use on Marriage and Fertility Decisions of Youth in South Korea

5.1 Introduction

Numerous studies on marriage and childbearing decisions have emphasized the importance of family background such as parents' education and economic status, in addition to an individual's demographic characteristics (Michael and Tuma, 1985).

Each country has its own history and traditions, and cultural values hardly disappear. This paper examines how family cultural values, proxied by lunar calendar use, affect young individuals' marital and fertility outcomes in South Korea. The lunar calendar is widely used, together with the western calendar, in everyday life.[1] So, a considerable part of the population still uses the lunar calendar for their birth-

[1]For example, the most important national holidays, New Year's Day (*Seolnal*) and Thanksgiving Day (*Choosuk*), are based on the lunar calendar, while many other holidays are based on the western calendar. Furthermore, every memorial service day of deceased family members is also based on the lunar calendar.

days, while others use the western calendar. This selection is usually determined by parents at the birth of a child, following their family tradition. Thus, it is expected to represent well the family cultures that cannot be controlled by routinized family background variables such as parents' education or economic status.

Since South Korea is considered a homogeneous society in culture, and ethnic diversity is very limited, demographic researchers interested in cultural changes have focused only on fertility variations over time due to modernization and economic development. In this context, the indicator of lunar calendar use helps us to capture cultural variations at the micro level. It allows researchers to control for family background more rigorously in various empirical settings employed in the demographic and labor market studies.

The marriage and fertility decisions by individuals are closely related to son preference in South Korea (Park and Cho, 1995*a*; Lee and Paik, 2006). It seems to have originated from patriarchal traditions, which have been weakened as the society has been modernized and people have become more educated. However, as Lee and Paik (2006) point out, son preference is widespread in South Korea even in the 2000s.[2] This prevalent son preference may enforce young men from families valuing patriarchal traditions to enter into early marriage and childbearing, especially for male offspring.

Few studies have been conducted concerning the cultural components contributing to family formation and fertility decisions in South Korea, due to the difficulties of measuring cultural variations among groups. On the one hand, these

[2]Their research also shows that another traditional value, the zodiacal preference, still prevails around the country.

difficulties are attributed mainly to specific characteristics of the religious belief system of Korea. Confucianism, which had been a major belief system of traditional life during the Chosun dynasty, is not considered a religion today, although Confucian tradition penetrates every aspect of Korean life. Only a small number of Confucian scholars and their followers (about 0.2 percent of the total population) report Confucianism as their religion.[3] Although usually a cultural indicator is inferred from religious categories (Goldscheider, 1999), religion variables do not properly reflect the cultural values of the Korean population, especially traditional family norms. On the other hand, the difficulties also ascribe to the nonexistence of race and ethnicity divisions in Korea, which is usually employed as an indirect indicator of the cultural characteristics of groups in societies composed of various ethnic sets. In this context, lunar calendar use is also expected to reflect a family's traditions about marriage and family formation better than religion categories as a cultural indicator in this situation.

Using the Youth Panel surveyed between 2001 and 2005, I first estimate the probability model of getting married by young men and women aged between 25 and 29 separately, and find that young people with lunar birthdays are more likely to be married, after controlling for individual characteristics as well as frequently used family background variables, including father's education and residence region when young. Second, I also estimate the probability of having children of the subsample of married youth, and find that young married men with lunar birthdays are more

[3]According to the Korea National Statistical Office, in 2005, 54 percent of the Korean population over 15 years old have religion. Among this religious population, Buddhism counts for 43 percent, Protestantism 35 percent, and Catholic 21 percent, while people who report Confucianism as their religion makes up only 0.4 percent.

likely to have children. These results are consistent with the hypotheses that young men from more traditional families enter into early marriage and that they try to have offspring at earlier ages.

5.2 Background: Marriage, Family, and Son Preference in South Korea

Marriage formation and fertility decisions are influenced by various social, economic, and cultural factors. According to Becker, marriage is a manifestation of utility-maximizing behavior. In other words, marriage occurs when a person gets into the marriage market and assesses that the utility of being married exceeds that of being single (Becker, 1973; Boulier and Rosenzweig, 1984; Mensch and Casterline, 2005). From this perspective, the relationship between individual, family background, and marriage formation is well documented. Disadvantaged family situations (such as low family income, low parental education level, large number of siblings, and nonintact family) are positively related to marriage at an early age because these factors tend to raise the cost of remaining single (Michael and Tuma, 1985; Lam and Schoeni, 1993). On the other hand, parental resources increase children's ability to attain their educational goals. Education of children, in turn, decreases the likelihood of early marriage because investments in education increase the opportunity costs of early marriage and constrain the time available for family roles (Landale and Forste, 1991; MacDonald and Rindfuss, 1981; Goldscheider and Waite, 1986).

Another important factor influencing marriage and fertility is cultural values, usually inferred from religious affiliation. Often the relationship between religious

affiliation and fertility is spurious. The main point of this perspective is that the effect of religion on fertility outcome may disappear when controlling for socioeconomic factors and family background such as income, education, and place of birth or residence. However, several researchers emphasize the role of religious values (or cultural values) in that the association between religious affiliation and fertility persists even after taking into account the groups' differing socioeconomic profiles (McQuillan, 1999; Goldscheider, 1999). Their argument is based on the idea that demographic behavior could be explained by religious teaching related to childbearing. Also, members of various religious groups make choices about marriage and fertility consistent with differences in perceived benefits and costs based on their distinctive value systems (Lehrer, 2004; Inglehart and Baker, 2000).

As in other East Asian Confucian societies, ancestor worship has been an important duty of offspring in South Korea.[4] Male offspring are expected to perform the rituals of ancestor worship to ensure the welfare of their ancestors in the afterlife, as well as good luck in their own current lives, as rewards (Gupta et al., 2003). This traditional belief has emphasized the duty of sons – especially the oldest – for respecting their parents, and enforced son preference in South Korea.[5] The family is the fundamental unit of society, incorporating the economic functions of production and consumption to create the norms and ethical principles of each family (Park and Cho, 1995*b*). These family norms are inherited by the next generation through

[4]Following Goodkind (1996*b*), I refer to the countries that share the common heritage of the Chinese language and the influences of Confucianism, Buddhism, and Taoism as Confucian societies.

[5]The influence of this tradition does not apply only to the families living in these countries. Kamo and Zhou (1994) show that the practice of primogeniture by Chinese and Japanese immigrant families still persists in the United States today.

the line of male offspring. Combined with the culture of agricultural society that considered sons as an important labor resource and valued a large family, early marriage was encouraged and son preference was enforced in traditional Korean society.

Thus, the marriage and fertility decisions by individuals are closely related to the son preference based on Confucian belief in Korea. There are numerous studies about son preference and fertility outcomes. Most focus on the idea that son preference in South Korea results in an imbalance of sex ratio at birth and social segregation by sex (Lee and Paik, 2006; Park and Cho, 1995*a*; Edlund, 1999). In the same context, son preference embedded in traditional values is also likely to influence the timing of marriage and fertility of men and women differently, because sons are more encouraged to form families and have male offspring to serve their parents and ancestors.

Based on this consideration, I developed two hypotheses for this study: (1) Youth with lunar calendar birthdays will marry at earlier ages and be more likely to be married than those with western calendar birthdays. (2) Lunar calendar use will have a greater effect on the decision of marriage and childbearing for male youth than for female.

5.3 Data and Descriptive Statistics

Data used in the research are from the Youth Panel surveyed in 2001 by the Work Information Center in the Human Resources Development Service of Korea. The Youth Panel was designed as a longitudinal data set, and initially surveyed more than

eight thousand young individuals aged 15-29 from about ten thousand households. However, since teenage marriage rarely occurs in South Korea, this study restricts the sample to individuals aged between 21 and 29, although the original data set includes younger persons.[6]

There are several advantages in utilizing the Youth Panel. First, and most importantly, it asks explicitly whether an individual's birthday is based on the western calendar or the lunar calendar, while various official records requiring date of birth (such as the Census and Birth Report) only instruct repliers to use the western calendar, which results in incorrect information on date of birth (Lee and Paik, 2006). Second, since it is designed as a panel data set to examine young individuals' schooling and labor market transitions, we can take advantage of this aspect by using various types of personal information as controls. Third, the Youth Panel also provides various household characteristics, thus enabling us to separate out the effects caused by variations in household or family backgrounds.

5.3.1 Lunar Calendar Use

Calendar type for birthday is used as a proxy for family cultures or traditions. In other words, I believe that individuals from more traditional families, which are not easily observed in a data set, are more likely to use lunar birthdays. This view can also be illustrated by the relationship between lunar birthday use and other individual characteristics. Table 5.1 reports the percentages of persons with lunar birthdays by age and sex. Both men and women show similar patterns across age.

[6]The legal minimum age for marriage is 18 in South Korea, and requires the consent of parents or guardians if a person is younger than 20.

Older men and women are more likely to have lunar birthdays. Although the fraction varies from 34 percent up to 52 percent and its trend declines, this result shows that a large number of young people still use the lunar calendar for their birthdays. The second panel of Table 5.1 shows the variations by education level. The more educated people are, the less likely they are to use the lunar calendar. For example, more than fifty percent of young people who don't have high school diplomas are using lunar birthdays, while the percentage among college-educated people is about 36. These educational variations do not differ by gender. Examining lunar calendar use by religion, about a half of Buddists and persons who don't have any religion use lunar birthdays. Comparably, individuals with western-origin religion are less likely to use lunar birthdays. Only 23 percent of Catholics use lunar calendar for their birthdays, while the fraction among Protestants goes up to 37 percent. There is no big difference betwen male and female. When considering that the lunar calendar must be used for traditional holidays and memorial service days of the deceased, widespread use of the lunar calendar implies that many people still value traditions.[7]

The differences in lunar birthday use by family background also show that lunar birthday use is related to valuing traditions and the possibility that it can capture some variations in family culture neither observed nor proxied by other characteristics. Table 5.2 reports the relationship between lunar birthday use and three family background characteristics. Both father's and mother's education are negatively related to lunar birthday use, as shown in the first and second panels. The

[7]Preparing family events for the traditional holidays and memorial service days of the deceased is considered the responsibility of the eldest son. This custom may be one of the reasons for son preference in South Korea.

usual perception of an adverse relationship between education and valuing traditions is confirmed from these distributions. As expected, persons whose parents are more educated are less likely to have lunar birthdays.

Since the data on individuals' birth places are not available, I use residence regions at age 14 to look at regional variations in calendar use. The fraction of lunar birthday users is smaller in Seoul/Inchon/Kyunggi, which is the most prosperous area including the national capital. An interesting finding is that the fraction is highest in Gwangju/Jonnam/Jonbuk, instead of Taegu/Kyungbuk or Pusan/Ulsan/Kyungnam, although the difference is not large. Usually Taegu/Kyungbuk and Pusan/Ulsan/Kyungnam are considered the most conservative regions in South Korea. This phenomenon seems related to the fact that Gwangju/Jonnam/Jonbuk has been the main agricultural area harvesting rice, and that the government has started to locate industries first in Taegu/Kyungbuk and Pusan/Ulsan/Kyungnam.

5.3.2 Summary Statistics

Table 5.3 shows descriptive statistics by sex and birthday type. As expected, the demographic outcomes are quite different by birthday type. The fraction of married men with lunar birthdays is about 6 percent higher than those with solar birthdays. In the case of females, the difference increases to more than 11 percent. If we restrict the sample of married individuals, the probability of having a child also shows similar patterns. However, the difference is much larger in the case of men. About 60 percent of married men with lunar birthdays have at least one child in 2001, while only 33 percent of those using the western calendar have a child. The gap among married

women is very small.

The sample means and standard deviations of other individual and family characteristics are also reported. Ages of lunar birthday users are older in both male and female samples, but the differences are not large. The fraction of persons who have ever attended college is larger for western calendar users. The difference between birthday types is about 10 percent in both men and women. Individuals who attend church are found more frequently among western calendar users than among lunar calendar users. About 31 percent of men using the western calendar are either a Protestant or Catholic, while the figure is 10 percent smaller among lunar calendar users. Similarly the fraction of female Christians using the western calendar is about 13 percent larger than their counterparts using the lunar calendar.[8] Looking at household information, father's education level is lower in lunar calendar users. The gap in father's schooling years is about two years in both male and female samples. And the difference between men and women does not seem notable.

5.4 Probability Models and Estimation Results

To estimate the effects of lunar birthday use on demographic outcomes, we exploit the following probability models controlling for various observables:

$$Prob(M_i = 1|Lunar_i, \mathbf{X}_i) = \Phi(\alpha_M Lunar_i + \mathbf{X}_i\beta),$$
$$Prob(F_i = 1|Lunar_i, \mathbf{X}_i) = \Phi(\alpha_F Lunar_i + \mathbf{X}_i\beta).$$

[8]Protestants and Catholics are categorized as a dummy variable, Christian, in the remaining part of this chapter.

In these estimation equations, M_i and F_i are dummy variables representing individual i's demographic outcomes, marriage and having a child respectively, and $\Phi(\cdot)$ is the cumulative distribution function of normal distribution, following the probit specification. $Lunar_i$ indicates whether or not individual i uses lunar birthday, and $\mathbf{X}_i$ represents a vector of control variables. To control variations by individual, we first include an individual's demographic information in $\mathbf{X}_i$ and then additionally use family background variables such as household income, father's education, and residence region when young. Furthermore, several observed demographics of an individual's spouse are also controlled to estimate the probability of having a child.

Thus, α_M and α_F are the coefficients of main interest. However, we report the difference in probability between lunar calendar users and western calendar users for easy interpretation. Similarly, for other covariates, the differences in probability are reported for dummies, and the marginal effects are reported for continuous variables.

5.4.1 Early Marriage

Among the demographic outcomes of interest when deliberating family cultures or traditions, the first and foremost expectation is that young people from families valuing traditions might get married at an earlier age to expand their family to the next generation. Table 5.4 reports estimation results on the probability of getting married for young men and women aged between 21 and 29, and we find that the family culture has a significant influence on marriage decision. Differences in the probability of being married between lunar birthday users and solar birthday users are about 3 percent for men and about 5 percent for women, regardless of controlling

family background variables. The larger estimates for women seem to be caused by the gender difference in marriage-age distribution. As confirmed by various reports, the average age of getting married is higher for men.[9] The significant difference for women is also driven by another traditional perception about women's roles or duties in families. To control for family background, I include father's education years, and five dummies indicating residence regions when young.[10] The results do not change after including these controls, as reported in Table 5.4.

The effects of individual characteristics are similar to those reported in previous studies. Since only persons under thirty years of age are examined, the marginal effect of age looks different by sex. Although the marriage probability does not turn out nonlinear to both men's and women's ages, additional age increases the probability by about 3.4 percent and 8 percent on average, respectively, for men and women. Individuals who have attended a college, including occupational college (junior college), are less likely to be married. The difference in probability is about 7 percent for men, and 25 percent for women. There seem to be two reasons for these results. First, postsecondary education requires young people to spend more time at school, thus decreasing the likelihood of getting married early, in terms of both time and finances. Second, higher education may also change an individual's preferences or tastes. Considering the general perception that education level is inversely related to

[9]According to the National Statistical Office, the average age at marriage is 30 for men and 27 for women in 2001, and it has increased steadily for the last several decades. In particular, the increase in women's marriage age is considered one of the major reasons for an extremely low fertility rate in South Korea.

[10]Residence region at age 14 is asked in the survey. six region categories are based on cultural and political differences in South Korea. I do not include mother's education here, since there are some missing values. However, using only the subsample with observed mother's education, I estimated all empirical models and obtained very similar results with the reported values.

valuing traditions, a person with postsecondary education may postpone marriage and choose to spend more time on other activities such as career development.

We also need to address personal experience or environmental factors in marriage decisions. Because traditional Korean society is based on Confucianism, as described earlier, the effect of religion cannot be ignored in demographic decisions. Two religions from western culture, Protestantism and Catholicism, are identified by a dummy variable, Christian.[11] However, it turns out to be insignificant in marriage probability for both men and women. To control for environmental factors, I include fifteen residence region dummies, although the estimates are reported. The included family background variables, father's education and five residence region dummies at age 14, have no significant effect on marriage.

5.4.2 Fertility

Early marriage is very closely related to fertility decisions. To examine whether the findings as described above are extended to fertility outcome, I also estimate probability models of having a child, and report the results in Table 5.5. In these regressions, the subsamples of married men and women are used.

Contrary to marriage decisions, fertility patterns differ by sex. As specified earlier in the hypothesis, married men with lunar birthdays turn out to be about 31 percent more likely to have a child than those with western-calendar birthdays. Even after controlling for family background and spousal demographics, the difference in

[11]The reference group is persons whose religion is Buddhism or another traditional religion and those who have no specific religion. Including more detailed religion dummies does not change the results significantly.

probability increases to 38 percent. However, this gap might be overestimated, because years since marriage are not taken into account due to lack of information. The Youth Panel in 2001 asked about each individual's current marital status, but it did not collect detailed information on marriage year.[12] To address this problem, I calculate the predicted probability of being married in 2001, using the estimation results from columns (2) and (4) in Table 5.4. Since these predicted values are obtained using individual and family characteristics, they are expected to be highly correlated with years since marriage, and can be used as a proxy. The result, including the natural logarithm of the predicted probability of being married, is not different from that of the previous estimation. The probability gap in having a child by calendar type is about 31 percent. The coefficient of the added control variable turns out to be positive, but it is not statistically significant. On the contrary, birthday type has no significant effect on married women's fertility decisions in any specification.

These results imply that a considerable number of young men, especially from more traditional families, are still under the influence of patriarchal traditions and try to have a child to extend their families to the next generation. Because the continuity of a family can be maintained only through male offspring in traditional Korean society, the insignificant effect of women's family traditions on their fertility decisions can be understood. However, the fertility decision within a family is made by both husband and wife. Thus, without considering variations in demographic characteristics of spouses, the estimates may be biased. The estimation results in-

[12]Since 2002, the questionnaire includes detailed questions on changes in marital status. Thus, if we use the subsample of first-marriage individuals, we can collect the data on years since marriage. However, small sample size and missing data on spouses restrict its usefulness for research.

cluding spousal information confirm the argument, as reported in columns (5) and (6) in Table 5.5. In the case of a married woman, husband's lunar birthday use has a significant effect on the probability of having a child. This consequence is consistent with the estimation result for married men. Comparably, in the estimations using male sample, a wife's lunar calendar use has no significant effect on child birth.

The nonlinearity of age effect is not found in both men and women's cases, and age turns out to be insignificant after including the predicted probability of marriage. The effect of college experience is also not notable. When ignoring household background and spousal characteristics, married women with experience in attending college seem less likely to have a child. However, additional controls eliminate the significance as well as the size of the estimates. An individual's religion has a negative effect on early fertility decision. Both married men and women whose religion is Protestant or Catholic are less likely to have a child at earlier ages. The differences are about 24 percent for men and about 14 percent for women.

The father's education has no significant impact on the probability. Among the dummy variables indicating residence region at age 14, Taegu/Kyungbuk is strongly significant in the case of men. Taegu/Kyungbuk is usually considered the most conservative region in South Korea. As shown in the previous chapter, the sex ratio at birth is highest in Taegu and Kyungbuk.[13] The estimate shows that men raised in Taegu/Kyungbuk are 86 percent more likely to have a child than are those raised in Seoul/Inchon/Kyunggi, the most prosperous and populated area in South Korea. The influence of regional background is not found in the female sample,

[13]The sex ratio at birth reaches up to 1.2 on average in 1990s. See Table 4.2.

confirming that the fertility decision is associated with patriarchal tradition.

5.5 Discussion

In spite of the common recognition that heterogeneous family cultures or traditions might affect an individual's marriage and fertility decisions, I can hardly find an empirical investigation focusing on individuals' demographic behavior originating from variations by family. Exploiting an idiosyncratic social practice in South Korea that is believed to have no notable cultural differences within a society, this research sheds light on empirical studies about the effects of cultural values on demographic outcomes.

The findings – that young people from more traditional families are more likely to enter into early marriage and that young married men with lunar birthdays are more likely to have children – show that traditional values still have significant effects on various demographic decisions at the micro level. Demographic studies focusing only on modernization and economic development in a society and not addressing these variations within families might have limited policy implications.

South Korea has witnessed very low fertility rate recently. If the traditional son preference is combined with this low fertility rate, due to economic reasons such as growing child-rearing and education costs, it might result in widespread abortion and severely unbalanced sex ratios, as partially proved in the previous chapter. Thus, policies affecting demographics in South Korea need to consider the implications addressed in this research.

Table 5.1: **Lunar Birthday Users by Individual Characteristics**

	Male		Female		Total	
	%	Obs.	%	Obs.	%	Obs.
By Age						
21	28.2	124	35.7	322	33.6	446
22	36.6	205	38.0	279	37.4	484
23	40.2	214	38.0	258	39.0	472
24	39.6	240	44.9	276	42.4	516
25	50.8	242	45.2	230	48.1	472
26	46.7	199	50.5	218	48.7	417
27	47.8	228	47.1	242	47.4	470
28	52.0	171	51.8	195	51.9	366
29+	47.3	165	50.7	152	48.9	317
By Education						
Middle School	52.8	479	52.5	676	52.6	1,155
High School	41.6	978	42.2	943	41.9	1,921
College Experience	37.2	331	35.4	553	36.1	884
By Religion						
No Religion	46.2	983	47.8	1,109	47.0	2,092
Buddist	51.0	312	51.7	354	51.4	666
Protestant	38.6	365	35.8	519	37.0	884
Catholic	18.5	108	25.7	171	22.9	279
Other	45.0	20	31.6	19	38.5	39
Total	43.8	1,788	43.7	2,172	43.7	3,960

Table 5.2: **Family Background and Lunar Birthday Use**

	Male		Female		Total	
	%	Obs.	%	Obs.	%	Obs.
By Father's Education						
Elementary School or Less	57.5	499	64.6	508	61.1	1,007
Middle School	50.8	398	48.5	538	49.5	936
High School	36.6	640	37.4	807	37.0	1,447
College Experience	23.9	251	18.2	319	20.7	570
By Mother's Education[a]						
Elementary School or Less	58.4	687	60.6	729	59.5	1,416
Middle School	42.1	487	44.1	691	43.3	1,178
High School	30.6	506	29.4	636	29.9	1,142
College Experience	18.4	76	10.0	100	13.6	176
By Residence When Young (at 14)						
Seoul/Inchon/Kyunggi	25.6	562	26.0	763	25.8	1,325
Pusan/Ulsan/Kyungnam	40.3	355	46.8	436	43.9	791
Taegu/Kyungbuk	50.4	258	53.4	307	52.0	565
Gwangju/Jonnam/Jonbuk	65.9	293	62.1	311	63.9	604
Daejon/Chungnam/Chungbuk	57.1	240	57.1	252	57.1	492
Other Regions	45.0	80	44.7	103	44.8	183
Total	43.8	1,788	43.7	2,172	43.7	3,960

[a] In the second panel, total observations are smaller because of missing values in mother's education.

Table 5.3: **Comparison of Sample Means by Sex and Birthday Type**

	Male			Female		
	Solar	Lunar	Total	Solar	Lunar	Total
Demographic Outcomes						
Married	0.086	0.151	0.114	0.206	0.316	0.254
	(0.280)	(0.358)	(0.318)	(0.405)	(0.465)	(0.435)
Have Child[a]	0.326	0.602	0.485	0.464	0.490	0.478
	(0.471)	(0.492)	(0.501)	(0.500)	(0.501)	(0.500)
Individual Characteristics						
Age	24.80	25.34	25.04	24.29	24.85	24.53
	(2.440)	(2.329)	(2.406)	(2.524)	(2.522)	(2.538)
College Experience	0.775	0.677	0.732	0.738	0.626	0.689
	(0.418)	(0.468)	(0.443)	(0.440)	(0.484)	(0.463)
Christian	0.310	0.206	0.265	0.376	0.242	0.318
	(0.463)	(0.404)	(0.441)	(0.485)	(0.429)	(0.466)
Household Information						
Father's Education	10.81	9.01	10.02	11.24	9.19	10.34
	(3.641)	(3.741)	(3.791)	(3.444)	(3.297)	(3.530)
Observations	1,005	783	1,788	1,223	949	2,172

[a] "Have Child" is conditional on marital status (Married=1).

Note: Standard deviations are in parentheses.

Table 5.4: **Probability Models of Marriage**

	Male		Female	
	(1)	(2)	(3)	(4)
Lunar Birthday	0.031*	0.028*	0.052**	0.047*
	(0.013)	(0.013)	(0.020)	(0.020)
Age	-0.068	-0.069	0.060	0.057
	(0.064)	(0.063)	(0.082)	(0.081)
$Age^2/100$	0.201	0.204	0.040	0.045
	(0.126)	(0.124)	(0.163)	(0.162)
College Experience	-0.074**	-0.070**	-0.254**	-0.248**
	(0.017)	(0.017)	(0.023)	(0.024)
Christian	0.008	0.007	0.011	0.013
	(0.013)	(0.013)	(0.020)	(0.021)
Father's Education		0.000		-0.003
		(0.002)		(0.003)
Region at Age 14				
Pusan/Ulsan/Kyungnam		-0.016		0.015
		(0.035)		(0.057)
Taegu/Kyungbuk		-0.045		0.034
		(0.024)		(0.063)
Gwangju/Jonnam/Jonbuk		0.043		0.056
		(0.041)		(0.050)
Daejon/Chungnam/Chungbuk		0.045		-0.037
		(0.045)		(0.043)
Other Regions		0.057		0.001
		(0.062)		(0.056)
Log likelihood	-480.5	-476.4	-819.3	-817.1
Pseudo-R^2	0.243	0.249	0.335	0.336
Observations	1,788	1,788	2,172	2,172

Note: Marginal effects are reported and robust standard errors are in parentheses, * significant at 0.05; ** significant at 0.01. The reference group of "Region at Age 14" variables is Seoul/Inchon/Kyunggi. All regressions are also controlled for fifteen current region dummies including seven metropolitan areas separately.

Table 5.5: **Probability Models of Child Birth**

	Male			Female		
	(1)	(2)	(3)	(4)	(5)	(6)
Lunar Birthday	0.309**	0.381**	0.308*	-0.012	-0.074	-0.099
	(0.083)	(0.117)	(0.146)	(0.052)	(0.057)	(0.058)
Age	-0.004	-0.186	-0.242	-0.490	-0.325	-0.647
	(0.482)	(0.477)	(0.486)	(0.275)	(0.295)	(0.375)
$Age^2/100$	0.072	0.361	0.254	1.029	0.699	1.208
	(0.918)	(0.917)	(0.921)	(0.531)	(0.568)	(0.676)
College Experience	0.017	0.110	0.252	-0.124*	-0.062	0.080
	(0.088)	(0.109)	(0.187)	(0.050)	(0.059)	(0.118)
Christian	-0.178	-0.230*	-0.237*	-0.124*	-0.135*	-0.139*
	(0.103)	(0.116)	(0.118)	(0.054)	(0.055)	(0.056)
Spouse Lunar Birthday		-0.113	-0.098		0.118*	0.116*
		(0.125)	(0.126)		(0.056)	(0.057)
Spouse Age		0.822*	0.796*		-0.538**	-0.529**
		(0.353)	(0.353)		(0.194)	(0.197)
Spouse $Age^2/100$		-1.517*	-1.468*		0.966**	0.952**
		(0.677)	(0.676)		(0.333)	(0.336)
Spouse College Experience		-0.131	-0.128		-0.038	-0.037
		(0.121)	(0.122)		(0.059)	(0.059)
Father's Education		-0.002	-0.001		-0.015	-0.015
		(0.014)	(0.014)		(0.009)	(0.009)
Region at Age 14						
Pusan/Ulsan/Kyungnam		0.112	0.167		0.044	0.054
		(0.193)	(0.200)		(0.108)	(0.109)
Taegu/Kyungbuk		0.852**	0.863**		-0.048	-0.078
		(0.033)	(0.032)		(0.109)	(0.109)
Gwangju/Jonnam/Jonbuk		0.415**	0.332		-0.007	-0.035
		(0.133)	(0.184)		(0.102)	(0.102)
Daejon/Chungnam/Chungbuk		0.277	0.193		-0.041	-0.024
		(0.149)	(0.188)		(0.118)	(0.121)
Other Regions		-0.184	-0.277		0.112	0.107
		(0.252)	(0.244)		(0.134)	(0.135)
Log of Predicted Marriage Prob.			0.249			0.190
			(0.270)			(0.139)
Log likelihood	-98.8	-88.2	-87.9	-297.1	-284.3	-283.2
Pseudo-R^2	0.159	0.249	0.252	0.096	0.134	0.138
Observations	170	170	170	474	474	474

Note: Marginal effects are reported and robust standard errors are in parentheses, * significant at 0.05; ** significant at 0.01. The reference group of "Region at Age 14" variables is Seoul/Inchon/Kyunggi. All regressions are also controlled for fifteen current region dummies including seven metropolitan areas separately.

Chapter 6

Conclusions

This dissertation examines gender differences in labor markets and demographic decisions. In the first essay, I examine changes in firm size distribution and size premium since the late 1980s. The firm size distribution shifts differently by gender over the study period. While the fraction of female workers employed by large firms has increased steadily, that of male workers has hardly changed over time. These trends cannot be explained fully by changes in the distribution of demographic and job characteristics. In addition, the gender differences in size-wage premia of workers in large firms decline continuously over the period. This study shows that the changes in firm size distribution and size premia explain a part of the gender wage convergence, and the decline in the size premium gap between male and female workers plays more important role.

The second essay analyzes how internet use affects job search and match outcomes of young workers in South Korea. Recent developments of computer and internet technologies have changed our economic lives considerably. This study shows that workers successfully employed by internet search have a significant wage premium

over those employed by traditional methods except referrals or social networks. The positive wage effect is prominent among women and previously unemployed workers. These results imply that the internet may play a positive role in enhancing match quality of workers with less social networks. Since South Korea has a well-established networking infrastructure and young people there are very familiar with internet use, this research could suggest meaningful policy implications about the introduction of internet technology in the labor market, especially for policymakers of economies witnessing the rapid development of internet technology.

The third essay focuses on the effects of zodiacal preferences on the sex ratio at birth and fertility. Since antiquity, South Koreans have believed that a person is destined to possess specific characteristics according to the sign of the zodiac of birth year. They, in particular, have traditionally considered that the year of the *Horse* bears inauspicious implications for the birth of daughters. Empirical analysis using monthly longitudinal data at the region level in South Korea between 1970 and 2003, shows that in the year of the *Horse*, the sex ratio at birth significantly increased while fertility decreased. These findings imply that the methods of controlling birth timing and sex-selective abortions have been widely used to avoid childbirth in an inauspicious year. Along with son preferences, zodiacal preferences still had significant impacts on fertility and the sex ratio in 2002. The finding that a cultural belief significantly affects demographic outcomes suggests that cultural reform or popular education by government and civil organizations should play an important role for population policymakers.

The last essay also examines how family cultural values, proxied by lunar cal-

endar use for birthday, affect young individuals' marriage and fertility outcomes in South Korea. The lunar calendar is widely used in everyday life, together with the western calendar, and is expected to represent the family cultures well. The estimation results show that young people with lunar birthdays, regardless of gender, are more likely to be married. More interestingly, young married men with lunar birthdays are more likely to have children, while young married women are not influenced by the tradition. These findings show that traditional values still have significant effects on various demographic decisions at the micro level. The traditional son preference, along with low fertility rate due to growing child-rearing and education costs, might cause social problems, such as widespread abortion and severely unbalanced sex ratios. Thus, policies affecting demographics in South Korea need to consider the implications addressed in this study.

Appendices

Appendix A

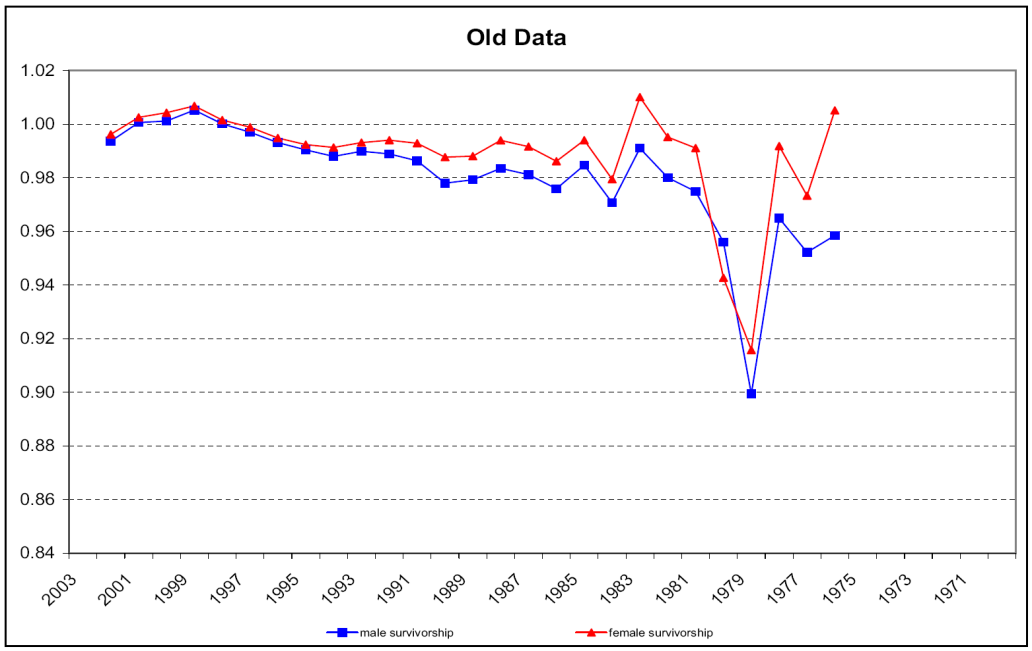
Additional Tables for Chapter 4

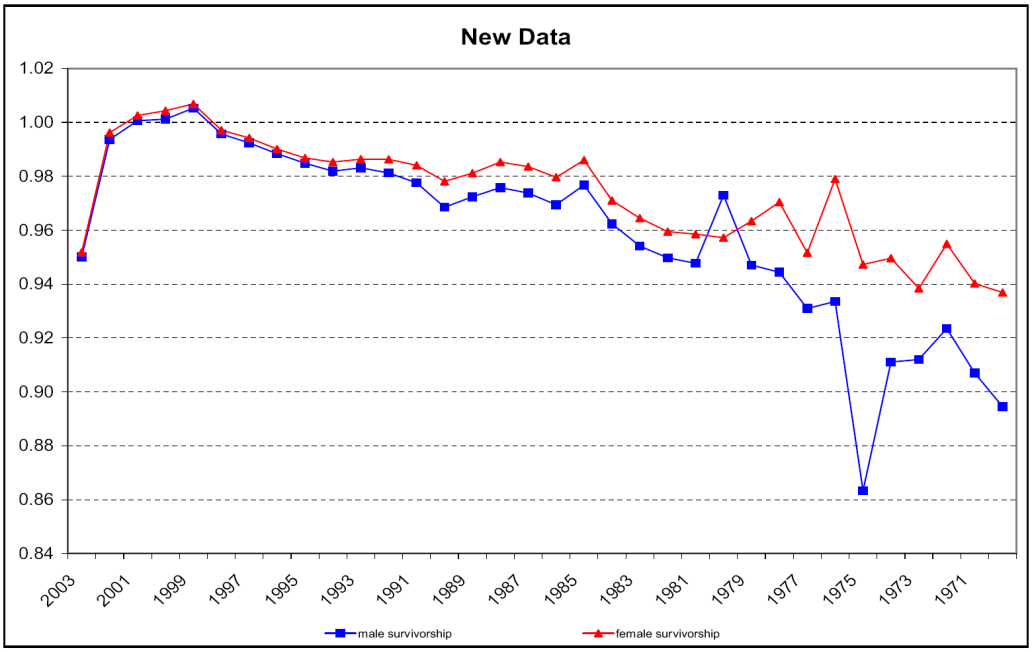
A.1 Comparison of Old and New Data

Table A.1: **Old vs. New Data: Number of Births**

	Old data		New data	
Birth Year	Male	Female	Male	Female
2003			257,044	236,427
2002	259,123	235,502	259,123	235,502
2001	290,655	266,573	290,655	266,573
2000	333,797	302,983	333,797	302,983
1999	322,284	294,038	322,284	294,038
1998	335,488	304,638	336,980	305,992
1997	350,977	324,250	352,627	325,775
1996	365,194	327,301	366,950	328,875
1995	380,714	336,279	382,881	338,193
1994	387,559	336,476	389,957	338,558
1993	385,042	333,941	387,693	336,241
1992	390,072	343,453	393,138	346,153
1991	376,656	335,235	380,036	338,243
1990	350,862	301,282	354,310	304,242
1989	338,619	303,048	341,010	305,187
1988	335,870	296,297	338,543	298,919
1987	325,485	299,012	327,977	301,455
1986	336,338	301,039	338,591	303,053
1985	343,408	313,734	346,206	316,304
1984	351,610	324,711	354,675	327,542
1983	387,970	358,405	402,992	375,370
1982	429,820	400,377	443,544	415,288
1981	442,662	410,986	455,355	424,955
1980	448,744	430,955	440,926	424,424
1979	466,321	443,382	442,827	421,470
1978	387,926	348,339	396,373	356,036
1977	412,718	395,903	422,139	404,940
1976	408,055	368,645	418,963	378,499
1975			462,971	411,898
1974			482,895	441,416
1973			494,703	472,944
1972			499,468	455,970
1971			534,254	490,519
1970			526,222	480,423

Figure A.1: **Old Versus New Data on Survivorship**





A.2 Lunar-Calendar Use in South Korea

Table A.2: **Lunar-Calendar Use by Age and Household Head's Education Level in 1998**[1]

	Under High School		High School Grad		College Experience		Total	
Age	% (Lunar)	Obs	% (Lunar)	Obs	% (Lunar)	Obs	% (Lunar)	Obs
0-4	13.2	167	8.0	561	4.8	499	7.4	1,227
5-9	19.4	252	9.2	586	5.4	426	10.0	1,264
10-14	23.2	367	16.3	559	8.8	330	16.3	1,256
15-19	41.5	696	27.1	632	13.0	322	30.4	1,650
20-24	60.9	717	50.1	505	24.9	265	50.8	1,487
25-29	70.7	508	72.1	603	53.0	406	66.5	1,517
30-34	86.1	266	86.4	612	74.9	553	81.9	1,431
35-39	91.3	401	90.6	700	81.4	521	87.8	1,622
40-44	94.5	470	90.8	619	77.8	342	88.9	1,431
45-49	92.4	487	89.3	394	79.3	242	88.5	1,123
50-54	91.1	426	83.1	308	73.1	156	85.2	890
55-59	87.0	471	80.6	196	73.7	137	83.2	804
60-	90.2	1,088	85.2	372	79.1	282	87.3	1,742
Total	71.4	6,316	58.0	6,647	47.6	4,481	60.2	17,444

[1] Source: Korean Labor and Income Panel Study 1998 by the Korea Labor Institute, household data.

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