THE IMPACT OF GROWTH AND CHANGES IN COMPUTER USE AT WORK IN THE UNITED STATES: An Analysis of Wages By Occupation, Industry, and Gender, 1984 - 2001

BY

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A Dissertation submitted to the Faculty of Claremont Graduate University in partial fulfillment of the requirements for the degree of Doctor of Philosophy in the Graduate Faculty of Economics

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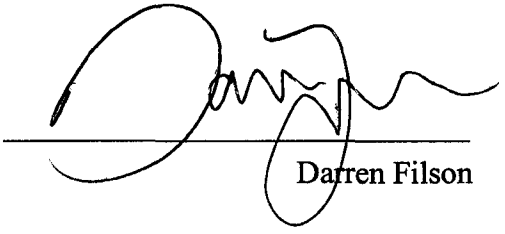

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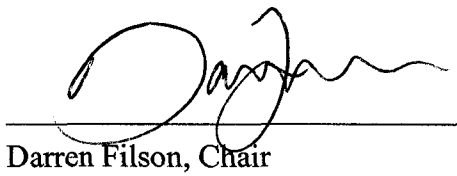

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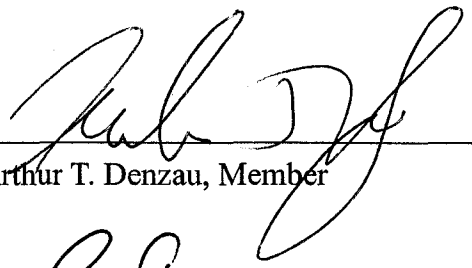

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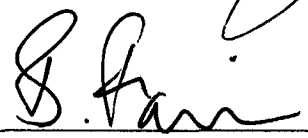

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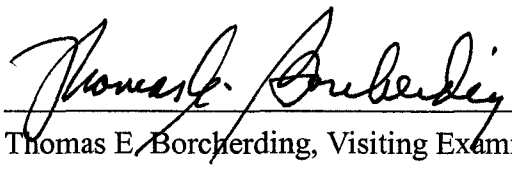

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Abstract of the Dissertation

THE IMPACT OF GROWTH AND CHANGES IN COMPUTER USE AT WORK IN THE UNITED STATES: An Analysis of Wages By Occupation, Industry, and Gender, 1984 - 2001

By

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Claremont Graduate University: 2004

This dissertation employs cross sectional estimations with the use of two distinct approaches to the U.S. Current Population Survey data for the years 1984, 1989, 1993, 1997, and 2001 to examine the impact of the diffusion of computers on wages and the effects attributable to differences in computer use, worker characteristics, occupations, and industries.

The first study in this dissertation analyzes how the diffusion of computers, different worker characteristics, occupations, and industries affect the wages of workers. The analysis further explores how the diffusion of computer technology altered a worker's skill premium and its effect on a worker's wage premium. Estimates find that at the aggregate level, computer use on the job generates an average wage premium of 20% to 25%. However, at the micro level, the computer-use wage premium varies depending on how computers are used by up to an additional 11 percentage points. The premium also varies according to worker characteristics, occupations and industries. The empirical results further suggest that the effect of experience on wages (and thus the resulting wage

premium) decreases with the diffusion of computers but at rates that depend on occupations and industries.

The second study in this dissertation examines how the diffusion of computers, the differences in demographics, occupations, and industries affect the wages of female workers in response to the recent structural change in women's employment. Estimates find that female wages were 20-36% lower than male wages during the period. The empirical results also suggest the effect on female wages of using a computer on the job reduced the penalty associated with being a female worker by 4-6 percentage points during the 1990s, and that the way computers were used on the job did not affect female wages during the full period. However, the estimation results show that occupational differences affected female wages, and more importantly, the industry that women worked in had a significant impact on female wages during the period.

The empirical findings in this dissertation suggest direct evidence of a wage premium from using a computer and the presence of both occupation and industry wage differentials for the period 1984-2001. The estimation results further illustrate the role of the "computer revolution" in the new economy and show the importance of policies that reduce the occupational and industry segregation in order to narrow the wage differentials in the U.S. labor market.

To my parents

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PART I

OVERVIEW

INFORMATION TECHNOLOGY AND LABOR MARKET

The technological revolution driven by information technology (IT) in the twentieth century was a time of tremendous investment-specific technological change for factories, firms and workers in all sectors of the U.S. Particularly, the introduction of the personal computer in the mid-1970s substantially changed the way institutions and workers performed their duties in the workplace. During the same period, the U.S. labor market experienced a significant change in the wage structure and a rapid increase in skill and educational differentials and in income inequality (Acemoglu, 2002; Katz and Autor, 1999; and others). Also, the U.S. labor market witnessed a substantial increase in female labor participation and a narrowing of the gender pay gap (Blau and Kahn, 2000; and others). Many scholars have performed various analyses of the impact on wages of the increase in the use of IT in order to explain the change in the wage structure, the increase in wage inequality, and the reduction in gender wage differentials in the U.S. labor market, but the impact of the diffusion of computers on wages is still rather unclear.

One area of research in this literature analyzes the impact on wages of the use of information technology (IT) in order to explain the widening U.S. wage inequality. The most widely cited explanation for this trend is the skill-biased technical change (SBTC) hypothesis. It suggests that an increase in the demand for more educated/skilled workers lifts the wages of these workers, and/or an increase in supply of more educated/skilled workers reduces the wages of less educated/skilled workers, which both cause an increase in wage inequality (Bresnahan, Brynjolfsson & Hitt, 2002; Autor, Katz and Krueger, 1998; Katz and Murphy, 1992; and others). The recent studies, however, suggest that the

SBTC hypothesis fails to explain movements in the educational, gender and racial wage differentials as well as the trend and timing of both the wage structure and wage inequality and its relation to the continuing advancing computer technology in the 1990s (Card and DiNardo, 2002; Acemoglu, 2002; and others). Accordingly, explaining the link between the adoption of IT and the increasing U.S. wage inequality still poses an intellectual challenge.

Another area of research to explain the changes in the wage structure concerns the impact on wages of the use of computers. The existing empirical studies find direct evidence of a wage premium from using computers (Krueger, 1993; DiNardo and Pischke, 1997; Dolton and Makepeace, 2004; and others). However, persistent debate centers on the cross-sectional estimations, which may yield biased estimation results because of the omission of unobservable heterogeneity in human capital, occupations, and industries (Handel, 1998; DiNardo and Pischke, 1997; and others). The recent studies, interestingly, have supported Krueger's findings if not his methods. These studies show that cross-section estimates of the computer wage premium are large and consistent when we allow the coefficients to differ across individuals (Dolton and Makepeace, 2004; and others). Although the significance of the empirical results from cross-section estimates has been established, the issues of possible biased results from cross-section estimates are still unresolved. Even more important has been the debate on the fundamental question of what is an appropriate proxy to measure scarce computer *skills* and/or *knowledge* (not just computer *use*) when determining the true returns of the impact of computers on wages. The current consensus on the estimation method still poses an intellectual

challenge in assessing the computer-use wage premium, especially in analyzing it over the long run taking into consideration the diffusion of computers.

Information technology (IT) also affected productivity and thus influenced economic growth. An area of research that focuses on the impact of technology on productivity growth provided an interesting finding: times of rapid technological advancement are associated with an increase in the demand for skill and in turn a rise in the return to skill; however, the skill premium declines as technological progress matures (Greenwood and Yorukoglu, 1997). Contrarily, a study that analyzes the effect of new technology (NT) use on wages has suggested that skill differentials are driven by the years of experience with NT rather than by the use of NT, and thus the wage premium increases with NT experience (Entorf and Kramarz, 1998). These studies show the contradicting result in examining the impact of technology on the skill premium and in turn analyzing its effect on wages.

Studies that examine the effect of technological change on women's employment suggest that information technology (IT), particularly the use of computers at work, has changed the way women perform in the workplace (National Research Council, 1986; and others) and that increased computer use has raised the demand for women relative to men (Weinberg, 2000). In addition, the increase in women's educational attainment and their workforce commitment have led to an increase in firms' on-the-job training for women and a reduction in occupational segregation, and in turn the gender wage differentials have significantly narrowed over the last two decades (Blau and Kahn, 2000; and others). Although these changes have been well documented (National Research Council, 1986;

Blau and Kahn, 1997; Weinberg, 2000; and others), the effect of computer use on female wages has not been closely analyzed in the literature.

Such intellectual questions and debate in the literatures have motivated me to examine the relationship between the diffusion of computers and wages by focusing on the following context as my dissertation.

DIFFUSION OF COMPUTERS AND WAGES IN THE U.S.

The study in Part Two of this dissertation concerns the impact of the diffusion of computers on wages. The existing empirical studies have examined the effect of computer use on wages with the use of data only during the 1980s. This study extends the prior empirical analysis of estimating the computer use wage premium up to the year 2001. This study also estimates the returns of the impact of computers on wages by employing a new empirical approach of grouping workers into high and low-computer use occupations and industries in order to reduce some (but not all) of the unobservable heterogeneity in the cross-section models. This study further analyzes the effect of the diffusion of computers on wages, focusing on trends, over time in the U.S. As discussed earlier, cross-sectional estimations of the computer wage premium could be biased each year because of the omission of unobservable heterogeneity in human capital, occupations, and industries. However, this should not affect a comparison over time of the computer wage premium as long as the biased heterogeneity does not vary systematically over the years observed. Finally, this study examines the effect of

experience and learning on wages while considering the diffusion of computers, which allows us to understand how the diffusion of computer technology has altered a worker's skill premium and in turn how it has affected a worker's wage premium.

DIFFUSION OF COMPUTERS, WAGES AND WOMEN IN THE U.S.

The study in Part Three of this dissertation explores the affect of computer use on female wages. This second study analyzes how the use of computers and, in particular, the way a computer is used affect differently the wages of women as computers diffused during the period 1984-2001. This study further examines the impact of how differences in occupations and in industries affect female wages while considering how workers use computers at work. This is done by employing a new empirical approach of grouping workers into high and low-computer use occupations and industries. The empirical results of this study provide the impact of computers on the determinants of female wages and further argues the importance in evaluating policies that reduce the existing occupational and industry wage differentials in order to improve the determination of wages for women.

PART II

THE DIFFUSION OF COMPUTERS AND WAGES IN THE U.S.: OCCUPATION AND INDUSTRY ANALYSIS, 1984-2001

THE DIFFUSION OF COMPUTERS AND WAGES IN THE U.S.: OCCUPATION AND INDUSTRY ANALYSIS, 1984 - 2001

ABSTRACT

This paper uses the U.S. Current Population Survey data for 1984-2001 to examine the impact of the diffusion of computers on wages and the effects attributable to differences in computer use, worker characteristics, occupations, and industries. Cross-section estimates find that at the aggregate level, computer use on the job generates an average wage premium of 20% to 25%. However, at the micro level, the computer-use wage premium varies depending on how computers are used by up to an additional 11 percentage points. The premium also varies according to worker characteristics, occupations and industries. Furthermore, the effect of experience on wages (and thus the resulting wage premium) decreases with the diffusion of computers but at rates that depend on occupations and industries.

Key Words: Wage, Computers, Occupation, Industry
JEL Classification: J30, J31, O33

I. INTRODUCTION

The information technology that has been driving the technological revolution in the U.S. since the last twentieth century has caused tremendous investment-specific change for factories, firms and workers in all sectors. In particular, the introduction of the personal computer (in the mid-1970s) and the sharp decline in the relative price of computer equipment (after 1980) substantially changed the way workers perform their duties. Several studied have documented that the wage differential associated with computer use is 10 to 15% (Krueger, 1993; Dinardo and Pischke, 1997; and others). However, the use of computers in the workplace was neither simultaneous nor instantaneous but evolved at individual rates as computer technology diffused into different industries and occupations.

When analyzing the data for evidence of a computer-use wage premium, one must account for many factors that were absent from prior studies and that complicate the analysis. For example, there are the problems of measurement and the long diffusion lag, which have been considered in studies that focus on the impact of technology from the perspective of productivity growth (Brynjolfsson, 1993; and David, 1989), but also need to be considered when estimating the true computer-use wage premium. Furthermore, as a study that assesses the impact of technological progress on a worker's skill premium suggests, times of rapid technological advancement are associated with an increase in the demand for skill and in turn a rise in the return to skill, but the skill premium declines as technological progress matures (Greenwood and Yorukoglu, 1997); therefore, it follows then that there is also an impact of varying importance over time on the computer-use

wage premium associated with the skill premium; this also must be considered. Moreover, the empirical analysis on the effect of different worker characteristics, occupations, and industries on wages while considering the impact of the diffusion of computers is not also well examined. This paper addresses these issues by employing cross-section estimates with the use of two distinct approaches to the U.S. Current Population Survey data for the years 1984, 1989, 1993, 1997, and 2001.

This paper's first analysis, which follows the method used by Krueger (1993), finds that the use of computers on the job generates an average wage premium of 20% to 25% and that this premium is largely invariant over time. However, this relatively constant wage premium at the aggregate level has several interesting patterns when examined at the micro level. For example, the computer-use wage premium varies by up to an additional 11 percentage points depending on how computers are used on the job. Furthermore, the premium for each of these computer applications changes at different rates over time. Additionally, different worker characteristics also affect wages differently over time.

This paper's second analysis employs a new empirical approach of grouping workers into high and low-computer use occupations and industries. The empirical analysis concludes that at the micro level, the computer-use wage premium depends also on occupation and industry and that the premiums for different occupations and industries change at different rates over time. Moreover, different worker characteristics not only affect wages differently over time but also cause wages to differ by occupations and industries. For example, while female wages overall are 23-36% lower than male wages, the wage

differential is smaller for women who work in high computer-usage industries. Furthermore, the effect of experience (and learning) on wages decreases with the diffusion of computers, and thus the resulting wage premium also decreases over time but at rates that depend on occupation and industry.

An area of considerable, persistent debate in the studies that estimate the effect of computers on wages concerns the biased estimates that are derived from the cross-section models, such as used in this study, due to the omission of unobservable heterogeneity in human capital, occupations, and industries (Handel, 1998; DiNardo and Pischke, 1997; and others). Even more important has been the debate on the fundamental question of what is an appropriate proxy to measure scarce computer *skills* and/or *knowledge* (not just computer *use*) when determining the true returns of computers on wages. Furthermore, the recent literature discusses a potentially important problem for the skill-biased technological change (SBTC) hypothesis (which explains the recent change in the wage structure and the rapid increase in wage inequality); several studies in this literature suggest that the SBTC hypothesis fails to explain movements in the educational, gender and racial wage differentials as well as the trend and timing of both the wage structure and wage inequality and its relation to the continuing advancing computer technology in the 1990s (Card and DiNardo, 2002; Acemoglu, 2002; and others).

Although the issues with the estimation method and the questions on the SBTC hypothesis still persist, the significance of the empirical results from cross-section estimates has been established in the literature. The recent study by Dolton and

Makepeace (2004), which uses the National Child Development Study (NCDS) data in Britain, concludes that cross-section estimates are large and consistent, and thus these estimates provide direct evidence of a wage premium using computers. Likewise, the empirical results of this study find that the cross-section estimates are statistically significant. Furthermore, a comparison over time of the computer wage premium for the purpose of assessing the effect of the diffusion of computers on wages is relevant as long as the biased heterogeneity does not vary systematically over the years observed. Accordingly, the estimation results in this study are empirically valid, and the findings are economically important.

The main conclusion derived from the empirical results in this study therefore proves that while in the aggregate the computer-use wage premium varies within the relatively narrow range of 20% to 25% for the period 1984-2001, at the micro level, the estimated wage premium depends on worker characteristics, occupations, industries and on how computers are used on the job. Furthermore, the effect of experience (and learning) decreases as computers diffuse, as the Greenwood and Yorukoglu (1997) study suggested, and thus the resulting wage premium is found to also decrease over time. These findings favor Krueger's study, which supports the skill-biased technical change (SBTC) hypothesis, and further suggest the presence of a computer-use wage premium as well as occupation and industry wage differentials.

The remainder of the paper is organized as follows. Section II reviews the descriptive analysis for computer usage for the years 1984, 1989, 1993, 1997, and 2001 CPS data.

Section III presents the analysis on computer use and wages. Section IV documents the analysis on computer use and wages by occupations and by industries. The final section concludes.

II. DESCRIPTIVE ANALYSIS

This section summarizes the trends in computer usage at work for the period 1984-2001 and the changing characteristics of the workers who use computers. The tabulations in this section are based on the October CPS data for the years 1984, 1989, 1993 and 1997 and the September CPS data for the year 2001. The data for this microdata file come from two sources, the basic CPS and the Supplement Questions on Computer Use, for the calendar year preceding each survey. The core sample is restricted to adults who are under the retirement age (individuals aged 18-65 at the survey date), who have at least a high school diploma or equivalent (GED), and who are currently employed (both full and part-time with both pay and no pay[1]) in the labor force. A more detailed description of the data is in Appendix A.

1. Computer Usage at Work Within Demographic Groups

Table 1 reports computer usage at work for various demographic groups over time. Figure 1 illustrates computer usage by education group. It shows that the likelihood of using a computer increased with education, and it further illustrates the diffusion of

[1] The data for the years 1989 and 1993 also include individuals who are part-time working with no pay (<=15 hours; temporary no pay job).

computer usage in the workplace but shows that the rate of diffusion differed for different education levels. Between 1984 and 2001 computer usage for workers who attained more than a Bachelor's degree increased relative to that for workers who attained less than an Associate degree. In addition, the rate of increase for more-educated workers increased over time; whereas, the rate of increase for less-educated workers declined during the period. This increased the computer usage differentials between more-educated and less-educated workers.

Figure 2 illustrates computer usage for all workers and individually for men and for women. It shows the diffusion of computer usage in the workplace for the last two decades. Between 1984 and 2001 the percentage of workers using computers increased from 26.7 % to 60.1%, although the rate of increase gradually declined over time. Figure 2 also demonstrates that computer usage by women was higher than computer usage by men during the full period. In addition, the computer usage differentials between men and women also slightly widened over time as a result of the rate of increase in computer usage for women being slightly higher relative to that for men. Table 1 further presents computer usage for other demographic subgroups. The likelihood of using a computer for all demographic subgroups increased during the period 1984-2001.

2. Computer Usage at Work by Application

Table 2 presents computer usage at work by each computer application for the years 1989, 1993, 1997 and 2001.[2] It illustrates the diffusion of computer usage in the workplace but

[2] Computer usage for the year 1984 is omitted because the data for computer applications for that year is not available.

shows that the rate of diffusion differed for each computer application. The table indicates that computer usage for the computer mediated communication (CMC) system[3] increased from 15.6% in 1989 to 48.9% in 2001. It shows that the use of Internet technology dramatically increased in the workplace during the last decade. In addition, computer usage for spreadsheets & databases increased from 15.2% in 1989 to 38.2% in 2001, and usage for word processing increased from 17.0% in 1989 to 41.1% in 2001. This indicates that workers also adopted these two specific computer applications in the last two decades. Looking at a technical computer application, computer usage for graphics & design increased from 7.6% in 1989 to 17.6% in 2001; however, the rate of computer usage was still small. Similarly, computer usage for programming increased only from 7.6% in 1989 to 9.2% in 2001, which indicates that still only a few workers use the computer for technical work.

3. Computer Usage at Work by Occupation and by Industry

Table 3 and Table 4 report computer usage at work by occupations and industries for the years 1984, 1989, 1993, 1997 and 2001. These tables demonstrate that the rate of diffusion of computers differed for each occupation and for each industry. Figure 3 shows that the rate of computer usage for occupations in which workers reported low initial computer use, such as service occupations (O20), increased at an increasing rate during the full period. This suggests that computers were still not fully used in the workforce for these occupations during the last two decades. On the other hand, the rate of computer usage for occupations in which workers reported high initial computer use, like engineers

[3] The computer mediated communication (CMC) system includes Internet, e-mail, a calendar, scheduling.

(O4), increased in the early stage, continued to increase at a decreasing rate during the middle stage, and then declined in the late stage. This indicates that computers were fully utilized in the workplace for these occupations during the full period. Additionally, there are occupations that reported their computer usage substantially changed (increased or decreased) during the period. For instance, the rate of computer usage for social scientists (O6) increased at an increasing rate during the full period (from 28.6% in 1984 to 92.8% in 2001); whereas, the rate of computer usage for computer equipment operators (O15) decreased over time (from 94.9% in 1984 to 87.7% in 2001).

Figure 4 demonstrates a similar pattern for computer usage at work by industry. The rate of computer usage for industries in which workers reported low initial computer use, such as construction (I2), increased at an increasing rate during the full period, and the rate of computer usage for industries in which workers reported high initial computer use, such as banking and other finance (I28), increased during the early stage, increased continuously but at a slower rate during the middle stage, and then computer usage declined in the late stage.

III. COMPUTER USE AND WAGES

As the first analysis in this paper, this section examines the impact of the diffusion of computers on wages. I estimated various specifications, which are applied for each year using Krueger's (1993) approach, to estimate the computer use wage premium for the years 1984, 1989, 1993, 1997, and 2001. I also examined the effect of the diffusion of

computers on wages for the period 1984-2001, by applying a comparison over time of the computer use wage premiums. Despite the biased estimates due to the omission of unobservable heterogeneity derived from Krueger's (1993) method, a comparison over time of the computer use wage premiums, focusing on trends, would be relevant in assessing the effect of the computer diffusion on wages if the biased heterogeneity does not vary systematically over the years observed. I applied the Chow-statistics and tested whether there are significant differences in the estimated equations for the years observed.[4] The core sample is focused on adults under the retirement age (individuals aged 18-65 at the survey date), who have at least a high school diploma or equivalent (GED), and who are currently employed (both full and part-time) in the labor force. However, the sample is further restricted to those individuals who report their weekly earnings as more than zero.

1. Methodology

I used the following standard cross-sectional earnings equation to examine firstly how the use of computers affects wages of workers. This updates Krueger's estimate, and secondly shows how wages are different depending on the use of specific computer applications. All of the regression analysis in this paper uses simple ordinary least squares (OLS) with White heteroscedasticity-consistent standard errors.

$$\ln(W_i) = \alpha + \beta X_i + \delta_1 CU_i + \sum_{c=1}^{C=5} \delta_{2c} CC_{ic} + \varepsilon_i, \qquad (1)$$

[4] See Appendix 3, The Results of Equality Between Sets of Coefficients using Chow-test; 1984-2001, for details.

where the actual log wage of an individual (worker) i ($\ln(W_i)$) is a function of: (1) control variables (X_i); (2) the use of computers for any purpose at work for worker i (CU_i) ("yes=1" if an individual uses a computer for any purpose at work); (3) the use of computers for any one of the five specific computer applications at work for worker i (CC_{ic}) ("yes=1" if an individual uses a computer for the computer mediated communication (CMC) system, graphic & design, programming, spreadsheets & databases, and/or word processing at work)[5]; and (4) a mean zero individual error term (ε_i).

2. Empirical Analysis and Results

2.1 Computer-Use Wage Premium Over Time

I first analyze how the use of computers affects wages over time - estimating the computer-use wage premium (the return on wages from using a computer for any purpose at work) for the period 1984-2001. Table 5 reports the results of fitting equation (1) by OLS, which includes a dummy variable for the use of computers for any purpose at work for worker i (CU_i) and control variables (X_i) (including the length of experience (age)[6],

[5] The CPS questionnaire asks the question, "Does ... directly use a computer at work?" to each individual in the survey. The CPS questionnaire further asks the question, "Does ... use the computer for (1) Internet/email; (2) graphic & design; (3) programming; (4) spreadsheets & database; (5) word processing; (6) a calendar or do scheduling; and (7) (work) other?" to each individual. I interpret CU_i=1 as "the individual uses a computer for any purpose at work," and I divide C1-C5 into five specific computer applications at work (see Table 2, Computer Use by Application). There are cases where CU_i=1 and C1 through C5 all equal zero. In this case, CU_i=1 should be interpreted as computer use for all purposes other than C1 through C5. The data shows that the percentage of cases each period that have CU=1 and C1-C5 all equal zero is relatively large: (28% in 1989, 27% in 1993, 19% in 1997 and 8% in 2001), but its percentage is decreasing over time. I expect that a worker uses a computer for at least one of the five computer applications at work. Thus, most of the cases where CU=1 and C1-C5=0 may resulted from a subjective response by interviewers during the survey.

[6] Experience (age) variable is defined as age of worker i.

the length of experience (age) squared, the highest degree an individual earned categorized into five levels of education, gender, race, ethnicity, marital status, union member status, labor force status, metropolitan living status, and region). The results indicate the computer-use wage premium varied within the relatively narrow range of 20% (exp(0.184)-1) to 25% for the period 1984-2001.

2.2 Computer-Use Premium With Computer Application Over Time

Next, I examine how specific computer applications affect wages differently over time for the period 1989-2001.[7] Table 6 reports the results of fitting equation (1) by OLS, which includes the five dummy variables for the use of computers at work by each computer application for worker i (CC_i) in the previous specification (in section 2.1). Under this specification, the regression includes both a dummy variable for the computer use for any purpose at work (CU_i) and dummy variables for the five specific computer applications (CC_{ic}), and thus the coefficients on the specific computer application are interpreted as an indication of the additional payoff that a worker earned from using a specific computer application relative to any computer use at work.

The results in Table 6 show that controlling for the five specific computer applications (CC_{ic}) reduces the estimated coefficient on the use of computers for any purpose at work for worker i (CU_i) to 13.9% in 1989, 13.5% in 1993, 10.8% in 1997, and 5.5% in 2001. The table, however, illustrates that an individual who used spreadsheets & databases

[7] The estimates for the year 1984 are omitted because the data for computer applications for that year is not available.

obtained an additional 7-9% wage premium during the full period. The results also suggest that an individual who used the CMC system did not receive any additional wage premium in 1989; but the additional wage premium started to appear after 1993 at an increasing rate -- 4.3% in 1993, 7.7% in 1997 and 10.7% in 2001. In contrast, an individual who used word processing obtained an additional wage premium of 3.1% in 1989, 9.0% in 1993, and 4.1% in 1997; but it disappeared (became insignificant) after 1997. Similarly, an individual who used graphic and design obtained an additional wage premium of 7.9% in 1989 and 3.5% in 1993; however, the additional premium disappeared (became insignificant) after 1993. Moreover, the additional wage premium from using programming was inconsistent across the years. This may reflect the fact that computer usage for programming was very small. These results indicate that the use of specific computer applications affect the wages of a worker differently at a different rate over time.

2.3 Wage Premium By Different Worker Characteristics

Next, I analyze how different worker characteristics affect the wages of a worker over time. Table 6 shows that education has a significant effect on earnings. The wage premium for an individual who had some college education but no diploma increased from 4.5% in 1989 to 6.5% in 2001; whereas, that for an individual who attained an Associate degree decreased from 16.4% in 1989 to 12.7% in 2001. The wage premium for an individual who attained a Bachelor's degree varied between 28% and 38% and that for an individual who attained an Advanced degree varied between 51% and 55% during

the period. This indicates that higher education provides a higher return on wages for a worker as many studies in the literature suggest (Katz and Autor, 1999; and others).

Table 6 further illustrates the impact of other characteristics on wages. Experience has a significant effect on wages and its impact is 4-5% per year during the period.[8] Furthermore, the wage premium for females averaged 20-25% lower relative to males, and the wage premium for Blacks averaged 5-12% lower relative to Whites. Looking at ethnic group, while the wage premium for Hispanics was statistically insignificant in 1989, the premium was an average of 11-13% lower relative to that for Non-Hispanics during the period 1993-2001. All of these findings are consistent with findings in the literature (Altonji and Blank, 1999; and others). Additionally, an individual who was married earned 6-9% more than a non-married individual, and a union member earned 16-26% more than a non-union member. In addition, an individual who lived in a Metropolitan area earned 14-17% more than the one who did not. Among regions, an individual who lived in the East earned the most, indicating that regional difference also affect wages.

[8] The return on experience may differ between men and women as a result of the differences in labor participation, workforce commitment, and education. The empirical results in Appendix 4 show that the return on experience for men was slightly higher than that of all workers between 1984 and 1993; however, the return on experience for men and that for all workers were quite similar between 1997 and 2001. It follows, then, that the same holds true for men when compared with just women. Some observed differences in the return on experience between men and women might be explained by differences in firms' on-the-job training by gender and in the academic major that an individual chose, which in turn affect a choice of occupations and industries, and also possibly by the unobservable ability or quality of a worker.

2.4 Computer-Use Wage Premium By Skill Differences

Finally, I examine the direct effect of the introduction of the personal computer on wages by focusing on the return on experience. To do so, I constructed an additional dummy variable that is defined as "experience after 1974" (which was the introduction of the personal computer). I also analyze the effect on wages of the highest academic degree that an individual earned prior to age 35. As many individuals hold multiple degrees, the educational return on wages might be hard to measure. Thus, I formulated an additional dummy variable, which is defined as "the highest academic degree that an individual earned prior to age 35," in order to avoid the effect of multiple degrees and to examine the direct effect of education on wages.

Table 7 shows the results of fitting equation (1) by OLS, with a dummy variable for the use of computers for any purpose at work for worker i (CU_i) and control variables (X_i) (including the length of experience (age), the length of experience measured only after the year 1974[9], the length of experience squared, the length of experience measured only after the year 1974 squared, the highest degree an individual earned categorized into five levels of education, the highest degree an individual earned prior to age 35 categorized into five levels of education, gender, race, ethnicity, marital status, union member status, labor force status, metropolitan living status, and region).

[9] Experience after 1974 is defined as the number of years that worker i (since age 18) used a computer on the job after the introduction of the personal computer in 1974.

The results in Table 7 illustrates that, when dummy variables are included in the equation for a worker's degree ((i) the highest degree an individual earned and (ii) the highest degree an individual earned prior to age 35), the length of a worker's experience (age), and the length of a worker's experience measured only after the year 1974, the computer-use wage premium (CU_i) was quite similar to the results in Table 5 (in section 2.1): 20.3% in 1984, 22.1% in 1989, 25.0% in 1993, 22.1% in 1997, and 20.4% in 2001 -- both an average of 22.0%.

Table 7 shows that the wage premium for experience measured only after the year 1974 was 2.4% in 1984, increased to 4.8% in 1989, decreased to 3.1% in 1993, and then became insignificant in both 1997 and 2001. This result suggests that worker's experience (and learning) increased the wage premium during the implementation of computers in the 1980s. However, the effect of experience (and learning) on wages decreased with the diffusion of computers in the mid-1990s, and it further became insignificant after the late 1990s. It is important to note that these trends indicate the correlation in timing between the change in the wage premium and the effect of worker's experience (and learning) over time. These results thus suggest that the effect of experience (and learning) decreased and became insignificant with the diffusion of computers and in turn the resulting wage premium also decreased over time, supporting the previous findings in Table 6 (in section 2.3). It further confirms the notion suggested by Greenwood and Yorukoglu (1997) in which skill premium rises during an implementation of a new technology but declines as information technology matures.

Table 7 also illustrates that the wage premium for workers with any of the five levels of educations (the highest degree an individual earned) was slightly higher than the results in Table 5 (in section 2.1) -- an average of 8.8% versus an average of 6.2% for some college education but no diploma, an average of 16.6% versus an average of 15.7% for an Associate degree, an average of 35.0% versus an average of 32.9% for a Bachelor's degree, an average of 57.4% versus an average of 53.8% for an Advanced degree. However, the result shows that the education wage premium for the highest academic degree that an individual earned prior to age 35 was inconsistent across the years; this result indicates that the effect of the highest academic degree that an individual earned prior to age 35 was insignificant in determining wages (at least for the periods that are examined).

IV. COMPUTER USE AND WAGES BY OCCUPATION & BY INDUSTRY

As the second analysis in this paper, this section analyzes the impact of the diffusion of computers on wages by occupations and by industries. I estimated various specifications, which employ a new empirical approach of grouping workers into high and low-computer use occupations and industries. This is done first to reduce some (but not all) of the unobservable heterogeneity in the cross-section models, focusing on occupation and industry differences, that may affect wages, and secondly to examine the wage differential associated with the diffusion of computers both at the occupation and industry level for the years 1984, 1989, 1993, 1997, and 2001. The analysis is based on the core sample that is used in Section III.

1. Methodology

1.1 Define "High" and "Low Computer-Usage" Groups

In order to examine the wage premium associated with the diffusion of computers both at the occupation and industry level, I grouped workers into high and low-computer use occupations and industries using the following procedure.

As a first step, I constructed two levels of "computer-usage *occupation*" groups (*high* computer-usage *occupation* (HO) and *low* computer-usage *occupation* (LO)) and two levels of "computer-usage *industry*" groups (*high* computer-usage *industry* (HI) and *low* computer-usage *industry* (LI)). To do so, I estimated for each year the relationship (1) between the use of computers and occupations and (2) between the use of computers and industries by using the following equations with simple ordinary least squares (OLS):

$$CU_i = \alpha_j O_j + \varepsilon_i \qquad \text{where } j = 1.....26 \qquad (2)$$

$$CU_i = \alpha_k I_k + \varepsilon_i \qquad \text{where } k = 1....44 \qquad (3)$$

where CU_i indicates a dummy variable for the use of computers for any purpose at work ("yes=1" if an individual uses a computer for any purpose at work). O_j indicates occupation, which is defined by j, and is divided into twenty-six categories based on the Standard Occupational Classification (SOC) code. I_k indicates industry, which is defined by k, and is divided into forty-four categories based on the Standard Industrial Classification (SIC) code. The coefficient (of each occupation and industry) derived from

the above equations represents the proportion of individuals who use computers for any purpose at work by occupations and industries for each year.

Based on the proportion of individuals who use computers for any purpose at work by occupation and industry for each year, I divided the occupation group into a "*high* computer-usage *occupation*" group (HO) if the percentage use is greater than .75 and a "*low* computer-usage *occupation*" group (LO) if the percentage use is lower than .75. Likewise, the industry group is divided into a "*high* computer-usage *industry*" group (HI) if the percentage use is greater than .60 and a "*low* computer-usage *industry*" group (LI) if the percentage use is lower than .60. I used the median percentage point based on 2001 as a cutoff point in determining the occupation and industry groups.

As a second step, I interacted the occupation and industry groups. This forms four groups, which are denoted as "computer-usage occupation and industry interacted" groups: (1) "*high* computer-usage *occupation* interacted with *high* computer-usage *industry*" group (HOHI); (2) "*high* computer-usage *occupation* interacted with *low* computer-usage *industry*" group (HOLI); (3) "*low* computer-usage *occupation* interacted with *high* computer-usage *industry*" group (LOHI); and (4) "*low* computer-usage *occupation* interacted with *low* computer-usage *industry*" group (LOLI). This was done in order to measure the impact of the use of computers on wages by occupations and by industries.
As a final step, I further combined each of these four "computer-usage occupation and industry interacted" groups with: (1) control variables ($HOHIX_i$, $HOLIEX_i$, $LOHIX_i$, and $LOLIX_i$, where i = 1 ...I); (2) a dummy variables for computer use for any purpose

(HOHICU$_i$, HOLICU$_i$ LOHICU$_i$, and LOLICU$_{i,}$ where i = 1 ...I); and (3) a dummy variables for each of five specific computer applications (HOHICC$_{ic}$, HOLICC$_{ic}$, LOHICC$_{ic}$, and LOLICC$_{ic}$, where i = 1 ...I and c = 1 ...5).

1.2 Model To Estimates for Occupation and Industry

I used the following standard cross-sectional earnings equation (which is estimated using simple least squares (OLS)) to analyze the impact of the diffusion of computers on wages by occupations and by industries.

$$\begin{aligned}\ln(W_i) = {} & \alpha + \beta X_i + \delta_1 CU_i + \sum_{c=1}^{C=5} \delta_{2c} CC_{ic} + \sum_{g=1}^{G=2} \phi_{1ig} CUO_{ig} \\ & + \sum_{g=1}^{G=2} \phi_{2ig} CUI_{ig} + \sum_{g=1}^{G=2} \gamma_{1ig} (CUO_{ig}) X_i + \sum_{g=1}^{G=2} \gamma_{2ig} (CUI_{ig}) X_i \\ & + \sum_{g=1}^{G=4} \eta_{ig} [(CUO*CUI)_{ig}] + \sum_{g=1}^{G=4} \lambda_{ig} [(CUO*CUI)_{ig}] X_i \\ & + \sum_{g=1}^{G=4} \mu_{1ig} [(CUO*CUI)_{ig}] CU_i + \sum_{g=1}^{G=4} \sum_{c=1}^{C=5} \mu_{2ig} [(CUO*CUI)_{ig}] CC_i \\ & + \varepsilon_i, \end{aligned} \quad (4)$$

where the actual log wage of an individual (worker) *i* (ln(W_i)) is a function of: (1) control variables (X_i); (2) the use of computers for any purpose at work for worker *i* (CU_i); (3) the use of computers for any one of the five computer applications at work for worker *i* (CC_{ic}); (4) worker *i*'s computer-usage occupation (which is also defined as worker *i*'s occupation *j*) (CUO_{ig}); (5) worker *i*'s computer-usage industry (which is also defined as worker *i*'s industry *k*) (CUI_{ig}); (6) worker *i*'s computer-usage occupation multiplied by each of control variables [(CUO_{ig})X_i]; (7) worker *i*'s computer-usage industry multiplied by each of control variables [(CUI_{ig})X_i]; (8) worker *i*'s "computer-usage occupation and

industry interacted" group (which is also defined as worker *i*'s occupation *j* interacted with worker *i*'s industry *k*) [$(CUO*CUI)_{ig}$]; (9) worker *i*'s "computer-usage occupation and industry interacted" group multiplied by each of control variables ([$(CUO*CUI)_{ig}$]X_i); (10) worker *i*'s "computer-usage occupation and industry interacted" group multiplied by the use of computers for any purpose at work for worker *i* ([$(CUO*CUI)_{ig}$]CU_i); (11) worker *i*'s "computer-usage occupation and industry interacted" group multiplied by the use of computers for any one of the five specific computer applications at work for worker *i* ([$(CUO*CUI)_{ig}$]CC_{ic}); and (12) a mean zero individual error term (ε_i).

2. Empirical Analysis and Results

2.1 Computer-Use Wage Premium With Occupation and Industry Differences Over Time

I first examine how the use of computers affects wages depending on the differences in occupations and industries for the period 1984-2001. Table 8 reports the results of fitting equation (4) by OLS, with the "computer-usage occupation and industry interacted" group multiplied by the use of computers for any purpose at work for worker *i* ([$(CUO*CUI)_{ig}$]CU_i), the "occupation and industry interacted" groups [$(CUO*CUI)_{ig}$], a dummy variable for the use of computers for any purpose at work for worker *i* (CU_i), and control variables (X_i) (including the length of experience (age), the length of experience (age) squared, the highest degree an individual earned categorized into five levels of education, gender, race, ethnicity, marital status, union member status, labor force status, metropolitan living status, and region).

Figure 5 indicates that an individual who was in the "*high* computer-usage *occupation*, in a *high* computer-usage *industry*" group using a computer for any purpose at work (HOHICU) earned an estimated wage premium relative to a worker who did not use a computer and was in the "*low* computer-usage *occupation*, in a *low* computer-usage *industry*" group of 46.7% (17.6% as the premium for using a computer, 37.9% as the premium for being in the HOHI group, and –8.8% as the premium for being in the HOHICU group) in 1984, 49.2% in 1989, 53.9% in 1993, 45.3% in 1997, and 35.7% in 2001; the premiums earned by this group of workers were the highest among all groups. Also, the wage premium for workers who were in this group increased between 1984 and 1993, and then it declined afterward.

The figure also shows that an individual who was in the "*high* computer-usage *occupation*, in a *low* computer-usage *industry*" group using a computer for any purpose at work (HOLICU) earned an estimated wage premium of 44.2% in 1984, 37.6% in 1989, 33.5% in 1993, 31.3% in 1997, and 29.8% in 2001; the premiums earned by this group of workers declined during the full period.

Finally, Figure 5 indicates that an individual who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group using a computer for any purpose at work (LOHICU) earned an estimated wage premium of 27.0% in 1984, 22.8% in 1989, 22.7% in 1993, 22.6% in 1997, and 16.2% in 2001. The premiums earned by this group of workers were relatively constant during the period 1989-1997 and then declined further between 1997 and 2001.

These wage premiums are determined in part by the computer use effect, which is between 11% and 18% for the period 1984-2001, but more so by the occupation and industry effect (25-39% wage premium for being in the HOHI group for the period 1984-2001, 18-30% premium for being in the HOLI group for the period 1984-2001, and 4-9% premium for being in the LOHI group for the 1984-1997). (The results of fitting equation (4) by OLS are presented in Table 8, 9, and 10, and the estimated wage premiums are in Table 11.) These results suggest that differences in both occupation and industry have a significant impact on wages and that the premium changed at different rates over time.

Technological change as the factor altering worker mobility may explain the changes in the wage premiums. A high demand for knowledge of computer use at a high technology-use work environment in the early stage of computer implementation (during the 1980s) increased the wages of workers who were in the high computer usage occupations. However, the wages of workers in this group decreased because the premium for knowledge of computer use declined with the diffusion of computers (after the 1990s) in this work environment. As computers diffused, there was worker mobility between industries, which led to an increase in the supply of high computer skill workers in the low computer usage industries. This led to a decrease in the wages of workers in this group over time. On the other hand, the effect of computer-use knowledge at a low technology-use work environment was relatively small and thus the wage premium for workers in this group was relatively constant during the period 1984-2001, although it was declining over time.

2.2 Computer-Use Wage Premium With "Occupation and Industry Interacted" Groups by Different Computer Application

Next, I examine how specific computer applications affect wages differently while controlling for occupation and industry for the period 1989-2001. Table 9 reports the results of fitting equation (4) by OLS, which includes the "computer-usage occupation and industry interacted" group multiplied by the use of computers for any one of the five specific computer applications at work for worker *i* ($[(CUO*CUI)_{ig}]CC_{ic}$) in the previous specification (in section 2.1).

Table 9 shows that controlling for occupation and industry as well as the five specific computer applications (CC_{ic}) reduces the estimated coefficients that are associated with both the computer use effect and the occupation and industry effect. The results show that an individual who was in the "*high* computer-usage *occupation*, in a ***high*** computer-usage *industry*" group using a computer for any purpose at work ($HOHICU_i$) earned an estimated wage premium of 39.0% (11.7% as the premium for using a computer, 34.9% as the premium for being in the HOHI group, and 7.6% as the premium for being in the HOHICU group) in 1989, 47.6% in 1993, 39.4% in 1997, and 25.5% in 2001 relative to a worker who did not use a computer and was in the "*low* computer-usage *occupation*, in a *low* computer-usage *industry*" group; their premiums increased significantly until 1993 and then declined. In contrast, an individual who was in the "*high* computer-usage *occupation*, in a *low* computer-usage *industry*" group using a computer for any purpose at work ($HOLICU_i$) earned the aggregate premium of 41.7% in 1989, 26.9% in 1993, 24.8% in 1997 and 19.6% in 2001; their premiums declined during the full period. Furthermore,

an individual who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group using a computer for any purpose at work ($LOHICU_i$) earned the estimated wage premium of 19.7% in 1989, 15.7% in 1993, and 9.8% in 1997, and a premium that was statistically insignificant in 2001, which shows that the aggregate premium declined until 1997 and then disappeared after 1997. This shows that the estimated wage premium differed depending on a worker's occupation and industry as well as the use of computers, and also that the wage premium changed at different rates over time.

Table 9 further demonstrates that, when occupation and industry are controlled, the use of the CMC system did not provide any additional wage premium for workers between 1989 and 1993. However, it started to provide an additional wage premium of 7.0% for workers in all groups in 1997. In 2001, it provided a premium of 13.5% for a worker who has a high computer occupation (HOHIC1 and HOLIC1) and an additional premium of 4.3% for a worker who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group (LOHIC1). These results indicate that the use of the CMC system since the 1990s increased the wage premium of workers in all groups, especially for an individual who had a high computer-usage occupation, and that the premium changed at different rates over time.

The table also illustrates that the use of graphics & design provided an additional 19.0% wage premium for workers in all three groups (HOHIC2, HOLIC2, and LOHIC2) in 1989. In 1993, it provided an additional premium of 1.2% for a worker who was in a high

computer-usage industry with a high computer-usage occupation (HOHIC2) and an additional premium of 13.5% for a worker who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group (HOLIC2). These results show that the use of graphics & design provided an additional wage premium in the early years, especially for a worker who had a high computer-usage occupation.

Table 9 shows that the use of spreadsheet & databases provided an additional 8-9% wage premium for an individual who was in a high computer-usage industry (HOHIC4 and LOHIC4) for the period 1997- 2001, and an additional 8% wage premium for an individual who was in the "*high* computer-usage *occupation*, in a *low* computer-usage *industry*" group (HOLIC4) only in 1997. The results suggest that the premium for the use of spreadsheet & databases depended on a worker's occupation and industry and that the premium changed at different rates over time.

Table 9 also suggests that the use of word processing did not provide any additional wage premium for workers in all three groups in 1989; however, it started to provide an additional 16.0% wage premium to an individual who was in the "*high* computer-usage *occupation*, in a *low* computer-usage *industry*" group (HOLIC5) and an individual who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group (LOHIC5) in 1993. It further shows that the use of word processing did not provide any additional wage premium after 1993 (except for a premium of 1.8% for a worker who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group (LOHIC5) in 2001). These results reflect the fact that nearly everyone used word

processing and further suggest that the effect of using word processing became less significant on wages as computers diffused in the workplace.

Furthermore, the additional wage premium from using programming was inconsistent across the years. This inconsistent wage premium for programming may result from the fact that there were relatively few individuals in these computer applications during the period.[10]

2.3 Computer-Use Wage Premium with "Occupation and Industry Interacted" Groups by Different Worker Characteristics

Lastly, I analyze how different worker characteristics affected wages for the period 1984-2001 while controlling for occupations and industries. Table 10 reports the results of fitting equation (4) by OLS, which includes the "computer-usage occupation and industry interacted" groups combined with control variables ($HOHIX_i$, $HOLIEX_i$, $LOHIX_i$, and $LOLIX_i$, where i = 1 ...I), the "computer-usage occupation and industry interacted" groups combined with a dummy variables for computer use for any purpose ($HOHICU_i$, $HOLICU_i$, $LOHICU_i$, and $LOLICU_i$, where i = 1 ...I), the "computer-usage occupation and industry interacted" groups (HOHI, HOLIE, LOHI, and LOLI), a dummy variable for the use of computers for any purpose at work for worker i (CU_i) and control variables (X_i).

[10] See Table 2, Computer Use by Application, for details.

Table 10 shows that, under this specification, the wage premium for an individual who was in a *high* computer-usage *industry*, especially that for a worker with a high computer-usage occupation, was much higher than that for an individual who was in a *low* computer-usage *industry*. The table also illustrates that the wage premium for an individual who was in the "*high* computer-usage *occupation*, in a *high* computer-usage *industry*" group using a computer for any purpose at work ($HOHICU_i$) increased until 1989 and declined afterward. On the other hand, the wage premium for an individual who was in either of the other groups ($HOHICU_i$ and $HOHICU_i$) declined in 1989, increased in 1993 and declined afterward. This indicates that the computer-use wage premium differed depending on a worker's occupation and industry and that the premium changed at different rates over time, all of which supports the findings in the previous section.

Table 10 also illustrates that the wage premium for an individual who was in a high computer-usage occupation with experience (HOHIAGE and HOLIAGE) averaged 0.5-1.0%, and that the wage premium for an individual who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group with experience (LOHIAGE) averaged 1.0-1.7% over time. In addition, it is important to note that the wage premium decreased over time. This result is consistent with the findings in Section III, 2.4, in which the effect of experience (and learning) decreased with the diffusion of computers, supporting Greenwood and Yorukoglu (1997), and thus the resulting wage premium also decreased over time.

Table 10 further shows that an Advanced degree had a significant effect on earnings for workers in all groups during the period (with the exception of the year 1997), which is consistent with the results in the literature (Katz and Autor, 1999; and others). However, it is important to note that the magnitude of the effect of an Advanced degree varied depending on occupation and industry during the 1984-1989; that effect was consistent for a worker in all groups in the period 1993-2001 (with the exception of the year 1997).

Looking at gender, Table 10 illustrates that the wage premium for a female worker who was in a high computer industry (HOHIGF and LOHIGF) averaged between –21% and –34%, and the wage premium for a female worker who was in the "*high* computer-usage *occupation*, in a *low* computer-usage *industry*" group (HOLIGF) averaged between –26% and –41%. This result suggests that females were better off having a job in a high computer-usage industry.

Table 10 also shows that, within ethnic group, the wage premium for Hispanics averaged between –10% and –15%, and among race group the wage premium for Blacks averaged between –5% and –10%, and that premium changed over time. Additionally, the wage premium for a married individual averaged 7-13% for the full period. However, the effect of the difference in occupation and industry on wages for these demographic groups was less significant during the full period.

Table 10 also indicates that the wage premium for a union member who was in the "*high* computer-usage *occupation*, in a *high* computer-usage *industry*" group (HOHIUM)

averaged 10-16% and the premium for a union member who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group (LOHIUM) averaged 20-36%; this suggests that a union member was better off having a low computer-usage occupation. Furthermore, the wage premium for a union member who was in the "*high* computer-usage *occupation*, in a *low* computer-usage *industry*" group (HOLIUM) was quite high in the earlier years but it declined. Overall, the effect of union membership on wages became less significant during the period.

Finally the table shows that an individual who lived in a metropolitan area and who had a *high* computer-usage *occupation* (HOHIMLS and HOLIMLS) earned the highest wage premium, an average of 17% during the period. In addition, an individual who lived in a metropolitan area and who was in the "*low* computer-usage *occupation*, in a *high* computer-usage *industry*" group (LOHIMLS) earned the least premium, an average of 13%. Among regions, an individual who lived in the East earned the most, while the wage premium for those living in the West was 8% in 1989 and the premium was statistically insignificant in 2001; this suggests that regional difference affect wages. These results are consistent with the results shown in the previous section; however, they further suggest the computer wage premium differed depending on a worker's occupation and industry.

V. CONCLUSIONS AND REMARKS

This paper uses the U.S. Current Population Survey data for the years 1984, 1989, 1993,

1997, and 2001 to examine the impact of the diffusion of computers on wages and to further analyze the effect of the use of specific computer applications, worker characteristics, occupations, and industries on wages by utilizing both Krueger's (1993) method and a new empirical approach of grouping workers into high and low-computer use occupations and industries.

This paper's first analysis, which follows the method used by Krueger (1993), finds that the use of computers on the job generates an average wage premium of 20% to 25% and that this premium is largely invariant over time. However, this relatively constant wage premium at the aggregate level has several interesting patterns when examined at the micro level. For example, the computer-use wage premium varies by up to an additional 11 percentage points depending on how computers are used on the job. Furthermore, the premium for each of these computer applications changes at different rates over time. Additionally, different worker characteristics also affect wages differently over time.

This paper's second analysis employs a new empirical approach of grouping workers into high and low-computer use occupations and industries. The estimation results conclude that at the micro level, the computer-use wage premium depends also on occupation and industry and that the premiums for different occupations and industries change at different rates over time. Moreover, different worker characteristics not only affect wages differently over time but also cause wages to differ by occupations and industries. For example, while female wages overall are 23-36% lower than male wages, the wage differential is smaller for women who work in high computer-usage industries.

Furthermore, the effect of experience (and learning) on wages decreases with the diffusion of computers, and thus the resulting wage premium also decreases over time but at rates that depend on occupation and industry.

Some studies have raised questions about the cross-sectional estimations (which may yield biased empirical results due to the omission of unobservable heterogeneity in human capital, occupations, and industries) in Krueger's estimates of the effects of computer use on wages (Handel, 1998; DiNardo and Pischke, 1997; and others). Moreover, the recent literature discusses a potential important problem for the skill-biased technological change (SBTC) hypothesis (which explains the recent change in the wage structure and the rapid increase in wage inequality), in which the SBTC fails to explain movements in the educational, gender and racial wage differentials as well as the trend and timing of both the wage structure and wage inequality and its relation to the continuing advancing computer technology in the 1990s.

Despite various concerns with Krueger's estimates and the recent issues with the skill-biased technological change (SBTC) hypothesis, the empirical results presented in this paper confirm that the cross-sectional estimations provide large and consistent results, which supports Dolton and Makepeace (2004). This study also suggests that a comparison over time of the computer wage premium is relevant in assessing the effect of the diffusion of computers on wages, focusing on trends, as long as the bias of the estimates, even though present, does not vary systematically across the years. Accordingly, this paper concludes that for the period 1984-2001 the computer-use wage

premium exists, varies within the relatively narrow range of 20% to 25%, and is decreasing over time. However, at the micro level, the estimated wage premium depends also on worker characteristics, occupations, industries and on how computers are used on the job. Furthermore, the effect of experience (and learning) decreases as computers diffuse, as the Greenwood and Yorukoglu (1997) study suggested, and thus the resulting wage premium also decreases over time. These findings favor Krueger's study, which supports the SBTC hypothesis, and further show that the computer use wage premium is from not only direct usage of computers at work but also differences in occupation and industry, which together suggests the presence of occupation and industry wage differentials as well.

TABLE 1
Computer Usage at Work
Using Selected Demographic Group: 1984 – 2001

Computer Use		1984	1989	1993	1997	2001
All Workers		26.71%	39.60%	47.68%	55.39%	60.06%
Sex	Men	23.48%	34.89%	42.61%	50.02%	54.83%
	Women	30.58%	44.82%	53.25%	61.18%	65.66%
Education	High School Grad-Diploma or Equiv	17.68%	26.66%	32.35%	37.57%	40.40%
	Some College But No Degree	25.88%	38.10%	47.60%	54.26%	57.13%
	Associate Degree	30.36%	46.48%	55.47%	60.60%	62.78%
	Bachelor's Degree	36.47%	52.02%	65.35%	74.48%	80.76%
	Advanced Degree (Master, Professional School and Doctorate)	41.79%	57.27%	67.27%	78.40%	86.32%
Race	White	27.18%	40.57%	48.84%	56.50%	61.38%
	Black	22.49%	30.15%	38.12%	45.70%	48.77%
	American Indian	-	32.77%	40.27%	43.96%	51.65%
	Asian	-	38.66%	45.23%	54.52%	58.76%
	Other	23.56%	34.38%	39.50%	-	-
Ethnicity	Hispanic	24.03%	33.42%	39.92%	43.06%	45.47%
	Non-Hispanic	26.92%	39.94%	48.20%	56.18%	61.08%
Age	Age 18-24	21.00%	31.65%	35.64%	41.48%	42.79%
	Age 25-39	30.47%	42.95%	50.76%	57.62%	62.67%
	Age 40-54	26.52%	41.26%	50.36%	58.85%	63.08%
	Age 55-65	19.91%	29.78%	40.11%	49.51%	58.31%
Marital Status	Married	27.22%	40.83%	50.14%	58.13%	63.41%
	Non-Married	25.72%	37.46%	43.54%	50.78%	54.65%
Union Status	Union Member	21.66%	34.62%	41.64%	49.45%	54.15%
	Non-union Member	30.02%	43.92%	50.81%	58.42%	60.50%
Labor Status	Full-Time	29.35%	42.66%	51.03%	58.29%	62.30%
	Part-Time	13.66%	23.28%	30.91%	39.28%	46.85%
Metropolitan	Lives in Metropolitan	30.27%	42.14%	50.31%	57.72%	62.08%
Status	Not Live in Metropolitan	20.53%	31.64%	39.81%	47.35%	53.66%
Region	Northeast	26.91%	38.46%	46.64%	54.79%	59.81%
	Midwest/North Central	25.10%	37.56%	46.98%	54.79%	59.86%
	South	26.54%	40.50%	47.26%	54.70%	59.34%
	West	28.38%	42.10%	50.31%	57.39%	61.32%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 2
Computer Use at Work by Application, 1989-2001

Computer Use by Application		1989	1993	1997	2001
Computer use at work for any purpose	CU	39.6%	47.7%	55.4%	60.1%
Computer use at work for the CMC system	C1	15.6%	21.3%	35.5%	48.9%
Computer use at work for Graphics & Design	C2	7.6%	9.5%	11.5%	17.6%
Computer use at work for Programming	C3	7.6%	6.2%	8.4%	9.2%
Computer use at work for Spreadsheets & Databases	C4	15.2%	20.4%	24.8%	38.2%
Computer use at work for Word Processing	C5	17.0%	21.6%	32.3%	41.1%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 3
Computer Usage at Work By Occupation: 1984-2001 (sorted by 2001)

Computer Use Level	Occupation		1984	1989	1993	1997	2001
HIGH	Social Scientists	O6	28.64%	47.89%	64.12%	81.00%	92.80%
HIGH	Teachers, college and university	O7	41.81%	65.38%	72.90%	81.46%	90.47%
HIGH	Engineers	O4	60.41%	76.54%	84.91%	92.17%	90.31%
HIGH	Officials & administrators, pub. admin.	O1	38.08%	68.60%	85.08%	89.14%	88.73%
HIGH	Management related occupations	O3	57.29%	75.23%	84.30%	88.61%	88.34%
HIGH	Computer equipment operators	O15	94.87%	94.33%	91.87%	93.10%	87.73%
HIGH	Engineering and science technicians	O11	60.48%	71.76%	76.95%	85.10%	84.82%
HIGH	Secretaries, stenographers, and typists	O16	44.99%	72.60%	82.17%	89.06%	84.65%
HIGH	Supervisors, admin. Support	O14	63.41%	72.20%	84.74%	85.67%	83.68%
HIGH	Other executive, admin. & Managerial	O2	38.24%	53.40%	64.50%	75.37%	80.53%
HIGH	Natural Scientists	O5	37.58%	56.33%	66.30%	75.14%	80.52%
HIGH	Other professional specialty occupations	O9	26.12%	44.95%	57.87%	70.22%	79.22%
LOW	Teachers, except college and university	O8	29.34%	39.26%	48.82%	61.84%	74.97%
LOW	Other admin support	O17	43.57%	60.14%	70.82%	76.41%	74.67%
LOW	Supervisors & proprietors, sales occupations	O12	26.60%	40.56%	55.26%	65.95%	71.85%
LOW	Health technologists and technicians	O10	28.87%	45.84%	53.27%	63.11%	63.98%
LOW	Sales related occupations	O13	22.95%	35.98%	45.15%	55.19%	60.36%
LOW	Protective service	O19	21.45%	34.46%	42.83%	50.53%	56.08%
LOW	Precision Product, Craft and Repair	O21	10.67%	15.96%	22.90%	27.38%	33.87%
LOW	Farming, Forestry and Fishing	O24	4.31%	6.37%	12.43%	15.22%	27.30%
LOW	Service Occupation excluding Private Household and Protective	O20	4.37%	7.82%	11.92%	15.16%	23.24%
LOW	Handlers, Equipment Cleaners, Helper and Laborers	O23	4.26%	10.45%	15.13%	17.96%	19.80%
LOW	Transportation and Material Moving	O22	4.08%	8.39%	13.55%	17.71%	18.82%
LOW	Private household service occupations	O18	1.39%	1.47%	1.81%	5.45%	10.68%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 4

Computer Usage at Work By Industry: 1984-2001 (sorted by 2001)

Computer Use Level	Industry		1984	1989	1993	1997	2001
HIGH	Banking And Other Finance	I28	67.99%	78.25%	85.87%	90.53%	88.24%
HIGH	Admin Of Human Resource Programs	I40	47.88%	68.96%	77.17%	82.30%	85.58%
HIGH	Other Professional Services	I38	35.98%	57.47%	69.86%	79.71%	84.68%
HIGH	Communications	I24	52.51%	69.69%	80.05%	83.33%	83.82%
HIGH	Other Public Administration	I42	43.86%	68.07%	77.52%	82.12%	82.15%
HIGH	Insurance And Real Estate	I29	45.62%	63.68%	72.89%	78.64%	80.32%
HIGH	National Security & Internal Affairs	I41	39.83%	70.99%	75.13%	84.42%	79.58%
HIGH	Mfg-Petroleum & Coal Prods	I20	44.72%	49.40%	57.58%	76.47%	78.33%
HIGH	Mfg-Chemicals & Allied Prods	I19	40.59%	56.60%	64.53%	71.98%	76.85%
HIGH	Measuring, Analyzing, and Controlling Instruments	I11	42.36%	55.13%	59.13%	67.38%	75.28%
HIGH	Educational Services	I36	31.58%	46.36%	54.97%	65.78%	73.83%
HIGH	Justice, Public Order & Safety	I39	29.65%	49.05%	62.57%	68.78%	73.26%
HIGH	Business Services	I31	37.42%	51.55%	57.85%	69.08%	71.23%
HIGH	Mfg-Electrical Machinery, Equip Supplies	I9	40.34%	51.55%	59.95%	69.33%	68.40%
HIGH	Mfg-Printing, Publishing & Allied Inds	I18	31.72%	44.70%	55.73%	66.62%	68.32%
HIGH	Health Services	I35	24.40%	41.69%	50.71%	60.09%	65.67%
HIGH	Wholesale Trade	I26	29.67%	42.96%	52.76%	60.48%	65.16%
HIGH	Mfg-Machinery, Ex Electrical	I8	45.14%	53.06%	59.89%	60.72%	63.60%
HIGH	Utilities & Sanitary Services	I25	31.89%	45.44%	55.99%	62.48%	62.77%
LOW	Mfg-Leather & Leather Prods	I22	16.87%	24.62%	34.55%	35.71%	58.54%
LOW	Transportation Equipment	I10	34.69%	44.77%	53.41%	56.00%	55.94%
LOW	Mfg-Paper & Allied Products	I17	21.56%	39.20%	50.31%	52.80%	55.75%
LOW	Mfg-Rubber & Misc Plastic Prods	I21	24.78%	32.73%	40.47%	46.92%	54.15%
LOW	Mfg-Primary Metals	I6	22.54%	34.02%	37.41%	48.28%	53.50%
LOW	Mis Manufacturing Industries	I12	18.07%	25.14%	32.29%	41.21%	52.65%
LOW	Entertainment & Recreation Services	I34	13.15%	24.41%	33.25%	41.88%	52.13%
LOW	Mfg-Fabricated Metals	I7	20.00%	31.99%	39.26%	45.37%	51.98%
LOW	Social Services	I37	12.13%	24.33%	31.19%	38.55%	50.06%
LOW	Mfg-Stone, Clay, Concrete, Glass Prods	I5	17.39%	27.46%	33.33%	41.55%	47.42%
LOW	Retail Trade	I27	15.68%	26.23%	34.64%	42.44%	46.20%
LOW	Automobile And Repair Services	I32	10.04%	18.36%	24.87%	35.79%	43.28%
LOW	Transportation	I23	20.87%	29.48%	37.69%	43.15%	43.02%
LOW	Mfg-Textile Mill Prods	I15	18.11%	28.07%	33.45%	42.78%	42.59%
LOW	Mfg-Food & Kindred Prods	I13	18.27%	24.18%	32.86%	36.93%	42.39%
LOW	Personal Serv Exc Private Households	I33	9.20%	15.55%	24.26%	34.89%	41.29%
LOW	Mfg-Apparel & Other Finished Textile Pr	I16	10.00%	14.95%	20.54%	27.24%	41.13%
LOW	Mfg-Furniture & Fixtures	I4	14.04%	22.04%	29.92%	34.85%	41.13%
LOW	Mfg-Tobacco Prods	I14	20.00%	45.83%	55.17%	80.00%	40.00%
LOW	Agriculture, Forestry, Fishing and Mining	I1	13.35%	18.54%	25.81%	30.03%	38.47%
LOW	Construction	I2	8.27%	14.99%	18.38%	23.80%	33.22%
LOW	Mfg-Lumber & Wood Prods, Ex Furniture	I3	9.66%	11.62%	16.42%	22.88%	33.22%
LOW	Private Household Services	I30	1.35%	1.89%	3.24%	5.49%	11.98%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 5
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	**1984**	**1989**	**1993**	**1997**	**2001**
Intercept	3.893	4.085	4.165	4.170	4.531
	(0.055)	(0.057)	(0.057)	(0.064)	(0.063)
Computer use at work (CU)	**0.184*** **	**0.200*** **	**0.222*** **	**0.199*** **	**0.187*** **
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Some College But No Degree (E2)	0.052***	0.048***	0.066***	0.069***	0.068***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.114***	0.159***	0.169***	0.162***	0.124***
	(0.019)	(0.018)	(0.018)	(0.020)	(0.017)
Bachelor's Degree (E4)	0.196***	0.256***	0.342***	0.317***	0.302***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.016)
Advanced Degree (EA)	0.322***	0.438***	0.472***	0.457***	0.456***
	(0.018)	(0.018)	(0.020)	(0.019)	(0.021)
Experience (Age)	0.052***	0.050***	0.048***	0.050***	0.042***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female (1=yes)	-0.227***	-0.229***	-0.185***	-0.204***	-0.201***
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
Black	-0.055***	-0.066***	-0.053***	-0.118***	-0.073***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-	-0.066	-0.079	0.083	-0.068
		(0.061)	(0.052)	(0.056)	(0.043)
Asian	-	-0.029	0.026	-0.031	-0.014
		(0.031)	(0.030)	(0.026)	(0.025)
Other	-0.080***	-0.238**	0.043	-	-
	(0.029)	(0.104)	(0.071)	-	-
Hispanic	-0.112***	-0.026	-0.116***	-0.126***	-0.114***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.054***	0.079***	0.082***	0.071***	0.065***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.206***	0.184***	0.215***	0.174***	0.135***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)
Part-Time	0.030**	0.063***	0.132***	0.000	-0.023
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.128***	0.158***	0.140***	0.153***	0.145***
	(0.010)	(0.012)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.112***	-0.178***	-0.151***	-0.072***	-0.068***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.064***	-0.154***	-0.132***	-0.097***	-0.068***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.041***	-0.067***	-0.039***	-0.033**	-0.022
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
R-Squared	0.251	0.278	0.277	0.262	0.203

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 6
OLS Estimates of the Impact of Computer Use on Wages: 1989-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Intercept	4.110	4.212	4.209	4.556
	(0.057)	(0.057)	(0.064)	(0.063)
Computer use at work (CU)	**0.130*** **	**0.127*** **	**0.103*** **	**0.054*** **
	(0.013)	(0.013)	(0.014)	(0.018)
Computer use at work for CMC System (C1)	0.024	0.042***	0.074***	0.102***
	(0.017)	(0.016)	(0.016)	(0.018)
Computer use at work for graphics & design (C2)	0.076***	0.034*	0.018	0.005
	(0.023)	(0.019)	(0.017)	(0.017)
Computer use at work for programming (C3)	0.014	0.066***	-0.004	0.062***
	(0.021)	(0.021)	(0.020)	(0.019)
Computer use at work for spreadsheets & databases (C4)	0.090***	0.071***	0.075***	0.075***
	(0.017)	(0.016)	(0.015)	(0.016)
Computer use at work for word processing (C5)	0.031***	0.086***	0.040**	0.000
	(0.016)	(0.016)	(0.015)	(0.015)
Some College But No Degree (E2)	0.044***	0.059***	0.062***	0.063***
	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.152***	0.162***	0.156***	0.120***
	(0.018)	(0.018)	(0.020)	(0.017)
Bachelor's Degree (E4)	0.245***	0.319***	0.289***	0.278***
	(0.014)	(0.015)	(0.015)	(0.016)
Advanced Degree (EA)	0.415***	0.438***	0.420***	0.428***
	(0.018)	(0.020)	(0.019)	(0.022)
Experience (Age)	0.048***	0.046***	0.049***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Female (1=yes)	-0.225***	-0.185***	-0.203***	-0.196***
	(0.010)	(0.010)	(0.011)	(0.011)
Black	-0.061***	-0.046***	-0.113***	-0.072***
	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-0.065	-0.077	0.080	-0.068
	(0.061)	(0.052)	(0.055)	(0.043)
Asian	-0.028	0.031	-0.024	-0.010
	(0.032)	(0.030)	(0.027)	(0.025)
Other	-0.214*	0.053	-	-
	(0.101)	(0.069)		
Hispanic	-0.024	-0.109***	-0.123***	-0.108***
	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.079***	0.083***	0.070***	0.062***
	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.190***	0.227***	0.183***	0.144***
	(0.013)	(0.013)	(0.014)	(0.014)
Part-Time	0.068***	0.141***	0.009	-0.012
	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.158***	0.134***	0.146***	0.139***
	(0.012)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.176***	-0.153***	-0.076***	-0.067***
	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.153***	-0.133***	-0.098***	-0.067***
	(0.014)	(0.014)	(0.015)	(0.015)
West	-0.066***	-0.047***	-0.039**	-0.023
	(0.016)	(0.015)	(0.016)	(0.016)
R-Squared	0.284	0.287	0.269	0.209

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 7
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	4.226	4.596	4.473	4.223	3.994
	(0.098)	(0.138)	(0.186)	(0.076)	(0.472)
Computer use at work (CU)	**0.185*** **	**0.200*** **	**0.223*** **	**0.200*** **	**0.186*** **
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Some College But No Degree (E2)	**0.088*** **	**0.030**	**0.100*** **	**0.069*** **	**0.081*** **
	(0.026)	(0.023)	(0.019)	(0.019)	(0.017)
Associate Degree (E3)	**0.128*** **	**0.185*** **	**0.173*** **	**0.148*** **	**0.131*** **
	(0.029)	(0.025)	(0.025)	(0.026)	(0.021)
Bachelor's Degree (E4)	**0.256*** **	**0.282*** **	**0.377*** **	**0.328*** **	**0.290*** **
	(0.021)	(0.020)	(0.021)	(0.020)	(0.022)
Advanced Degree (EA)	**0.341*** **	**0.468*** **	**0.493*** **	**0.485*** **	**0.474*** **
	(0.023)	(0.022)	(0.023)	(0.021)	(0.022)
Some College But No Degree (E2') (Age < 35 as of time t)	-0.057*	0.037	-0.066***	-0.001	-0.032
	(0.031)	(0.029)	(0.025)	(0.027)	(0.025)
Associate Degree (E3') (Age < 35 as of time t)	-0.033	-0.058*	-0.015	0.033	-0.026
	(0.037)	(0.034)	(0.034)	(0.038)	(0.033)
Bachelor's Degree (E4') (Age < 35 as of time t)	-0.113***	-0.059**	-0.080***	-0.024	0.025
	(0.026)	(0.026)	(0.028)	(0.028)	(0.029)
Advanced Degree (EA') (Age < 35 as of time t)	-0.041	-0.081**	-0.053	-0.102*	-0.080
	(0.033)	(0.034)	(0.042)	(0.040)	(0.053)
Experience (Age)	0.027***	0.009	0.024**	0.047***	0.076**
	(0.006)	(0.009)	(0.012)	(0.004)	(0.031)
Experience (Age'') Post 1974	**0.024****	**0.047*** **	**0.031*** **	**0.000**	**-0.015**
	(0.010)	(0.007)	(0.008)	(0.004)	(0.020)
Experience Square (Age2)	-0.0003***	-0.0006	-0.0002***	-0.0005***	-0.0007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience Post 1974 Square (Age'2)	-0.0002	-0.001***	-0.001***	0.000	-0.0000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Female (1=yes)	-0.226***	-0.228***	-0.184***	-0.204***	-0.201***
	(0.010)	(0.010)	(0.010)	(0.011)	(0.011)
Black	-0.057***	-0.070***	-0.053***	-0.118***	-0.074***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.019)
American Indian	-	-0.060	-0.078	0.084	-0.068
		(0.061)	(0.051)	(0.056)	(0.044)
Asian	-	-0.026	0.025	-0.029	-0.013
		(0.032)	(0.030)	(0.027)	(0.025)
Other	-0.078***	-0.243**	0.040	-	-
	(0.029)	(0.105)	(0.071)		
Hispanic	-0.111***	-0.029	-0.119***	-0.129***	-0.115***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.047***	0.071***	0.077***	0.070***	0.063***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.208***	0.185***	0.216***	0.173***	0.135***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)
Part-Time	0.040***	0.072***	0.138***	-0.002	-0.017
	(0.017)	(0.017)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.128***	0.157***	0.139***	0.154***	0.145***
	(0.010)	(0.012)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.114***	-0.178***	-0.151***	-0.073***	-0.067***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.064***	-0.154***	-0.132***	-0.098***	-0.068***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.039***	-0.067***	-0.040**	-0.034**	-0.022
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
R-Squared	0.253	0.281	0.279	0.263	0.204

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 8
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.896	4.130	4.186	4.198	4.558
	(0.055)	(0.057)	(0.056)	(0.064)	(0.063)
HOHI*CU(Computer Use at Work)	**-0.084*** **	-0.007	-0.004	-0.031	0.058
	(0.032)	(0.031)	(0.033)	(0.038)	(0.039)
HOLI*CU(Computer Use at Work)	-0.022	**-0.067***	0.064	0.001	0.031
	(0.042)	(0.039)	(0.043)	(0.048)	(0.042)
LOHI*CU(Computer Use at Work)	-0.007	0.010	0.013	**0.057****	**0.054****
	(0.031)	(0.026)	(0.024)	(0.027)	(0.028)
HOHI (High C-U Occupation w/ High C-U Industry)	**0.321*****	**0.295*****	**0.329*****	**0.279*****	**0.223*****
	(0.019)	(0.023)	(0.028)	(0.035)	(0.035)
HOLI (High C-U Occupation w/ Low C-U Industry)	**0.236*****	**0.259*****	**0.171*****	**0.167*****	**0.175*****
	(0.026)	(0.027)	(0.034)	(0.040)	(0.034)
LOHI (Low C-U Occupation w/ High C-U Industry)	**0.090*****	**0.076*****	**0.075*****	**0.035***	0.014
	(0.014)	(0.015)	(0.015)	(0.020)	(0.019)
CU (Computer Use at Work)	**0.162*****	**0.139*****	**0.139*****	**0.123*****	**0.102*****
	(0.024)	(0.021)	(0.018)	(0.019)	(0.019)
Some College But No Degree (E2)	0.023	0.025	0.040***	0.051***	0.047***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.073***	0.118***	0.117***	0.126***	0.087***
	(0.018)	(0.017)	(0.017)	(0.019)	(0.017)
Bachelor's Degree (E4)	0.124***	0.189***	0.260***	0.252***	0.235***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.017)
Advanced Degree (EA)	0.207***	0.334***	0.348***	0.356***	0.349***
	(0.018)	(0.018)	(0.020)	(0.019)	(0.021)
Experience (Age)	0.049***	0.045***	0.046***	0.049***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Female (1=yes)	-0.258***	-0.252***	-0.205***	-0.218***	-0.210***
	(0.011)	(0.010)	(0.010)	(0.011)	(0.011)
Black	-0.046***	-0.059***	-0.049***	-0.117***	-0.074***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-	-0.049	-0.076	0.074	-0.057
	-	(0.061)	(0.051)	(0.053)	(0.043)
Asian	-	-0.034	0.022	-0.031	-0.018
	-	(0.031)	(0.030)	(0.026)	(0.025)
Other	-0.070**	-0.228**	0.035	-	-
	(0.028)	(0.101)	(0.069)	-	-
Hispanic	-0.102***	-0.022	-0.110***	-0.125***	-0.104***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.048***	0.072***	0.075***	0.064***	0.059***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.248***	0.221***	0.252***	0.204***	0.171***
	(0.013)	(0.013)	(0.013)	(0.015)	(0.014)
Part-Time	0.065***	0.090***	0.143***	0.008	-0.007
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.115***	0.145***	0.127***	0.142***	0.132***
	(0.010)	(0.011)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.105***	-0.160***	-0.139***	-0.064***	-0.061***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
South	-0.052***	-0.138***	-0.118***	-0.088***	-0.061***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.050***	-0.051***	-0.028*	-0.028*	-0.016
	(0.014)	(0.016)	(0.015)	(0.016)	(0.016)
R-Squared	0.278	0.303	0.306	0.279	0.222

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 9

OLS Estimates of the Impact of Computer Use on Wages: 1989-2001

(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Intercept	4.141	4.217	4.222	4.565
	(0.057)	(0.056)	(0.064)	(0.062)
HOHI*CU(Computer Use at Work)	**-0.073****	-0.019	-0.013	-0.048
	(0.037)	(0.039)	(0.045)	(0.055)
HOLI*CU(Computer Use at Work)	-0.058	0.045	-0.082	0.010
	(0.048)	(0.053)	(0.061)	(0.067)
LOHI*CU(Computer Use at Work)	0.014	0.029	0.048	0.023
	(0.032)	(0.030)	(0.034)	(0.041)
HOHI (High C-U Occupation w/ High C-U Industry)	**0.299*****	**0.336*****	**0.288*****	**0.227*****
	(0.023)	(0.028)	(0.035)	(0.035)
HOLI (High C-U Occupation w/ Low C-U Industry)	**0.262*****	**0.176*****	**0.172*****	**0.179*****
	(0.027)	(0.034)	(0.040)	(0.034)
LOHI (Low C-U Occupation w/ High C-U Industry)	**0.077****	**0.077*****	**0.037***	0.013
	(0.015)	(0.015)	(0.020)	(0.019)
CU (Computer Use at Work)	**0.111*****	**0.074*****	**0.058****	0.044
	(0.024)	(0.022)	(0.023)	(0.029)
HOHI*C1(Computer Use for CMC System)	0.024	0.033	-0.005	-0.012
	(0.051)	(0.043)	(0.041)	(0.050)
HOLI*C1(Computer Use for CMC System)	0.047	0.021	0.080	-0.067
	(0.064)	(0.059)	(0.075)	(0.066)
LOHI*C1(Computer Use for CMC System)	-0.006	0.028	-0.039	**-0.088***
	(0.052)	(0.043)	(0.040)	(0.045)
C1 (Computer use at work for CMC System)	0.008	0.016	**0.068****	**0.127*****
	(0.044)	(0.035)	(0.032)	(0.035)
HOHI*C2(Computer Use for graphics & design)	-0.114	**-0.116****	-0.044	0.027
	(0.089)	(0.058)	(0.056)	(0.050)
HOLI*C2(Computer Use for graphics & design)	-0.069	-0.077	0.024	**0.134***
	(0.104)	(0.072)	(0.073)	(0.072)
LOHI*C2(Computer Use for graphics & design)	-0.151	**-0.137****	0.004	0.020
	(0.095)	(0.062)	(0.059)	(0.054)
C2 (Computer use at work for graphics & design)	**0.174****	**0.127****	0.030	-0.035
	(0.084)	(0.051)	(0.051)	(0.045)
HOHI*C3(Computer Use for programming)	0.065	-0.015	-0.009	-0.023
	(0.072)	(0.066)	(0.053)	(0.048)
HOLI*C3(Computer Use for programming)	0.086	0.072	-0.092	-0.047
	(0.087)	(0.082)	(0.105)	(0.093)
LOHI*C3(Computer Use for programming)	-0.005	-0.076	0.025	-0.023
	(0.077)	(0.069)	(0.058)	(0.055)
C3 (Computer use at work for programming)	-0.042	0.066	-0.004	0.061
	(0.066)	(0.058)	(0.048)	(0.043)
HOHI*C4(Computer Use for spreadsheets & databases)	0.073	0.041	-0.014	**0.090***
	(0.056)	(0.047)	(0.042)	(0.048)
HOLI*C4(Computer Use for spreadsheets & databases)	-0.038	-0.078	0.027	0.006
	(0.069)	(0.062)	(0.067)	(0.059)
LOHI*C4(Computer Use for spreadsheets & databases)	0.033	-0.015	-0.034	**0.078***
	(0.058)	(0.048)	(0.044)	(0.046)
C4 (Computer use at work for spreadsheets & databases)	0.039	0.053	**0.080****	0.006
	(0.050)	(0.040)	(0.036)	(0.039)
HOHI*C5(Computer Use for word processing)	-0.033	**-0.158*****	**-0.089****	0.047
	(0.060)	(0.051)	(0.044)	(0.045)
HOLI*C5(Computer Use for word processing)	**-0.144****	-0.067	-0.053	0.042
	(0.072)	(0.067)	(0.062)	(0.055)
LOHI*C5(Computer Use for word processing)	-0.023	-0.085	0.020	**0.078***
	(0.062)	(0.052)	(0.045)	(0.043)
C5 (Computer use at work for word processing)	0.041	**0.148*****	0.049	**-0.061***
	(0.054)	(0.045)	(0.037)	(0.036)

TABLE 9 - Continued
OLS Estimates of the Impact of Computer Use on Wages: 1989-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Some College But No Degree (E2)	0.024	0.035***	0.047***	0.045***
	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.115***	0.111***	0.122***	0.085***
	(0.017)	(0.017)	(0.019)	(0.017)
Bachelor's Degree (E4)	0.183***	0.246***	0.234***	0.222***
	(0.014)	(0.015)	(0.015)	(0.017)
Advanced Degree (EA)	0.322***	0.333***	0.337***	0.337***
	(0.018)	(0.021)	(0.020)	(0.022)
Experience (Age)	0.044***	0.044***	0.047***	0.040***
	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0004***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Female (1=yes)	-0.248***	-0.205***	-0.217***	-0.205***
	(0.010)	(0.010)	(0.011)	(0.011)
Black	-0.056***	-0.046***	-0.114***	-0.073***
	(0.018)	(0.016)	(0.018)	(0.019)
American Indian	-0.047	-0.076	0.073	-0.058
	(0.062)	(0.051)	(0.053)	(0.043)
Asian	-0.032	0.026	-0.025	-0.015
	(0.031)	(0.029)	(0.026)	(0.025)
Other	-0.217**	0.040	-	-
	(0.097)	(0.068)	-	-
Hispanic	-0.021	-0.106***	-0.122***	-0.100***
	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.072***	0.077***	0.064***	0.056***
	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.224***	0.259***	0.207***	0.176***
	(0.013)	(0.013)	(0.015)	(0.014)
Part-Time	0.094***	0.149***	0.014	-0.001
	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.145***	0.123***	0.138***	0.129***
	(0.011)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.160***	-0.141***	-0.066***	-0.059***
	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.138***	-0.119***	-0.089***	-0.060***
	(0.014)	(0.014)	(0.015)	(0.015)
West	-0.050***	-0.034**	-0.031*	-0.017
	(0.016)	(0.015)	(0.016)	(0.016)
R-Squared	0.308	0.312	0.284	0.227

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 10
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	4.625	4.827	4.928	4.976	5.271
	(0.031)	(0.036)	(0.033)	(0.038)	(0.039)
HOHI*CU(Computer Use at Work)	**-0.131*** **	-0.052	-0.046	-0.044	0.058
	(0.033)	(0.031)	(0.034)	(0.040)	(0.040)
HOLI*CU(Computer Use at Work)	-0.052	**-0.101** **	0.065	-0.019	0.034
	(0.043)	(0.041)	(0.043)	(0.049)	(0.044)
LOHI*CU(Computer Use at Work)	**-0.053***	-0.028	-0.018	0.039	0.047
	(0.032)	(0.028)	(0.026)	(0.028)	(0.029)
HOHI (High C-U Occupation w/ High C-U Industry)	**0.339*** **	**0.342*** **	**0.316*** **	**0.282*** **	**0.153** **
	(0.059)	(0.069)	(0.071)	(0.072)	(0.071)
HOLI (High C-U Occupation w/ Low C-U Industry)	0.045	0.126	-0.053	-0.062	-0.058
	(0.084)	(0.088)	(0.097)	(0.114)	(0.088)
LOHI (Low C-U Occupation w/ High C-U Industry)	**0.133*** **	**0.053**	**0.115** **	**0.130** **	0.058
	(0.048)	(0.054)	(0.054)	(0.064)	(0.064)
CU (Computer Use at Work)	**0.213*** **	**0.197*** **	**0.193*** **	**0.171*** **	**0.149*** **
	(0.025)	(0.021)	(0.018)	(0.019)	(0.020)
HOHI*EA(Advanced Degree)	0.135*	0.247***	-0.061	0.080	-0.010
	(0.078)	(0.072)	(0.086)	(0.140)	(0.082)
HOLI*EA(Advanced Degree)	0.101	0.279***	0.058	0.127	0.035
	(0.092)	(0.084)	(0.109)	(0.151)	(0.093)
LOHI*EA(Advanced Degree)	0.130	0.189**	0.021	0.094	0.091
	(0.079)	(0.073)	(0.088)	(0.142)	(0.084)
EA	0.065	0.045	0.261***	0.157	0.211***
	(0.074)	(0.067)	(0.082)	(0.138)	(0.077)
HOHI*AGE(Experience)	0.003**	0.002*	0.003**	0.002	0.002
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HOLI*AGE(Experience)	0.010***	0.006***	0.006***	0.006***	0.005***
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
LOHI*AGE(Experience)	0.001***	0.003**	0.000	-0.001	-0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
AGE	0.007***	0.007***	0.007***	0.007***	0.005***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HOHI*GF(Female)	0.085***	0.043	0.071**	0.129***	0.061**
	(0.029)	(0.029)	(0.029)	(0.029)	(0.028)
HOLI*GF(Female)	-0.023	-0.071*	-0.018	0.072*	-0.040
	(0.043)	(0.039)	(0.041)	(0.043)	(0.040)
LOHI*GF(Female)	0.099***	0.107***	0.073***	0.101***	0.038
	(0.026)	(0.026)	(0.025)	(0.027)	(0.028)
GF	-0.310***	-0.294***	-0.248***	-0.288***	-0.238***
	(0.018)	(0.019)	(0.017)	(0.020)	(0.019)
HOHI*R2(Black)	-0.035	-0.053	-0.023	-0.072	-0.017
	(0.049)	(0.051)	(0.047)	(0.053)	(0.057)
HOLI*R2(Black)	-0.055	0.071	0.054	-0.003	-0.004
	(0.066)	(0.083)	(0.084)	(0.073)	(0.066)
LOHI*R2(Black)	-0.078*	-0.001	-0.012	-0.019	0.038
	(0.040)	(0.041)	(0.037)	(0.044)	(0.044)
R2	0.015	-0.045	-0.048*	-0.091***	-0.085**
	(0.029)	(0.027)	(0.026)	(0.031)	(0.033)

TABLE 10 - Continued
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
HOHI*R3(American Indian)	-	-0.205	-0.073	0.387***	0.162
		(0.212)	(0.121)	(0.154)	(0.122)
HOLI*R3(American Indian)	-	-0.375***	-0.604**	-0.105	0.108
		(0.123)	(0.270)	(0.180)	(0.184)
LOHI*R3(American Indian)	-	0.010	0.126	0.197	0.167
		(0.128)	(0.117)	(0.121)	(0.102)
R3	-	0.021	-0.104	-0.066	-0.153*
		(0.066)	(0.076)	(0.075)	(0.081)
HOHI*R4(Asian)	-	-0.006	0.135**	0.069	0.170***
		(0.076)	(0.067)	(0.060)	(0.060)
HOLI*R4(Asian)	-	0.024	0.047	-0.013	0.186*
		(0.106)	(0.144)	(0.099)	(0.099)
LOHI*R4(Asian)	-	0.003	-0.017	-0.093	0.073
		(0.083)	(0.083)	(0.075)	(0.065)
R4	-	-0.033	-0.007	-0.003	-0.099**
		(0.055)	(0.040)	(0.045)	(0.043)
HOHI*R5(Other)	0.032	-0.135	0.009	-	-
	(0.068)	(0.405)	(0.189)		
HOLI*R5(Other)	0.124	-0.336	-0.369**	-	-
	(0.109)	(0.434)	(0.186)		
LOHI*R5(Other)	0.024	-0.092	-0.003	-	-
	(0.069)	(0.425)	(0.170)		
R5	-0.067	-0.007	0.035	-	-
	(0.046)	(0.392)	(0.135)		
HOHI*H(Hispanic)	0.027	-0.092	-0.005	0.006	0.008
	(0.066)	(0.069)	(0.058)	(0.054)	(0.054)
HOLI*H(Hispanic)	-0.043	-0.085	0.033	0.000	-0.014
	(0.104)	(0.078)	(0.104)	(0.111)	(0.076)
LOHI*H(Hispanic)	-0.023	-0.072	0.008	-0.078	-0.025
	(0.055)	(0.055)	(0.049)	(0.050)	(0.045)
H(Hispanic)	-0.099***	0.004	-0.135**	-0.128***	-0.115***
	(0.037)	(0.039)	(0.031)	(0.032)	(0.028)
HOHI*MAS(Married)	-0.033	-0.033	-0.015	0.007	-0.020
	(0.030)	(0.030)	(0.030)	(0.029)	(0.029)
HOLI*MAS(Married)	-0.071	-0.008	-0.019	0.009	0.009
	(0.045)	(0.039)	(0.044)	(0.044)	(0.039)
LOHI*MAS(Married)	-0.056**	-0.016	0.037	0.034	0.004
	(0.026)	(0.026)	(0.025)	(0.028)	(0.028)
MAS	0.120***	0.117***	0.103***	0.084***	0.095***
	(0.019)	(0.018)	(0.016)	(0.020)	(0.020)
HOHI*UM(Union Member)	-0.313***	-0.240***	-0.237***	-0.188***	-0.182***
	(0.037)	(0.040)	(0.041)	(0.044)	(0.039)
HOLI*UM(Union Member)	-0.233***	-0.095	-0.070	-0.178***	-0.182**
	(0.070)	(0.070)	(0.076)	(0.068)	(0.075)
LOHI*UM(Union Member)	-0.195***	-0.167***	-0.134***	-0.116***	-0.100***
	(0.028)	(0.031)	(0.029)	(0.035)	(0.031)
UM	0.391***	0.358***	0.364***	0.301***	0.262***
	(0.020)	(0.023)	(0.021)	(0.026)	(0.022)

TABLE 10 - Continued
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
HOHI*PT(Part Time)	-0.129***	-0.138***	-0.087*	0.017	0.020
	(0.047)	(0.048)	(0.048)	(0.066)	(0.061)
HOLI*PT(Part Time)	-0.011	-0.065	-0.067	-0.019	0.134
	(0.109)	(0.075)	(0.090)	(0.097)	(0.092)
LOHI*PT(Part Time)	-0.100***	-0.109***	-0.038	-0.079	-0.104**
	(0.037)	(0.037)	(0.036)	(0.055)	(0.051)
PT	0.109***	0.144***	0.143***	-0.004	-0.016
	(0.023)	(0.025)	(0.022)	(0.034)	(0.031)
HOHI*MLS(Lives in Metropolitan)	0.051*	0.047	0.130***	0.040	0.111***
	(0.028)	(0.033)	(0.034)	(0.035)	(0.032)
HOLI*MLS(Lives in Metropolitan)	0.063	0.037	0.085*	0.168***	0.049
	(0.044)	(0.043)	(0.048)	(0.062)	(0.040)
LOHI*MLS(Lives in Metropolitan)	0.039	0.045*	0.046*	0.010	0.050*
	(0.024)	(0.026)	(0.026)	(0.032)	(0.030)
MLS	0.087***	0.123***	0.094***	0.130***	0.101***
	(0.016)	(0.018)	(0.017)	(0.023)	(0.019)
HOHI*RE2(Midwest/North Central)	-0.142***	-0.043	-0.091**	-0.094**	-0.032
	(0.036)	(0.039)	(0.038)	(0.039)	(0.040)
HOLI*RE2(Midwest/North Central)	-0.088	0.000	0.074	-0.118*	0.050
	(0.059)	(0.055)	(0.059)	(0.072)	(0.067)
LOHI*RE2(Midwest/North Central)	-0.009	-0.071**	-0.083**	-0.051	-0.031
	(0.033)	(0.035)	(0.033)	(0.038)	(0.039)
RE2	-0.074***	-0.127***	-0.104***	-0.019	-0.053**
	(0.023)	(0.025)	(0.022)	(0.027)	(0.026)
HOHI*RE3(South)	-0.026	-0.002	-0.047	-0.068*	-0.003
	(0.037)	(0.037)	(0.037)	(0.039)	(0.038)
HOLI*RE3(South)	-0.013	0.017	-0.002	-0.054	0.089
	(0.053)	(0.052)	(0.056)	(0.069)	(0.068)
LOHI*RE3(South)	-0.022	-0.080**	-0.066**	-0.034	-0.013
	(0.033)	(0.035)	(0.033)	(0.038)	(0.038)
RE3	-0.044*	-0.112***	-0.088***	-0.059**	-0.070***
	(0.023)	(0.025)	(0.022)	(0.028)	(0.026)
HOHI*RE4(West)	-0.035	-0.086**	-0.117***	-0.136***	-0.009
	(0.037)	(0.042)	(0.042)	(0.041)	(0.038)
HOLI*RE4(West)	-0.080	-0.007	0.026	-0.086	0.056
	(0.056)	(0.059)	(0.063)	(0.068)	(0.067)
LOHI*RE4(West)	-0.039	-0.091**	-0.066*	-0.088**	-0.050
	(0.035)	(0.040)	(0.037)	(0.042)	(0.040)
RE4	0.080*	0.011	0.026	0.041	-0.002
	(0.024)	(0.028)	(0.024)	(0.028)	(0.026)
R-Squared	0.271	0.290	0.283	0.254	0.205

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 11
Estimated Wage Premium: 1984-2001

Table		1984	1989	1993	1997	2001
TABLE 8	HOHI *CU(Computer use at work)	46.70%	49.20%	53.90%	45.30%	35.70%
	HOLI *CU(Computer use at work)	44.20%	37.60%	33.50%	31.30%	29.80%
	LOHI *CU(Computer use at work)	27.00%	22.80%	22.70%	22.60%	16.20%
TABLE 9	HOHI *CU(Computer use at work)	-	39.00%	47.60%	39.40%	25.50%
	HOLI *CU(Computer use at work)	-	41.70%	26.90%	24.80%	19.60%
	LOHI *CU(Computer use at work)	-	19.70%	15.70%	9.80%	N/S
	HOHI *C1(CMC System)	-	N/S	N/S	7.00%	14.30%
	HOLI *C1(CMC System)	-	N/S	N/S	7.00%	14.30%
	LOHI *C1(CMC System)	-	N/S	N/S	7.00%	5.10%
	HOHI *C2(Graphics & Design)	-	19.00%	1.20%	N/S	N/S
	HOLI *C2(Graphics & Design)	-	19.00%	13.50%	N/S	N/S
	LOHI *C2(Graphics & Design)	-	19.00%	-1.20%	N/S	N/S
	HOHI *C3(Programming)	-	N/S	N/S	N/S	N/S
	HOLI *C3(Programming)	-	N/S	N/S	N/S	N/S
	LOHI *C3(Programming)	-	N/S	N/S	N/S	N/S
	HOHI *C4(Spreadsheets & Databases)	-	N/S	N/S	8.30%	9.40%
	HOLI *C4(Spreadsheets & Databases)	-	N/S	N/S	8.30%	N/S
	LOHI *C4(Spreadsheets & Databases)	-	N/S	N/S	8.30%	8.10%
	HOHI *C5(Word Processing)	-	N/S	-1.10%	-9.30%	-6.30%
	HOLI *C5(Word Processing)	-	-15.50%	16.00%	N/S	-6.30%
	LOHI *C5(Word Processing)	-	N/S	16.00%	N/S	1.81%
TABLE 10	HOHI*CU(Computer use at work)	50.09%	62.55%	58.45%	51.23%	32.60%
	HOLI*CU(Computer use at work)	23.74%	11.14%	21.29%	18.65%	16.07%
	LOHI*CU(Computer use at work)	32.52%	21.77%	33.48%	32.53%	16.07%
	HOHI*AGE(Experience)	1.00%	0.90%	1.00%	0.90%	0.50%
	HOLI*AGE(Experience)	1.70%	1.30%	1.30%	1.30%	1.00%
	LOHI*AGE(Experience)	0.80%	1.00%	0.70%	0.70%	0.50%
	HOHI*EA(Advanced Degree)	14.45%	28.00%	29.80%	N/S	23.50%
	HOLI*EA(Advanced Degree)	-	32.10%	29.80%	N/S	23.50%
	LOHI*EA(Advanced Degree)	-	20.80%	29.80%	N/S	23.50%
	HOHI*GF(Female)	-27.47%	-34.18%	-20.79%	-19.61%	-20.58%
	HOLI*GF(Female)	-36.34%	-41.54%	-28.15%	-25.91%	-26.87%
	LOHI*GF(Female)	-25.93%	-22.89%	-20.58%	-22.75%	-26.87%
	HOHI*UM(Union Member)	11.10%	15.93%	17.17%	14.44%	9.99%
	HOLI*UM(Union Member)	21.61%	43.05%	43.91%	15.64%	9.99%
	LOHI*UM(Union Member)	26.32%	24.87%	29.57%	22.82%	19.43%
	HOHI*MLS(Metropolitan Living Status)	14.32%	13.09%	23.74%	13.88%	22.36%
	HOLI*MLS(Metropolitan Living Status)	9.09%	13.09%	18.73%	32.17%	10.62%
	LOHI*MLS(Metropolitan Living Status)	9.09%	13.09%	14.57%	13.88%	15.72%

FIGURE 1
Computer Use at Work – Education, 1984-2001

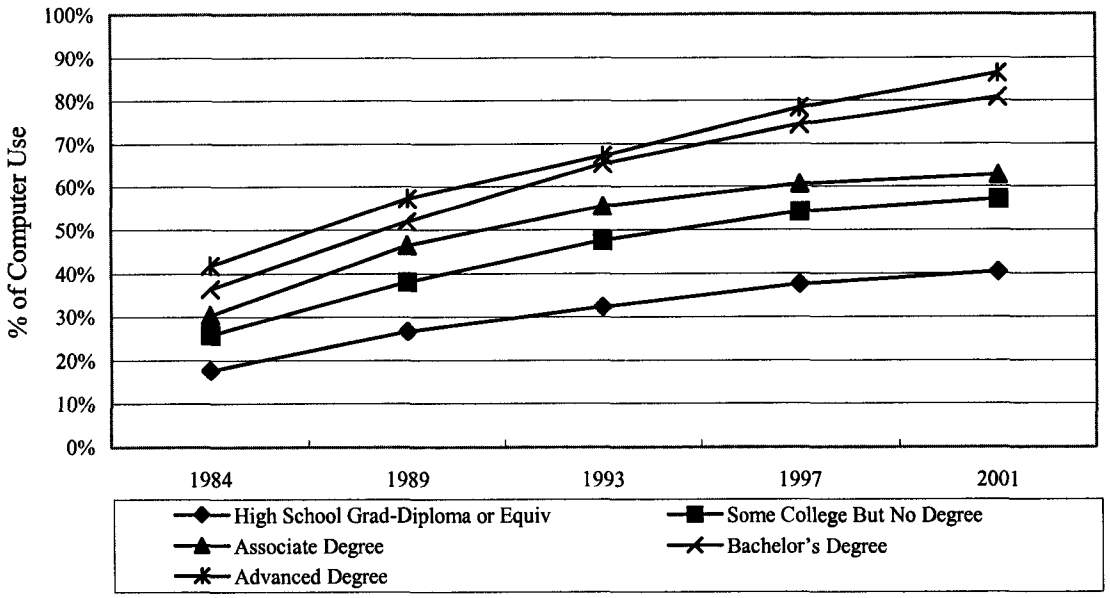


FIGURE 2
Computer Use at Work – All Workers, Men & Women, 1984-2001

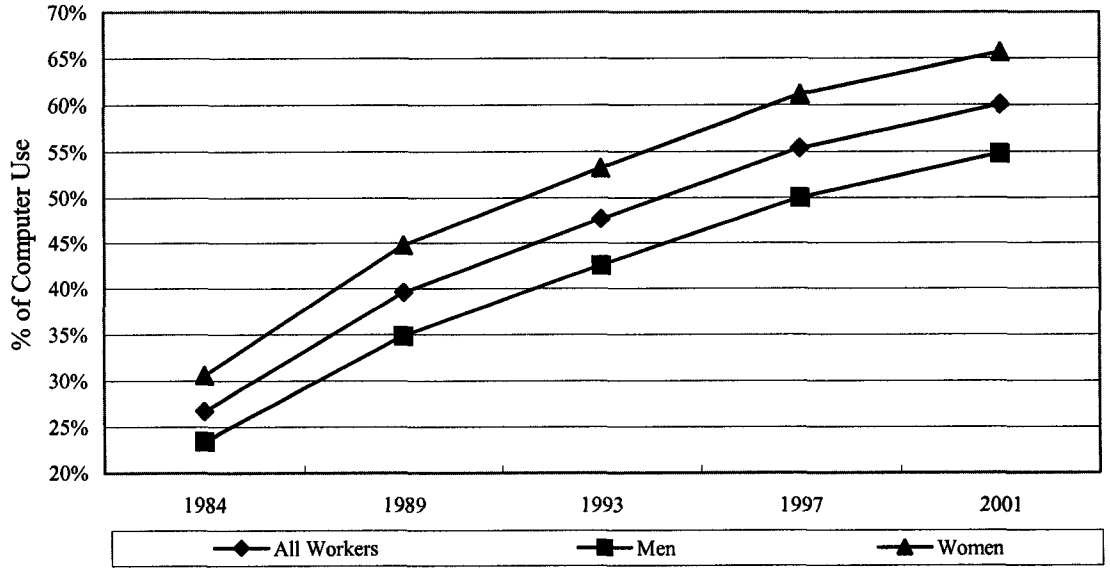


FIGURE 3

Computer Usage by Occupation: 1984-2001

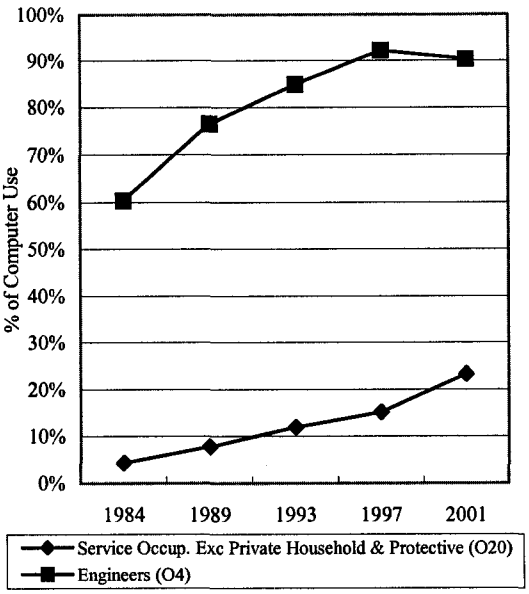


FIGURE 4

Computer Usage by Industry: 1984-2001

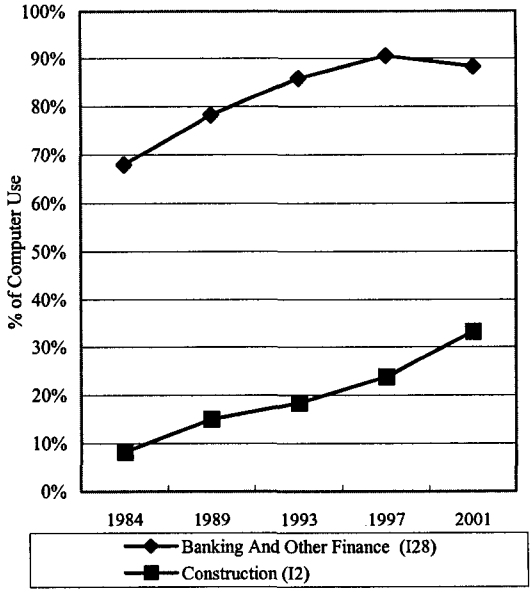
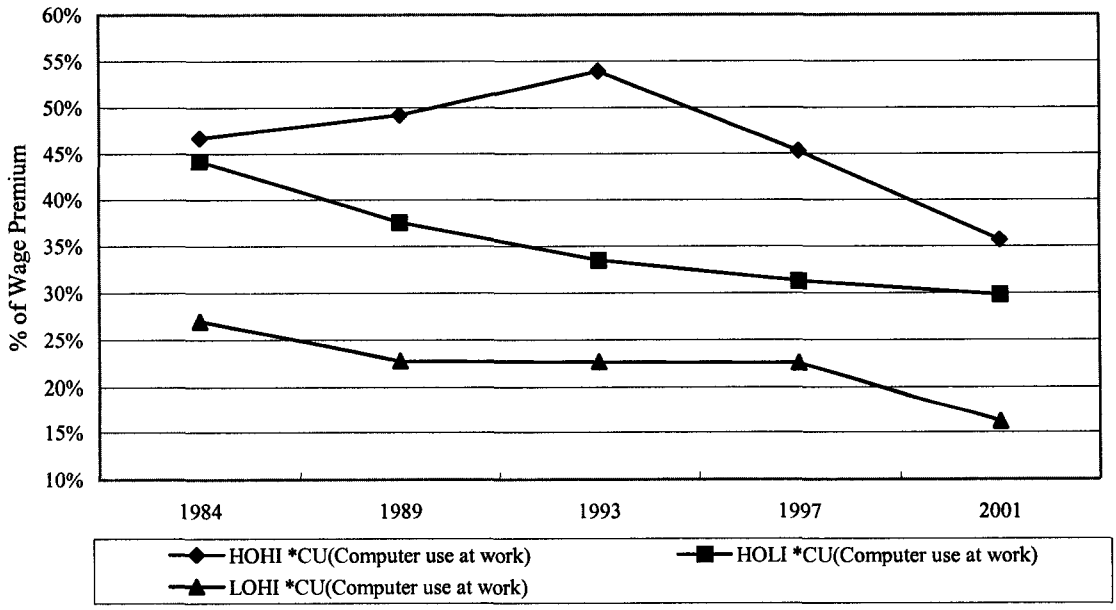


FIGURE 5

Estimated Wage Premium for a Worker Using Computer Within the "Occupation and Industry Interacted" Groups: 1984-2001



APPENDIX A: CPS DATA SETS – 1984-2001

1. Detailed Data Description for Descriptive Analysis

Section II in this paper uses the individual level earnings data from the October CPS data for the years 1984, 1989, 1993 and 1997 and the September survey for the year 2001. The data for this microdata file come from two sources: (1) the basic CPS; and (2) the Supplement Questions on Computer Use. The basic CPS data collects information on the demographic status of the population (such as age, sex, race, marital status, educational attainment, family structure, wage, and weeks worked). The Supplement Questions on Computer Use data gathers information on the use of computers at work. In this data, interviewers asked the following eight specific questions on computers in which computers are used at work for: (1) in general (yes or no); (2) Internet and/or, email; (3) programming; (4) graphic and design; (5) spreadsheets and databases; (6) word-processing; and (7) "other," and (8) a calendar or do scheduling. The CPS data sample used for the descriptive analysis is restricted to individuals between age 18 and 65, who have at least a high school diploma or equivalent (GED), and who are currently employed (both full and part-time with both pay and no pay) in the labor force.

The weekly earning in the 1984 CPS is top coded at $999, that in the 1989, 1993 and 1997 CPS are top coded at $1,923 and the weekly earning in the 2001 CPS are top coded at $2884.61. In order to make the earning comparable over time, the weekly earnings data in the 1984, 1989, 1993 and 1997 CPS data are converted into 1984 dollars using the CPE deflator as follows.

Real Weekly Earning for Year t = (Nominal Weekly Earning for Year t) * (100/CPE Index for Year 2001)

2. Detailed Data Description for Analysis on Computer Use & Wages

The CPS data sample used in Section III and Section IV of this paper is restricted to individuals between age 18 and 65, who have at least a high school diploma or equivalent (GED), and who are currently employed in the labor force. In addition, this data sample focuses only on individuals who have reported a "weekly earning" greater than zero. The weekly earnings data in the 1984, 1989, 1993 and 1997 CPS data are converted into 1984 dollars using the CPE deflator as in Section II. The mean log hourly wage, which is a dependent variable, is then calculated based on the converted weekly earning for each year.

3. Detailed Description for Dummy Variables

Control variables (X_i)	X_i	Length of Experience (Age) for Worker *i*
	X^2_i	Length of Experience (Age) Squared
	E_{ie}	Level of Education for Worker *i* - Five Levels: (i) Some college but no diploma; (ii) Associate degree; (iii) Bachelor's degree; (vi) Advanced degree
	G_i	Gender of Worker *i*
	R_i	Race of Worker *i* (White, Black, American Indian, and Asian)
	H_i	Ethnicity of Worker *i* (Hispanic or Non-Hispanic)
	ME_i	Metropolitan Living Status of Worker *i* - a dummy variable that equals one if an individual lives in metropolitan area and zero otherwise
	MS_i	Marital Status of Worker *i* - a dummy variable that equals one if an individual is married and zero otherwise
	L_i	Labor Force Status of Worker *i* (full-time or part-time)
	U_i	Union Member Status of Worker *i*
	RE_i	Region of Worker *i* (Northeast, Midwest, South and West)
Computer Application	CU_i	Dummy variable for the use of computers for any purpose at work ("yes=1" if an individual uses a computer for any purpose at work, and zero otherwise)
	CC_{ic}	Five Dummy variables for the use of each computer application at work ("yes=1" if an individual uses a computer for (i) the computer mediated communication (CMC) system (includes Internet, e-mail, a calendar, scheduling); (ii) graphic & design; (iii) programming; and (vi) spreadsheets & databases; (v) word processing at work, and zero otherwise)
Computer-Usage Occupation	HO LO	Worker i's computer-usage occupation (which is also defined as worker i's occupation *j*) at time t. It is divided into two groups: (i) "high computer-usage occupation" group; and (ii) "low computer-usage occupation" group (based on SOC code)
Computer-Usage Industry	HI LI	Worker i's computer-usage industry (which is also defined as worker i's industry *k*) at time t. It is divided into two groups: (i) "high computer-usage industry" group; and (ii) "low computer-usage industry" group (based on SIC code)
"Computer-Usage Occupation and Industry interacted" groups	HOHI HOLI LOHI LOLI	Worker i's Occupation *j* interacted with Worker i's Industry *k*. It is divided into four groups: (i) "*high* computer-usage *occupation* interacted with *high* computer-usage *industry*" group; (ii) "*high* computer-usage *occupation* interacted with *low* computer-usage *industry*" group; (iii) "*low* computer-usage *occupation* interacted with *high* computer-usage *industry*" group; and (vi) "*low* computer-usage *occupation* interacted with *low* computer-usage *industry*" group.

PART III

HOW DOES THE DIFFUSION OF COMPUTERS AFFECT FEMALE WAGES IN THE U.S.?

HOW DOES THE DIFFUSION OF COMPUTERS AFFECT FEMALE WAGES IN THE U.S.?

ABSTRACT

This paper uses the U.S. Current Population Survey data for 1984-2001 to examine the impact on female wages of the diffusion of computers and the effects attributable to differences in computer use, worker characteristics, occupations, and industries. Cross-section estimates find that female wages overall were 20-36% lower than male wages during the period. Estimates also show that the effect on female wages of using a computer on the job reduced the penalty associated with being a female worker by 4-6 percentage points during the 1990s, and that the way computers were used on the job did not affect female wages during the full period. However, estimates further suggest that in addition to occupational differences, the industry that women worked in had a significant impact on female wages during the period. These findings confirm the presence of both occupation and industry wage differentials and further demonstrate the importance of policies that reduce the occupational and industry segregation in order to narrow the gender wage differentials in the U.S. labor market.

Key Words: Wage, Computers, Occupation, Industry

JEL Classification: J30, J31, O33

I. INTRODUCTION

Information technology (IT) has significantly changed the way female workers perform their duties since the late twentieth century in the U.S. and thereby has caused substantial structural changes in the labor market. Several studies have documented that women are more likely than men to use a computer at work (Kruegers, 1993; and others) and that women's employment opportunities have rapidly risen because increased computer usage has increased the demand for female workers during the last two decades (Weinberg, 2000; and others). However, the role of IT at work varied during the period because the use of computers in the workplace evolved as computer technology diffused into different industries and occupations. As a result, the use of IT differed for individual job tasks, occupations, industries, and demographics. It also differed by gender.

During the same period, women's educational attainment and workforce commitment also improved and thereby their employment opportunities increased, which further led to an increase in firms' on-the-job training for women. As a consequence of these structural changes, women have increased their opportunity to enter into traditionally male occupations and industries. The empirical studies on gender wage differentials have documented that the substantial structural changes, which resulted from increased human capital and effective labor market experience by women, reduced occupational segregation and narrowed the gender wage differentials for the last two decades (Blau and Kahn, 2000; and others). However, the gender wage differentials are still persistent in the current U.S. labor market.

While the effect of computer use on women's employment has been well examined (National Research Council, 1986; and others), the empirical analysis of its impact on female wages has not yet been explored even though computer technology continues to evolve in the workplace and affect women's employment. Furthermore, even as the existing empirical studies have proven the reduction in both occupational segregation and gender wage differentials due to the recent structural changes in the labor market, the effect on female jobs and wages of the differences in occupation and industry that are associated with the use of a computer has not been examined as a potential factor for explaining the persisting gender wage differentials. This paper addresses the affect on female jobs and wages of the differences in occupation and industry that are associated with the use of a computer by employing cross-section estimates with the use of two distinct approaches to the U.S. Current Population Survey data for the years 1984, 1989, 1993, 1997, and 2001.

This paper's first analysis, which follows the method used by Krueger (1993), finds that at the aggregate level, the computer-use wage premium for all workers persists within the range of 20% to 25% during the period 1984-2001. In addition, when looking at only female workers, the effect on female wages of using a computer on the job reduced the penalty associated with being a female worker by 4-6 percentage points during the 1990s. Estimates also suggest that at the micro level, the computer-use wage premium for all workers varies by up to an additional 11 percentage points depending on the way computers were used on the job. Nevertheless, the way computers were used on the job did not affect female wages during the period. The empirical results further suggest that

female wages overall were 20-27% lower than male wages.

This paper's second analysis, which employs Tashiro's (2004) approach of grouping workers into high and low-computer use occupations and industries, concludes that female wages overall were 23-36% lower than male wages. However, the wage differential was smaller by 4-10 percentage points for women who worked in high computer-usage industries; this result suggests that the choice of industry in which women worked had a significant impact on female wages. Estimates further show that the occupation that women had also affected their wage differentials; that is, the wage differential was smaller for women, who worked in high computer-usage industries (smaller by 8-16 percentage points for those female workers who had high computer-usage occupations in contrast to 7-10 percentage points for women who had low computer-usage occupations).

An area of considerable, persistent debate in the studies that estimate the effect of computers on wages concerns the biased estimates that are derived from the cross-section models such as used in this study, due to the omission of unobservable heterogeneity in human capital, occupations, and industries (Handel, 1998; DiNardo and Pischke, 1997; and others). Even more important has been the debate on the fundamental question of what is an appropriate proxy to measure scarce computer *skills* and/or *knowledge* (not just computer *use*) when determining the true returns of computers on wages. Furthermore, the recent literature discusses a potentially important problem for the skill-biased technological change (SBTC) hypothesis (which explains the recent change

in the wage structure and the rapid increase in wage inequality); several studies in this literature suggest that the SBTC hypothesis fails to explain movements in the educational, gender and racial wage differentials as well as the trend and timing of both the wage structure and wage inequality and its relation to the continuing advancing computer technology in the 1990s (Card and DiNardo, 2002; Acemoglu, 2002; and others).

Although the issues with the estimation method and the questions on the skill-biased technological change (SBTC) hypothesis still persist, the significance of the empirical results from cross-section estimates has been established in the literature. The recent study by Dolton and Makepeace (2004), which uses the National Child Development Study (NCDS) data in Britain, concludes that cross-section estimates are large and consistent and thus these estimates provide direct evidence of a wage premium using computers. Likewise, the empirical results of this study find that the cross-section estimates are statistically significant. Furthermore, a comparison over time of the computer wage premium for the purpose of assessing the effect of the diffusion of computers on wages is relevant as long as the biased heterogeneity does not vary systematically over the years observed. Accordingly, the estimation results in this study are empirically valid, and the findings are economically important.

The reminder of the paper is organized as follows. Section II demonstrates descriptive analysis. Section III presents analyses on computer use and wages by gender. Section IV documents analyses on computer-use differential on female wages by occupation and by industry. The final section presents the conclusion and remarks.

II. DESCRIPTIVE ANALYSIS

This section summarizes the trends in computer usage at work by men and women and the changing characteristics of workers who used a computer during the period 1984-2001. The tabulations in this section are based on the October CPS data for the years 1984, 1989, 1993 and 1997 and the September CPS data for the year 2001. The data for this microdata file come from two sources, the basic CPS and the Supplement Questions on Computer Use, for the calendar year preceding each survey. The core sample is restricted to adults who are under the retirement age (individuals aged 18-65 at the survey date), who have at least a high school diploma or equivalent (GED), and who are currently employed (both full and part-time with both those paid weekly earnings and not paid weekly earnings[11]) in the labor force. A more detailed description of the data is in Appendix A.

1. Computer Usage at Work for Men and Women Within Demographic Groups

Table 1 reports computer usage at work individually for men and women by various demographic groups for the years 1984, 1989, 1993, 1997 and 2001. Figure 1 illustrates computer usage for all workers and individually for men and women. It shows that computer usage by women was higher than computer usage by men during the full period. It also shows that the differences in the percentage of computer usage (which is denoted as the computer usage differentials) between men and women widened slightly over time

[11] The data for the years 1989 and 1993 include individuals who are part-time working with no pay (<=15 hours; temporary no pay job).

as a result of the rate of increase in computer usage for women being slightly higher relative to that for men.

Figure 2 shows the likelihood, broken down by education individually for men and women, of using a computer. Computer usage for men increased with their level of education during the full period; however, the rate of increase in computer usage for men varied for different education levels. For example, the increase in the percentage of computer usage for more-educated men (those who attained more than a Bachelor's degree) was higher than that for less-educated men (those who attained less than a Bachelor's degree) over time. Figure 2 also illustrates that the likelihood of women using a computer increased with their level of education. However, it shows a different trend, relative to men, in the rate of increase in computer usage particularly in 1989 and 1993. For example, computer usage in 1989 by women who attained an Associate degree was slightly higher than that of women who attained a Bachelor's degree. In addition, computer usage in 1993 for women who attained a Bachelor's degree was also slightly higher than that for women who attained an Advanced degree. These results indicate that highly educated women were more likely to use a computer but with some exceptions. Figure 2 further illustrates that the computer usage differentials between different levels of education differed by gender. That is, the computer usage differentials between any levels of education for women were much smaller relative to that for men during the full periods although the computer usage differentials between levels of education for both men and women widened over time.

By comparing the computer usage at each education level by gender over time, Table 1 further illustrates that, during the 1980s and the year 2001, computer usage for women who attained a Bachelor's degree or less was higher than that for men with the same level of education; whereas, computer usage for women who attained an Advanced degree was lower than that for the corresponding group of men. This suggests that less-educated (relative to other women) women were more likely to use a computer than similarly-educated men, but more-educated women are less likely to use a computer than their male counterparts. However, this trend was somewhat different during 1990s in which computer usage for women who attained an Associate degree or less was higher than for men with the same level of education; on the other hand, computer usage for women who attained a Bachelor' degree or more was lower than that for the corresponding groups of men. This result indicates that women who attained at least a Bachelor's degree or higher used computers less than men who had the same level of education during the 1990s. It suggests that, men's higher level of education (more than Bachelor's degree) during the 1990s led them to use more computers relative to women. Table 1 further presents computer usage for other demographic subgroups. The likelihood of using a computer for all demographic subgroups increased during the period 1984-2001.

2. Computer Usage at Work for Men and Women by Application

Table 2 reports computer usage at work separately for men and women by computer

application for the years 1989, 1993, 1997 and 2001.[12] It shows that women used computers for computer mediated communication (CMC) system[13], spreadsheets & database, and word processing more than men during the full period. On the other hand, men used a computer for technical applications, such as graphics & design and programming, more than women during the full period. This shows that women were less likely to use a computer for technical work relative to men.

Table 2 also indicates that computer usage for the CMC system substantially increased for both men and women during the period -- from 14.7% in 1989 to 45.7% in 2001 for men and from 16.5% in 1989 to 52.3% in 2001 for women. This result suggests that the use of Internet technology dramatically increased in the workplace during the last decade. Computer usage for spreadsheets & databases also significantly increased for both men and women during the entire period, and the rate of computer usage for this application was quite similar for men and women (14.8% in 1989 and 36.3% in 2001 for men vs 15.7% in 1989 and 40.2% in 2001 for women). Computer usage for word processing substantially increased for both men and women during the entire period (especially after 1997) -- from 13.7% in 1989 to 36.0% in 2001 for men and from 18.6% in 1989 to 46.6% in 2001 for women. Computer usage for graphics & design increased modestly for men after 1997 and for women after 1993; however, computer usage for graphics & design was still low for both men and women. Finally, computer usage for programming slightly increased for men, but it was relatively constant for women during the full period, and the

[12] Computer usage for the year 1984 is omitted because the data for computer applications for that year is not available.
[13] The computer mediated communication (CMC) system includes Internet, e-mail, a calendar, and scheduling.

overall rate of computer usage for programming was still very low for the entire period.

3. Computer Usage at Work for Men and Women by Occupation and by Industry

Table 3 and Table 4 report computer usage at work for men, women, and all workers by occupations and industries for the years 1984, 1989, 1993, 1997 and 2001. Table 3 shows that the occupations in which workers reported low initial computer use were quite similar for men and women during the period. In addition, computer usage for all occupations in this application for both men and women increased over time. However, the increase in the ratio of computer usage between men and women differed for each occupation. For example, Figure 3 shows that computer usage for transportation and material moving (O22) for men increased at a decreasing rate, whereas that for women increased at an increasing rate during the period. On the other hand, computer usage for the service occupation excluding private household and protective (O20) for both men and women increased at an increasing rate for the full period. These results show that the rate of diffusion of computers varied for each occupation and also differed between men and women.

Table 3 also shows that the occupations in which workers reported high initial computer use were also similar for men and women during the full period. However, computer usage for most of the occupations in this application for both men and women slightly declined over time. Furthermore, the increase in the ratio of computer usage between men and women was quite similar for each occupation. For example, Figure 3 indicates that the rate of computer usage for computer equipment operators (O15) for both men and

women was relatively consistent until 1997 and declined in 2001. On the other hand, computer usage for social scientists (O6) for both men and women increased at an increasing rate for the full period. These results suggest that the rate of diffusion of computers varied for each occupation and also differed between men and women. Furthermore, these results show that there is an occupational difference within a sector between men and women and thus there is a computer usage difference at work by gender.[14]

Turning to industries, Table 4 shows that the industries in which workers reported low initial computer use was also similar for men and women during the period. In addition, computer use for all industries in this application for both men and women increased over time. However, the overall percentage of computer use for women was higher relative to men. Furthermore, the increase in the rate of computer usage between men and women differed for each industry. For example, Figure 4 demonstrates that computer usage for manufacturing-textile mill products (I15) for men increased at an increasing rate until 1997 and then declined in 2001, whereas that for women increased at an increasing rate during the period. On the other hand, computer usage for entertainment & recreation services (I34) for both men and women increased at an increasing rate for the full period. These results suggest that the rate of diffusion of computers varied for each industry and also differed between men and women.

[14] See a report by The Council of Economic Advisor (2000) for a review of evidence for occupational difference within the IT sector.

Table 4 also shows that the industries in which workers reported high initial computer use were also similar with some exceptions for men and women during the entire period. However, the rate of computer usage for some industries in this application for both men and women increased; on the other hand, that for some industries for both men and women declined. For example, Figure 4 indicates that the rate of computer usage for banking and other finance (I28) for men increased until 1997 and declined in 2001; whereas, that for women increased over time. On the other hand, computer usage for communication (I24) for both men and women increased at a decreasing rate for the full period. These results suggest that the rate of diffusion of computers varied for each industry and also differed between men and women. Moreover, these results suggest that there is an industry difference within a sector between men and women and thus there is computer usage difference at work by gender.

III. COMPUTER USE AND FEMALE WAGES

As the first analysis in this paper, this section examines the impact of the diffusion of computers on wages by gender. I estimated various specifications, which are applied for each year using Krueger's (1993) approach, to estimate the wage differentials associated with the diffusion of computers at work for the years 1984, 1989, 1993, 1997, and 2001. I also examined the effect of the diffusion of computers on wages for the period 1984-2001, by applying a comparison over time of the computer use wage premiums. Despite the biased estimates due to the omission of unobservable heterogeneity derived from Krueger's (1993) method, a comparison over time of the computer use wage premiums,

focusing on trends, would be relevant in assessing the effect of the computer diffusion on wages if the biased heterogeneity does not vary systematically over the years observed. I applied the Chow-statistics and tested whether there are significant differences in the estimated equations for the years observed.[15] The core sample is focused on adults under the retirement age (individuals aged 18-65 at the survey date), who have at least a high school diploma or equivalent (GED), and who are currently employed (both full and part-time) in the labor force. However, the sample is further restricted to those individuals who report their weekly earnings as more than zero.

1. Methodology

I used the following standard cross-sectional earnings equation to examine firstly how the use of a computer affects female wages. This updates Krueger's estimate, and secondly shows how female wages vary depending on the differences in the use of a computer by each application. All of the regression analyses in this paper use simple ordinary least squares (OLS) with White heteroscedasticity-consistent standard errors.

$$\ln(W_i) = \alpha + \beta X_i + \delta_1 CU_i + \sum_{c=1}^{C=5} \delta_{2c} CC_{ic} + \varepsilon_i, \qquad (1)$$

where the actual log wage of an individual (worker) i ($\ln(W_i)$) is a function of: (1) control variables (X_i); (2) the use of computers for any purpose at work for worker i (CU_i) ("yes=1" if an individual uses a computer for any purpose at work); (3) the use of

[15] See Appendix 3, The Results of Equality Between Sets of Coefficients using Chow-test; 1984-2001, for details.

computers for any one of the five specific computer applications at work for worker i (CC_{ic}) ("yes=1" if an individual uses a computer for the computer mediated communication (CMC) system, graphic & design, programming, spreadsheets & databases, and/or word processing at work)[16]; and (4) a (mean) zero individual error term (ε_i).

2. Empirical Analysis and Results

2.1 Female Wage Over Time

I first analyze how being female affects wages over time during the period 1984-2001. Table 5 reports the results of fitting equation (1) by OLS, which includes control variables (X_i) (including the length of experience (age)[17], the length of experience (age) squared, the highest degree an individual earned categorized into five levels of education, gender, race, ethnicity, marital status, union member status, labor force status, metropolitan living status, and region). The results indicate that the female wage premium was –22.9% (exp(–0.206)–1) in 1984, –22.3% in 1989, –16.2% in 1993,

[16] The CPS questionnaire asks the question, "Does ... directly use a computer at work?" to each individual in the survey. The CPS questionnaire further asks the question, "Does ... use the computer for (1) Internet/email; (2) graphic & design; (3) programming; (4) spreadsheets & database; (5) word processing; (6) a calendar or do scheduling; and (7) (work) other?" to each individual. I interpret CU_i=1 as "the individual uses a computer for any purpose at work," and I divide C1-C5 into five specific computer applications at work (see Table 2, Computer Use by Application). There are cases where CU_i=1 and C1 through C5 all equal zero. In this case, CU_i=1 should be interpreted as computer use for all purposes other than C1 through C5. The data shows that the percentage of cases each period that have CU=1 and C1-C5 all equal zero is relatively large: (28% in 1989, 27% in 1993, 19% in 1997 and 8% in 2001), but its percentage is decreasing over time. I expect that a worker uses a computer for at least one of the five computer applications at work. Thus, most of the cases where CU=1 and C1-C5=0 may resulted from a subjective response by interviewers during the survey.

[17] Experience (age) variable is defined as age of worker i.

–19.2% in 1997, and –19% in 2001. It suggests that female wages were 16-23% lower relative to male wages during the period 1984-2001.

2.2 Impact of Computer Use on Female Wages Over Time

I analyze second how the use of computers affects female wages over time - estimating the computer-use wage premium (the return on wages from using a computer for any purpose at work) for the period 1984-2001. Table 6 reports the results of fitting equation (1) by OLS, which includes a dummy variable for the use of computers for any purpose at work for worker i (CU_i) and a dummy variable for the use of computers for any purpose at work for worker i multiplied by gender (CU_iGF) in the first specification (in section 2.1).

The results in Table 6 show that the female wage premium was –26.6% in 1984, –27.3% in 1989, –22.9% in 1993, –26.9% in 1997, and –24.6% in 2001. It suggests that female wages were 13-27% lower relative to male wages when a dummy variable for computer use and a dummy variable for the use of computers multiplied by gender are included in the specification. In examining the effect on female wages of using a computer, the use of a computer did not affect the wage differentials in the 1980s; however, it narrowed the wage differentials by 4.2 percentage points (thus the female wage premium was –18.7% instead of –22.9%; in other words, the wages of female workers who used a computer at work were 18.7% lower relative to the wages of male workers who used a computer at work) in 1993 and by 6 percentage points (thus the female wage premium was –20.9% instead of –26.9%) in 1997, and the use of a computer did not affect the gender wage

differentials in 2001. These results suggest that the use of a computer had no impact on narrowing the wage differentials in the early stage (during the 1980s), but it helped narrowing the differentials in the middle stage (during in the 1990s), and it had no significant impact on the wage differentials in the late stage (in 2001) as more individuals used computers at work. Furthermore, the results indicate that the computer-use wage premium varied within the relatively narrow range of 18% to 22% during the period 1984-2001. It suggests that the wages of workers who used a computer at work were 18-22% higher relative to the wages of workers who did not use a computer at work.

2.3 Computer-Use Wage Premium with Computer Application

Next, I examine how specific computer applications affect wages differently over time during the period 1989-2001.[18] Table 7-1 reports the results of fitting equation (1) by OLS, which includes a dummy variable for the use of computers for any purpose at work for worker i (CU_i) and the five dummy variables for the use of computers at work by each computer application for worker i (CC_i) in the first specification (in section 2.1). Under this specification, the regression includes both a dummy variable for the computer use for any purpose at work (CU_i) and dummy variables for the five specific computer applications (CC_{ic}), and thus the coefficients on the specific computer application are interpreted as an indication of the additional payoff that a worker earned from using a specific computer application relative to any computer use at work.

[18] The estimates for the year 1984 are omitted because the data for computer categories for the year is not available.

The results in Table 7-1 show that controlling for the five specific computer applications (CC_{ic}) reduces the estimated coefficient on the use of computers for any purpose at work for worker i (CU_i) to 13.9% in 1989, 13.5% in 1993, 10.8% in 1997, and 5.5% in 2001. The table, however, illustrates that an individual who used spreadsheets & databases obtained an additional 7-9% wage premium during the full period. The results also suggest that an individual who used the CMC system did not receive any additional wage premium in 1989; but the additional wage premium started to appear after 1993 at an increasing rate -- 4.3% in 1993, 7.7% in 1997 and 10.7% in 2001. In contrast, an individual who used word processing obtained an additional wage premium of 3.1% in 1989, 9.0% in 1993, and 4.1% in 1997; but it disappeared (became insignificant) after 1997. Similarly, an individual who used graphic and design obtained an additional wage premium of 7.9% in 1989 and 3.5% in 1993; however, the additional premium disappeared (became insignificant) after 1993. Moreover, the additional wage premium from using programming was inconsistent across the years. This may reflect the fact that computer usage for programming was very small.

2.4 Impact of Computer Application on Female Wages Over Time

Finally, I examine how specific computer applications affect female wages during the period 1989-2001. Table 7-2 reports the results of fitting equation (1) by OLS, which includes dummy variables for each one of the five specific computer applications multiplied by gender (CC_{ic} GF) in the previous specification (in section 2.3).

The results in Table 7-2 show that the five specific computer applications ($CC_{ic}GF$) did not impact female wages over time with the exception of the year 1989, in which the use of a computer for word processing increased female wages by an additional 7.8 percentage points. This result indicates that the differences in the use of specific computer applications had very little effect on narrowing the gender wage differentials. Table 7-2 also shows that the computer-use wage premium (CU_i) was slightly reduced relative to the results in the previous specification -- 11.3% in 1989, 10.8% in 1993, 7.1% in 1997; but it became insignificant in 2001. Furthermore, the impact of the five specific computer applications (CC_{ic}) on wages was relatively similar to the results in the previous specification. For example, an individual who used spreadsheets & databases obtained an additional 5-12% wage premium during the full period. An individual who used the CMC system did not receive any additional wage premium in 1989; but the additional wage premium was 5-10% during the period 1993-2001. In contrast, the additional wage premium for using word processing and graphic and design was rather insignificant relative to the case in the previous specification, and the additional wage premium from using programming was inconsistent, which confirmed the previous results.

IV. COMPUTER USE AND FEMALE WAGES BY OCCUPATION & BY INDUSTRY

As the second analysis in this paper, this section examines the impact of the diffusion of computers on female wages by occupations and by industries. I estimated various specifications, which are applied for each year using Tashiro's (2004) approach of

grouping workers into high and low-computer use occupations and industries. This is done first to reduce some (but not all) of the unobservable heterogeneity in the cross-section models, focusing on occupation and industry differences, that may affect wages, and secondly to examine the wage differential associated with the diffusion of computers both at the occupation and industry level for the years 1984, 1989, 1993, 1997, and 2001. The analysis is based on the core sample that is used in Section III.

1. Methodology

I used the following standard cross-sectional earnings equation (which is estimated using simple least squares (OLS)) to analyze the impact of the diffusion of computers on wages by occupations and by industries.

$$\begin{aligned}\ln(W_i) = {} & \alpha + \beta X_i + \delta_1 CU_i + \sum_{c=1}^{C=5} \delta_{2c} CC_{ic} + \sum_{g=1}^{G=2} \phi_{1ig} CUO_{ig} \\ & + \sum_{g=1}^{G=2} \phi_{2ig} CUI_{ig} + \sum_{g=1}^{G=2} \gamma_{1ig} (CUO_{ig}) X_i + \sum_{g=1}^{G=2} \gamma_{2ig} (CUI_{ig}) X_i \\ & + \sum_{g=1}^{G=4} \eta_{ig} [(CUO*CUI)_{ig}] + \sum_{g=1}^{G=4} \lambda_{ig} [(CUO*CUI)_{ig}] X_i \\ & + \sum_{g=1}^{G=4} \mu_{1ig} [(CUO*CUI)_{ig}] CU_i + \sum_{g=1}^{G=4} \sum_{c=1}^{C=5} \mu_{2ig} [(CUO*CUI)_{ig}] CC_i \\ & + \varepsilon_i, \end{aligned} \tag{4}$$

where the actual log wage of an individual (worker) i ($\ln(W_i)$) is a function of: (1) control variables (X_i); (2) the use of computers for any purpose at work for worker i (CU_i); (3) the use of computers for any one of the five specific computer applications at work for worker i (CC_{ic}); (4) worker i's computer-usage occupation (which is also defined as

worker *i*'s occupation *j*) (CUO_{ig}); (5) worker *i*'s computer-usage industry (which is also defined as worker *i*'s industry *k*) (CUI_{ig}); (6) worker *i*'s computer-usage occupation multiplied by each of control variables [(CUO_{ig})X_i]; (7) worker *i*'s computer-usage industry multiplied by each of control variables [(CUI_{ig})X_i]; (8) worker *i*'s "computer-usage occupation and industry interacted" group (which is also defined as worker *i*'s occupation *j* interacted with worker *i*'s industry *k*) [$(CUO*CUI)_{ig}$]; (9) worker *i*'s "computer-usage occupation and industry interacted" group multiplied by each of control variables ([$(CUO*CUI)_{ig}$]X_i); (10) worker *i*'s "computer-usage occupation and industry interacted" group multiplied by the use of computers for any purpose at work for worker *i* ([$(CUO*CUI)_{ig}$]CU_i); (11) worker *i*'s "computer-usage occupation and industry interacted" group multiplied by the use of computers for any one of the five specific computer applications at work for worker *i* ([$(CUO*CUI)_{ig}$]CC_{ic}); and (12) a mean zero individual error term (ε_i).

2. Empirical Analysis and Results

2.1 Computer-Use Wage Premium With Occupation Differences Over Time

I first examine how the use of computers and the differences in occupations affect wages during the period 1984-2001. Table 8-1 reports the results of fitting equation (4) by OLS, with a dummy variable for the "computer-usage occupation" group (CUO_{ij}), a dummy variable for the use of computers for any purpose at work for worker *i* (CU_i), and control variables (X_i) (including the length of experience (age), the length of experience (age) squared, the highest degree an individual earned categorized into five levels of education,

gender, race, ethnicity, marital status, union member status, labor force status, metropolitan living status, and region).

The results in Table 8-1 indicate that the female wage premium was –27.5% in 1984, –27.1% in 1989, –21.3% in 1993, –23.2% in 1997, and –22.8% in 2001. It suggests that female wages were 21-28% lower than male wages when both a dummy variable for computer use and the "computer-usage occupation" group are included in the specification. The results further show that the computer-use wage premium was 15-18%; in other words, the wages of workers who used a computer at work were 15-18% higher relative to the wages of workers who did not use a computer at work. In addition, the premium for having a high computer-usage occupation was 20-28%, which implies that workers who had a high computer-usage occupation earned 20-28% more than workers who had a low computer-usage occupation during the period 1984-2001.

2.2 Computer-Use Female Wage Premium With Occupation Differences Over Time

I second examine how the use of computers and the differences in occupations affects female wages during the period 1984-2001. Table 8-2 reports the results of fitting equation (4) by OLS, which includes a dummy variable for the use of computers for any purpose at work for worker *i* multiplied by gender (CU_iGF) and a dummy variable for the "computer-usage occupation" group multiplied by gender ($CUO_{ij}GF$) in the previous specification (in section 2.1).

The results in Table 8-2 show that the female wage premium was –29.2% in 1984, –27.5% in 1989, –24.9% in 1993, –29.3% in 1997, and –26.2% in 2001. These results suggest that female wages were 25-29% lower relative to male wages, and these premiums were further reduced slightly compared to the results in the previous specification (in section 2.1). In examining the effect on female wages of using a computer, the use of a computer narrowed the gender wage differentials by 4.7 percentage points in 1984, by 5.8 percentage points in 1989 and by 4 percentage points in 1993; however, the use of a computer did not affect the wage differentials after 1993. These results suggest that the use of a computer had a positive impact on narrowing the gender wage differentials between 1984 and 1993, and it had no significant impact on the wage differentials in 1997 and 2001 as more individuals used a computer at work. Furthermore, the results indicate that having a high computer-usage occupation did not have a constant impact on the wage differentials for the full period although it narrowed the differentials by 7.5 percentage points in 1997.

2.3 Computer-Use Wage Premium With Industry Differences Over Time

Next, I examine how the use of computers and the differences in industries affected wages during the period 1984-2001. Table 9-1 reports the results of fitting equation (4) by OLS, with a dummy variable for the "computer-usage industry" group (CUI_{ij}), a dummy variable for the use of computers for any purpose at work for worker i (CU_i), and control variables (X_i) (including the length of experience (age), the length of experience (age) squared, the highest degree an individual earned categorized into five levels of

education, gender, race, ethnicity, marital status, union member status, labor force status, metropolitan living status, and region).

The results in Table 9-1 indicate that the female wage premium was –27.6% in 1984, –27.6% in 1989, –22.1% in 1993, –23.9% in 1997, and –23.4% in 2001. It suggests that female wages were 22-28% lower than male wages. The results further show that the computer-use wage premium was 18-22%; in other words, workers who used a computer at work earned 18-22% higher wages relative to workers who did not use a computer at work. Additionally, the premium for being in a high computer usage industry was 7-12%, which implies that workers who worked in a high computer usage industry earned 7-12% more than workers who worked in a low computer usage industry during the period 1984-2001.

2.4 Computer-Use Female Wage Premium With Industry Differences Over Time

I then examine how the use of computers and the differences in industries affected female wages during the period 1984-2001. Table 9-2 reports the results of fitting equation (4) by OLS, which includes a dummy variable for the use of computers for any purpose at work for worker *i* multiplied by gender (CU_iGF) and a dummy variable for the "computer-usage industry" group multiplied by gender ($CUI_{ij}GF$) in the previous specification.

The results in Table 9-2 show that the female wage premium was –35% in 1984, –33.5% in 1989, –28.9% in 1993, –33.1% in 1997, and –28.1% in 2001. These results suggest that female wages were 28-35% lower than male wages, and these premiums were further reduced slightly compared to the results in the previous specification (in section 2.3). The effect on the gender wage differentials of using a computer appeared to be insignificant during the full period. On the other hand, the results indicate that working in a high computer-usage industry narrowed significantly the gender wage differentials -- 10% in 1984, 7.5% in 1989, 8% in 1993, 9.5% in 1997, and 4.3% in 2001. It indicates that female workers who used a computer and worked in a high computer-usage industry narrowed their wage differentials by 4-10%, which suggest that female workers were able to narrow the wage differentials by having a job in a high computer-usage industry.

2.5 Computer-Use Wage Premium With Occupation and Industry Differences by Gender Over Time

Lastly, I analyze how the impact on female wages as a result of using a computer depends on the differences in occupations and industries during the period 1984-2001. Table 10 reports the results of fitting equation (4) by OLS, with the "computer-usage occupation and industry interacted" group multiplied by gender ($[(CUO*CUI)_{ig}]GF$), the "computer-usage occupation and industry interacted" group multiplied by the use of computers for any purpose at work for worker i ($[(CUO*CUI)_{ig}]CU_i$), the "occupation and industry interacted" groups $[(CUO*CUI)_{ig}]$, a dummy variable for the use of computers for any purpose at work for worker i (CU_i), and control variables (X_i) (including the length of experience (age), the length of experience (age) squared, the

highest degree an individual earned categorized into five levels of education, gender, race, ethnicity, marital status, union member status, labor force status, metropolitan living status, and region).

The results in Table 10 show that the female wage premium was –35% in 1984, –33.5% in 1989, –28.9% in 1993, –33.1% in 1997, and –28.1% in 2001. These results suggest that female wages were 28-35% lower relative to male wages, which is consistent with the previous results (in section 2.4). In examining the effect on the gender wage differentials of the differences in occupations and industries, Table 10 shows that the differences in both occupations and industries had a significant effect on the wage differentials during the period. For example, female workers who worked in a high computer-usage industry with a high computer-usage occupation (HOHIGF) were able to narrow their wages by 8.7 percentage points in 1984; thus, the female wage premium was –27.6% instead of –36.3%. This means that the wages of a female worker who worked in a high computer-usage industry with a high computer-usage occupation (HOHIGF) were 27.6% lower than that for a male worker who used a computer and was in the high computer-usage industry with high computer-usage occupation. Furthermore, a female worker who worked in a high computer-usage industry with a high computer-usage occupation (HOHIGF) was able to narrow her wage by 9.6 percentage points in 1993 (making the female wage premium for that year –18.7% instead of –28.3%) and by 16.1 percentage points in 1997 (making female wage premium for that year –17.8% instead of –33.9%). These results show a reduction in the gender wage differentials for workers who were in a high computer-usage industry with a high computer-usage occupation.

This trend, however, is reversed in 2001: female workers who worked in this group narrowed their wage differentials by 8.1 percentage points (making the female wage premium for that year –19% instead of –27.1%).

Turning to analyzing the impact of differences in occupations for a worker who worked in a high computer-usage industry, the results in Table 10 show that a female worker who was in a high computer-usage industry with a low computer-usage occupation (LOHIGF) was able to narrow her wage differentials by 10.3 percentage points (thus the female wage premium was –26%) in 1984, by 9.1 percentage points (thus the female wage premium was –23.5%) in 1989, by 7 percentage points (thus the female wage premium was –21.3%) in 1993, and by 9.3 percentage points (thus the female wage premium was –24.6%) in 1997. These results indicate that having a high computer-usage occupation narrowed the gender wage differentials for female workers given they were in a high computer-usage industry.

Finally, the empirical analysis examines the impact of differences in industries for a worker who had a high computer-usage occupation, the results further indicate that a female worker who had a high computer-usage occupation but was in the low computer-usage industry (HOLIGF) was able to reduce her wage differentials by 8.1 percentage points (thus the female wage premium was –25.8%) only in 1997; otherwise, the overall results were rather inconsistent. These results show that differences in industries had a significant impact on narrowing the gender wage differentials.

V. CONCLUSIONS

This paper uses the U.S. Current Population Survey data for the years 1984, 1989, 1993, 1997, and 2001 to examine the impact on female wages of the diffusion of computers and to further analyze the effect of the differences in the use of a computer, worker characteristics, occupations, and industries on female wages by utilizing both Krueger's (1993) method and Tashiro's (2004) approach of grouping workers into high and low-computer use occupations and industries.

This paper's first analysis, which follows the method used by Krueger (1993), finds that at the aggregate level, the computer-use wage premium for all workers persists within the range of 20% to 25% during the period 1984-2001. In addition, the effect on female wages of using a computer on the job reduced the penalty associated with being a female worker by 4-6 percentage points during the 1990s. Additionally, estimates suggest that at the micro level, the computer-use wage premium for all workers varies by up to an additional 11 percentage points depending on the way computers were used on the job and the premium for each of these computer applications changed at different rates over time. Nevertheless, the way computers were used on the job did not affect the gender wage differentials during the period. Moreover, the empirical results further suggest that female wages overall were 20-27% lower than male wages.

This paper's second analysis, which employs Tashiro's (2004) approach of grouping workers into high and low-computer use occupations and industries, concludes that female wages overall were 23-36% lower than male wages. However, the wage

differential was smaller by 4-10 percentage points if women worked in high computer-usage industries; this result suggests that the industry that women worked in had a significant impact on female wages. Furthermore, the occupation that women had also affected their wage differentials; that is, the wage differential was smaller for women, who worked in high computer-usage industries: by 8-16 percentage points for those female workers who had high computer-usage occupations in contrast to 7-10 percentage points for those who had low computer-usage occupations.

Some studies have raised questions about the cross-sectional estimations (which may yield biased empirical results due to the omission of unobservable heterogeneity in human capital, occupations, and industries) in Krueger's estimates of the effects of computer use on wages (Handel, 1998; DiNardo and Pischke, 1997; and others). Moreover, the recent literature discusses a potential important problem for the skill-biased technological change (SBTC) hypothesis (which explains the recent change in the wage structure and the rapid increase in wage inequality), in which the SBTC fails to explain movements in the educational, gender and racial wage differentials as well as the trend and timing of both the wage structure and wage inequality and its relation to the continuing advancing computer technology in the 1990s.

Despite various concerns with Krueger's estimates and the recent issues with the skill-biased technological change (SBTC) hypothesis, the empirical results presented in this paper confirm that the cross-sectional estimations provide large and consistent results, which supports Dolton and Makepeace (2004). This study also suggests that a

comparison over time of the computer wage premium, focusing on trends, is relevant in assessing the effect of the diffusion of computers on wages as long as the bias of the estimates, even though present, does not vary systematically across the years. Accordingly, this paper concludes that female wages overall were 20-36% lower than male wages during the period 1984-2001. The results also confirm that the computer-use wage premium exists, that the premium is decreasing over time, and that the use of computers on the job reduced the penalty associated with being a female worker during the 1990s. Additionally, the study shows that the way computers were used on the job did not affect female wages; instead, occupational differences, and more importantly, the industry that women worked in had a significant impact on female wages during the period 1984-2001. These findings indicate the presence of occupation and industry wage differentials and thus suggest the importance of policies that reduce the occupational and industry segregation in order to narrow the gender wage differentials in the labor market in the U.S.

TABLE 1
Computer Usage at Work
Using Selected Demographic Group: 1984 – 2001

Computer Use		1984		1989		1993		1997		2001	
		Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Workers		23.48%	30.58%	34.89%	44.82%	42.61%	53.25%	50.02%	61.18%	54.83%	65.66%
Education	High School Grad-Diploma or Equiv	10.90%	25.02%	17.81%	36.02%	22.83%	42.50%	28.21%	47.93%	30.88%	51.19%
	Some College But No Degree	19.80%	32.24%	28.73%	47.11%	39.75%	55.77%	46.35%	62.25%	50.88%	63.34%
	Associate Degree	25.51%	36.39%	40.17%	53.04%	50.10%	60.38%	55.05%	65.40%	57.66%	67.26%
	Bachelor's Degree	36.42%	36.53%	51.81%	52.28%	66.21%	64.33%	75.14%	73.75%	80.53%	81.00%
	Advanced Degree	43.90%	38.16%	59.33%	54.33%	72.18%	63.80%	81.33%	78.05%	87.43%	86.12%
Race	White	24.01%	31.11%	35.84%	45.96%	43.70%	54.63%	51.16%	62.45%	56.09%	67.24%
	Black	16.75%	27.41%	23.48%	35.53%	30.61%	44.18%	37.36%	51.91%	41.21%	54.58%
	American Indian	-	-	23.83%	43.29%	28.25%	52.23%	34.13%	54.82%	39.26%	63.45%
	Asian	-	-	35.61%	41.88%	44.48%	46.09%	50.51%	58.85%	56.47%	61.31%
	Other	22.13%	25.25%	31.58%	38.46%	35.62%	45.65%	-	-	-	-
Ethnicity	Hispanic	18.37%	30.80%	24.35%	44.05%	34.23%	46.90%	35.35%	52.06%	38.24%	53.81%
	Non-Hispanic	23.79%	30.68%	35.46%	44.89%	43.21%	53.65%	50.99%	61.74%	56.04%	66.46%
Age	Age 18-24	13.98%	27.90%	21.09%	41.54%	28.43%	42.49%	32.95%	49.82%	34.91%	50.19%
	Age 25-39	26.64%	35.24%	37.52%	49.08%	44.86%	57.40%	51.53%	64.22%	56.89%	68.96%
	Age 40-54	25.86%	27.34%	38.95%	43.90%	46.59%	54.47%	54.26%	63.79%	58.06%	68.44%
	Age 55-65	17.89%	22.56%	27.68%	32.22%	35.67%	45.39%	46.71%	52.78%	55.30%	61.89%
Marital Status	Married	25.12%	30.01%	37.64%	44.74%	46.27%	54.79%	53.83%	63.19%	59.14%	68.45%
	Non-Married	19.83%	31.52%	29.41%	44.95%	35.61%	50.96%	42.79%	58.19%	47.02%	61.69%
Union Status	Union Member	16.01%	32.03%	27.40%	45.18%	32.38%	54.81%	41.16%	60.90%	43.31%	67.71%
	Non-union Member	27.61%	32.39%	40.33%	47.32%	45.65%	55.73%	53.87%	62.72%	56.13%	64.74%
Labor Status	Full-Time	24.78%	36.17%	36.42%	51.03%	44.60%	59.51%	51.54%	67.13%	56.16%	70.21%
	Part-Time	9.98%	15.12%	17.19%	25.54%	22.51%	34.33%	30.62%	42.14%	37.29%	50.04%
Metropolitan	Lives in Metropolitan	26.94%	34.24%	37.15%	47.67%	45.48%	55.58%	52.65%	63.16%	57.35%	67.18%
Status	Not Live in Metropolitan	17.35%	24.43%	27.69%	35.98%	33.88%	46.33%	41.00%	54.29%	46.77%	60.97%
Region	Northeast	24.55%	29.69%	34.03%	43.39%	41.12%	52.74%	49.91%	59.98%	55.28%	64.62%
	Midwest/North Central	21.76%	29.19%	32.84%	42.87%	41.31%	53.13%	48.75%	61.39%	53.94%	66.06%
	South	22.85%	30.78%	35.34%	45.96%	42.86%	51.96%	49.50%	60.13%	53.44%	65.60%
	West	24.96%	32.69%	37.65%	47.21%	45.51%	55.74%	52.02%	63.35%	56.94%	66.26%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 2
Computer Use at Work by Application – Men and Women, 1989-2001

Computer Use by Application		1989		1993		1997		2001	
		Men	Women	Men	Women	Men	Women	Men	Women
Computer use at work for any purpose	CU	34.89%	44.82%	42.61%	53.25%	50.02%	61.18%	54.83%	65.66%
Computer use at work for the CMC system (Internet, e-mail, a calendar, scheduling) System	C1	14.70%	16.50%	19.46%	23.41%	33.77%	37.34%	45.68%	52.29%
Computer use at work for Graphics & Design	C2	9.09%	5.94%	10.71%	5.06%	12.33%	10.63%	17.88%	17.39%
Computer use at work for Programming	C3	8.63%	6.54%	7.22%	5.06%	10.25%	6.47%	11.25%	6.97%
Computer use at work for Spreadsheets & Databases	C4	14.78%	15.71%	19.00%	21.98%	23.75%	25.82%	36.31%	40.15%
Computer use at work for Word Processing	C5	13.72%	18.61%	17.92%	25.71%	27.41%	37.53%	36.02%	46.59%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 3
Computer Use at Work by Occupation– All Workers, Men, and Women: Sorted by 2001

Occupation	Code	All Workers	Computer Usage	Code	Men	Computer Usage	Code	Women	Computer Usage
Officials & administrators, pub. admin.	O1	88.73%	HIGH	O1	87.61%	HIGH	O1	90.10%	HIGH
Other executive, admin. & managerial	O2	80.53%	HIGH	O2	77.75%	HIGH	O2	84.22%	HIGH
Management related occupations	O3	88.34%	HIGH	O3	87.72%	HIGH	O3	88.76%	HIGH
Engineers	O4	90.31%	HIGH	O4	90.09%	HIGH	O4	92.59%	HIGH
Natural Scientists	O5	80.52%	HIGH	O5	85.35%	HIGH	O5	76.83%	LOW
Social Scientists	O6	92.80%	HIGH	O6	91.96%	HIGH	O6	94.67%	HIGH
Teachers, college and university	O7	90.47%	HIGH	O7	92.43%	HIGH	O7	87.88%	HIGH
Teachers, except college and university	O8	74.97%	LOW	O8	80.80%	HIGH	O8	73.03%	LOW
Other professional specialty occupations	O9	79.22%	HIGH	O9	79.16%	HIGH	O9	79.27%	HIGH
Health technologists and technicians	O10	63.98%	LOW	O10	62.34%	LOW	O10	64.30%	LOW
Engineering and science technicians	O11	84.82%	HIGH	O11	83.10%	HIGH	O11	87.97%	HIGH
Supervisors and proprietors, sales occupations	O12	71.85%	LOW	O12	72.61%	LOW	O12	70.68%	LOW
Sales related occupations	O13	60.36%	LOW	O13	66.87%	LOW	O13	54.40%	LOW
Supervisors, admin. Support	O14	83.68%	HIGH	O14	77.31%	LOW	O14	87.16%	HIGH
Computer equipment operators	O15	87.73%	HIGH	O15	84.29%	HIGH	O15	90.32%	HIGH
Secretaries, stenographers, and typists	O16	84.65%	HIGH	O16	92.31%	HIGH	O16	84.52%	HIGH
Other admin support	O17	74.67%	LOW	O17	62.13%	LOW	O17	78.45%	HIGH
Private household service occupations	O18	10.68%	LOW	O18	0.00%	LOW	O18	11.00%	LOW
Protective service	O19	56.08%	LOW	O19	57.26%	LOW	O19	51.01%	LOW
Service Occupation excluding Private Household and Protective	O20	23.24%	LOW	O20	20.90%	LOW	O20	24.28%	LOW
Precision Product, Craft and Repair	O21	33.87%	LOW	O21	33.32%	LOW	O21	36.91%	LOW
Transportation and Material Moving	O22	18.82%	LOW	O22	18.17%	LOW	O22	23.85%	LOW
Handlers, Equipment Cleaners, Helper and Laborers	O23	19.80%	LOW	O23	18.83%	LOW	O23	23.18%	LOW
Farming, Forestry and Fishing	O24	27.30%	LOW	O24	23.73%	LOW	O24	39.66%	LOW

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 4

Computer Use at Work by Industry– All Workers, Men, and Women: Sorted by 2001

Industry	Code	All Workers	Computer Usage	Code	Men	Computer Usage	Code	Women	Computer Usage
Banking And Other Finance	I1	38.47%	LOW	I1	31.59%	LOW	I1	56.42%	LOW
Admin Of Human Resource Programs	I2	33.22%	LOW	I2	26.44%	LOW	I2	70.31%	HIGH
Other Professional Services	I3	33.22%	LOW	I3	28.86%	LOW	I3	56.52%	LOW
Communications	I4	41.13%	LOW	I4	38.71%	LOW	I4	45.16%	LOW
Other Public Administration	I5	47.42%	LOW	I5	42.86%	LOW	I5	65.00%	HIGH
Insurance And Real Estate	I6	53.50%	LOW	I6	48.52%	LOW	I6	77.55%	HIGH
National Security & Internal Affairs	I7	51.98%	LOW	I7	47.89%	LOW	I7	65.08%	HIGH
Mfg-Petroleum & Coal Prods	I8	63.60%	HIGH	I8	59.61%	HIGH	I8	76.58%	HIGH
Mfg-Chemicals & Allied Prods	I9	68.40%	HIGH	I9	71.21%	HIGH	I9	63.20%	LOW
Measuring, Analyzing, and Controlling Instruments	I10	55.94%	LOW	I10	54.40%	LOW	I10	60.81%	LOW
Educational Services	I11	75.28%	HIGH	I11	76.50%	HIGH	I11	73.75%	HIGH
Justice, Public Order & Safety	I12	52.65%	LOW	I12	52.29%	LOW	I12	53.26%	LOW
Business Services	I13	42.39%	LOW	I13	37.78%	LOW	I13	51.04%	LOW
Mfg-Electrical Machinery, Equip Supplies	I14	40.00%	LOW	I14	25.00%	LOW	I14	57.14%	LOW
Mfg-Printing, Publishing & Allied Inds	I15	42.59%	LOW	I15	39.02%	LOW	I15	46.25%	LOW
Health Services	I16	41.13%	LOW	I16	43.64%	LOW	I16	39.53%	LOW
Wholesale Trade	I17	55.75%	LOW	I17	56.55%	HIGH	I17	53.45%	LOW
Mfg-Machinery, Ex Electrical	I18	68.32%	HIGH	I18	63.39%	HIGH	I18	74.85%	HIGH
Utilities & Sanitary Services	I19	76.85%	HIGH	I19	75.29%	HIGH	I19	79.68%	HIGH
Mfg-Leather & Leather Prods	I20	78.33%	HIGH	I20	80.85%	HIGH	I20	69.23%	HIGH
Transportation Equipment	I21	54.15%	LOW	I21	52.97%	LOW	I21	56.57%	LOW
Mfg-Paper & Allied Products	I22	58.54%	LOW	I22	56.52%	HIGH	I22	61.11%	LOW

TABLE 4 - Continued

Computer Use at Work by Industry– All Workers, Men, and Women: Sorted by 2001

Mfg-Rubber & Misc Plastic Prods	I23	43.02%	LOW	I23	36.01%	LOW	I23	61.55%	LOW
Mfg-Primary Metals	I24	83.82%	HIGH	I24	79.11%	HIGH	I24	90.31%	HIGH
Mis Manufacturing Industries	I25	62.77%	HIGH	I25	56.35%	HIGH	I25	87.32%	HIGH
Entertainment & Recreation Services	I26	65.16%	HIGH	I26	60.42%	HIGH	I26	76.43%	HIGH
Mfg-Fabricated Metals	I27	46.20%	LOW	I27	46.25%	LOW	I27	46.15%	LOW
Social Services	I28	88.24%	HIGH	I28	90.28%	HIGH	I28	86.93%	HIGH
Mfg-Stone, Clay, Concrete, Glass Prods	I29	80.32%	HIGH	I29	73.39%	HIGH	I29	85.16%	HIGH
Retail Trade	I30	11.98%	LOW	I30	15.00%	LOW	I30	11.71%	LOW
Automobile And Repair Services	I31	71.23%	HIGH	I31	70.86%	HIGH	I31	71.67%	HIGH
Transportation	I32	43.28%	LOW	I32	39.86%	LOW	I32	64.66%	LOW
Mfg-Textile Mill Prods	I33	41.29%	LOW	I33	44.51%	LOW	I33	39.63%	LOW
Mfg-Food & Kindred Prods	I34	52.13%	LOW	I34	48.62%	LOW	I34	56.39%	LOW
Personal Serv Exc Private Households	I35	65.67%	HIGH	I35	67.70%	HIGH	I35	65.13%	HIGH
Mfg-Apparel & Other Finished Textile Pr	I36	73.83%	HIGH	I36	74.13%	HIGH	I36	73.70%	HIGH
Mfg-Furniture & Fixtures	I37	50.06%	LOW	I37	53.70%	LOW	I37	49.35%	LOW
Mfg-Tobacco Prods	I38	84.68%	HIGH	I38	83.46%	HIGH	I38	86.04%	HIGH
Agriculture, Forestry, Fishing and Mining	I39	73.26%	HIGH	I39	69.82%	HIGH	I39	79.42%	HIGH
Construction	I40	85.58%	HIGH	I40	84.68%	HIGH	I40	85.95%	HIGH
Mfg-Lumber & Wood Prods, Ex Furniture	I41	79.58%	HIGH	I41	80.10%	HIGH	I41	78.57%	HIGH
Private Household Services	I42	82.15%	HIGH	I42	76.29%	HIGH	I42	88.09%	HIGH

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

TABLE 5
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.880	4.052	4.136	4.187	4.535
	(0.056)	(0.058)	(0.057)	(0.065)	(0.064)
Female (GF) (1=yes)	**-0.206*** **	**-0.201*** **	**-0.150*** **	**-0.176*** **	**-0.174*** **
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
Some College But No Degree (E2)	0.068***	0.076***	0.103***	0.106***	0.101***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.134***	0.195***	0.212***	0.204***	0.159***
	(0.019)	(0.018)	(0.018)	(0.020)	(0.017)
Bachelor's Degree (E4)	0.229***	0.307***	0.412***	0.385***	0.375***
	(0.014)	(0.014)	(0.015)	(0.014)	(0.016)
Advanced Degree (EA)	0.366***	0.499***	0.553***	0.534***	0.541***
	(0.017)	(0.018)	(0.020)	(0.018)	(0.020)
Experience (Age)	0.054***	0.054***	0.053***	0.053***	0.045***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0006***	-0.0006***	-0.0005***	-0.0006***	-0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.067***	-0.090***	-0.073***	-0.144***	-0.093***
	(0.017)	(0.018)	(0.017)	(0.018)	(0.019)
American Indian	-	-0.076	-0.097*	0.067	-0.072
		(0.063)	(0.052)	(0.057)	(0.044)
Asian	-	-0.038	-0.004	-0.051*	-0.030
		(0.032)	(0.031)	(0.027)	(0.026)
Other	-0.100***	-0.232**	0.032	-	-
	(0.029)	(0.105)	(0.069)		
Hispanic	-0.122***	-0.038	-0.125***	-0.154***	-0.135***
	(0.025)	(0.024)	(0.022)	(0.022)	(0.019)
Married	0.058***	0.088***	0.094***	0.082***	0.077***
	(0.012)	(0.012)	(0.011)	(0.011)	(0.011)
Union Member	0.189***	0.165***	0.192***	0.152***	0.118***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)
Part-Time	-0.006	0.016	0.082***	-0.043*	-0.056**
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.141***	0.173***	0.151***	0.169***	-0.154***
	(0.010)	(0.012)	(0.012)	(0.014)	(0.012)
Midwest/North Central	-0.113***	-0.181***	-0.141***	-0.070***	-0.066***
	(0.014)	(0.015)	(0.014)	(0.015)	(0.016)
South	-0.068***	-0.152***	-0.128***	-0.094***	-0.068***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.046***	-0.061***	-0.029*	-0.024	-0.017
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
R-Square	0.234	0.257	0.251	0.242	0.187

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 6
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.894	4.088	4.171	4.180	4.538
	(0.055)	(0.057)	(0.057)	(0.064)	(0.063)
Computer use at work (CU)	**0.168*** **	**0.185*** **	**0.201*** **	**0.170*** **	**0.172*** **
	(0.016)	(0.015)	(0.015)	(0.015)	(0.015)
Female (1=yes)	**-0.236*** **	**-0.241*** **	**-0.206*** **	**-0.238*** **	**-0.220*** **
	(0.013)	(0.014)	(0.015)	(0.018)	(0.018)
Computer use at work*Female (CUGF)	**0.030**	**0.028**	**0.041** **	**0.058*** **	**0.031**
	(0.022)	(0.020)	(0.020)	(0.022)	(0.022)
Some College But No Degree (E2)	0.052***	0.048***	0.066***	0.069***	0.069***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.115***	0.159***	0.170***	0.163***	0.125***
	(0.019)	(0.018)	(0.018)	(0.020)	(0.017)
Bachelor's Degree (E4)	0.197***	0.258***	0.345***	0.321***	0.304***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.016)
Advanced Degree (EA)	0.325***	0.440***	0.477***	0.461***	0.458***
	(0.018)	(0.018)	(0.020)	(0.019)	(0.021)
Experience (Age)	0.052***	0.050***	0.048***	0.051***	0.043***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0005***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.055***	-0.066***	-0.052***	-0.116***	-0.072***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.019)
American Indian	-	-0.067	-0.081	0.083	-0.068
	-	(0.061)	(0.052)	(0.055)	(0.043)
Asian	-	-0.030	0.027	-0.031	-0.014
	-	(0.031)	(0.030)	(0.027)	(0.025)
Other	-0.080***	-0.239**	0.044	-	-
	(0.029)	(0.103)	(0.071)	-	-
Hispanic	-0.112***	-0.026	-0.116***	-0.127***	-0.114***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.054***	0.079***	0.082***	0.071***	0.065***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.205***	0.183***	0.213***	0.172***	0.133***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)
Part-Time	0.031*	0.065***	0.134***	0.004	-0.021
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.128***	0.158***	0.140***	0.153***	0.145***
	(0.010)	(0.012)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.113***	-0.178***	-0.151***	-0.072***	-0.068***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.064***	-0.154***	-0.131***	-0.097***	-0.068***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.040***	-0.067***	-0.039**	-0.033**	-0.022
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
R-Square	0.251	0.278	0.278	0.263	0.203

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 7-1
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Intercept	4.110	4.212	4.209	4.556
	(0.057)	(0.057)	(0.064)	(0.063)
Computer use at work (CU)	**0.130*** **	**0.127*** **	**0.103*** **	**0.054*** **
	(0.013)	(0.013)	(0.014)	(0.018)
Computer use at work for CMC System (C1)	**0.024**	**0.042*** **	**0.074*** **	**0.102*** **
	(0.017)	(0.016)	(0.016)	(0.018)
Computer use at work for graphics & design (C2)	**0.076*** **	**0.034***	**0.018**	**0.005**
	(0.023)	(0.019)	(0.017)	(0.017)
Computer use at work for programming (C3)	**0.014**	**0.066*** **	**-0.004**	**0.062*** **
	(0.021)	(0.021)	(0.020)	(0.019)
Computer use at work for spreadsheets & databases (C4)	**0.090*** **	**0.071*** **	**0.075*** **	**0.075*** **
	(0.017)	(0.016)	(0.015)	(0.016)
Computer use at work for word processing (C5)	**0.031***	**0.086*** **	**0.040*** **	**0.000**
	(0.016)	(0.016)	(0.015)	(0.015)
Female (GF) (1=yes)	**-0.225*** **	**-0.185*** **	**-0.203*** **	**-0.196*** **
	(0.010)	(0.010)	(0.011)	(0.011)
Some College But No Degree (E2)	0.044***	0.059***	0.062***	0.063***
	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.152***	0.162***	0.156***	0.120***
	(0.018)	(0.018)	(0.020)	(0.017)
Bachelor's Degree (E4)	0.245***	0.319***	0.289***	0.278***
	(0.014)	(0.015)	(0.015)	(0.016)
Advanced Degree (EA)	0.415***	0.438***	0.420***	0.428***
	(0.018)	(0.020)	(0.019)	(0.022)
Experience (Age)	0.048***	0.046***	0.049***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.061***	-0.046***	-0.113***	-0.072***
	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-0.065	-0.077	0.080	-0.068
	(0.061)	(0.052)	(0.055)	(0.043)
Asian	-0.028	0.031	-0.024	-0.010
	(0.032)	(0.030)	(0.027)	(0.025)
Other	-0.214**	0.053	-	-
	(0.101)	(0.069)		
Hispanic	-0.024	-0.109***	-0.123***	-0.108***
	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.079***	0.083***	0.070***	0.062***
	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.190***	0.227***	0.183***	0.144***
	(0.013)	(0.013)	(0.014)	(0.014)
Part-Time	0.068***	0.141***	0.009	-0.012
	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.158***	0.134***	0.146***	0.139***
	(0.012)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.176***	-0.153***	-0.076***	-0.067***
	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.153***	-0.133***	-0.098***	-0.067***
	(0.014)	(0.014)	(0.015)	(0.015)
West	-0.066***	-0.047***	-0.039**	-0.023
	(0.016)	(0.015)	(0.016)	(0.016)
R-Square	0.284	0.287	0.269	0.209

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 7-2
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Intercept	4.115	4.217	4.220	4.564
	(0.057)	(0.057)	(0.064)	(0.063)
Computer use at work (CU)	0.107***	0.103***	0.069***	0.029
	(0.019)	(0.018)	(0.020)	(0.022)
Computer use at work for CMC System (C1)	0.040	0.044*	0.092***	0.091***
	(0.026)	(0.025)	(0.027)	(0.025)
Computer use at work for graphics & design (C2)	0.120***	0.040	0.029	0.028
	(0.031)	(0.026)	(0.024)	(0.026)
Computer use at work for programming (C3)	-0.014	0.076***	0.009	0.083***
	(0.030)	(0.029)	(0.030)	(0.028)
Computer use at work for spreadsheets & databases (C4)	0.114***	0.048*	0.067***	0.087***
	(0.027)	(0.026)	(0.024)	(0.026)
Computer use at work for word processing (C5)	-0.017	0.108***	0.023	-0.008
	(0.026)	(0.027)	(0.024)	(0.023)
Female (GF) (1=yes)	**-0.241*** **	**-0.205*** **	**-0.238*** **	**-0.221*** **
	(0.014)	(0.015)	(0.018)	(0.018)
Computer use at work*Female (CUGF)	**0.040**	**0.049***	**0.064** **	**0.049**
	(0.026)	(0.026)	(0.029)	(0.035)
Computer use at work for CMC System*Female (C1GF)	**-0.027**	**-0.004**	**-0.026**	**0.021**
	(0.034)	(0.032)	(0.033)	(0.035)
Computer use at work for graphics & design*Female (C2GF)	**-0.089***	**-0.005**	**-0.017**	**-0.042**
	(0.045)	(0.038)	(0.033)	(0.033)
Computer use at work for programming*Female (C3GF)	**0.063**	**-0.018**	**-0.021**	**-0.046**
	(0.043)	(0.043)	(0.039)	(0.037)
Computer use at work for spreadsheets & databases*Female (C4GF)	**-0.041**	**0.035**	**0.016**	**-0.019**
	(0.035)	(0.033)	(0.031)	(0.033)
Computer use at work for word processing*Female (C5GF)	**0.075** **	**-0.040**	**0.023**	**0.009**
	(0.033)	(0.033)	(0.031)	(0.031)
Some College But No Degree (E2)	0.044***	0.059***	0.063***	0.064***
	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.152***	0.163***	0.157***	0.121***
	(0.018)	(0.018)	(0.020)	(0.017)
Bachelor's Degree (E4)	0.246***	0.322***	0.293***	0.280***
	(0.014)	(0.015)	(0.015)	(0.016)
Advanced Degree (EA)	0.419***	0.442***	0.425***	0.431***
	(0.018)	(0.020)	(0.019)	(0.022)

TABLE 7-2 - Continued
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Experience (Age)	0.048***	0.046***	0.049***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.061***	-0.046***	-0.111***	-0.070***
	(0.018)	(0.016)	(0.018)	(0.019)
American Indian	-0.068	-0.077	0.080	-0.067
	(0.061)	(0.052)	(0.055)	(0.044)
Asian	-0.029	0.031	-0.024	-0.011
	(0.032)	(0.030)	(0.027)	(0.025)
Other	-0.217**	0.053	-	-
	(0.099)	(0.069)		
Hispanic	-0.025	-0.109***	-0.124***	-0.108***
	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.079***	0.083***	0.070***	0.061***
	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.189***	0.226***	0.181***	0.143***
	(0.013)	(0.013)	(0.015)	(0.014)
Part-Time	0.071***	0.143***	0.013	-0.010
	(0.017)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.157***	0.134***	0.145***	0.139***
	(0.012)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.176***	-0.153***	-0.076***	-0.067***
	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.153***	-0.132***	-0.098***	-0.066***
	(0.014)	(0.014)	(0.015)	(0.015)
West	-0.066***	-0.048***	-0.039**	-0.022
	(0.016)	(0.015)	(0.016)	(0.016)
R-Square	0.285	0.288	0.270	0.210

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 8-1
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.904	4.127	4.187	4.195	4.551
	(0.055)	(0.057)	(0.056)	(0.064)	(0.062)
Female (GF) (1=yes)	**-0.243*** **	**-0.240*** **	**-0.193*** **	**-0.209*** **	**-0.205*** **
	(0.010)	(0.010)	(0.010)	(0.010)	(0.011)
Computer use at work (CU)	**0.141*** **	**0.147*** **	**0.164*** **	**0.153*** **	**0.142*** **
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
High Computer Usage Occupation (HO)	**0.221*** **	**0.224*** **	**0.243*** **	**0.182*** **	**0.213*** **
	(0.012)	(0.012)	(0.012)	(0.012)	(0.013)
Some College But No Degree (E2)	0.031**	0.031**	0.046***	0.055***	0.049***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.084***	0.127***	0.129***	0.136***	0.091***
	(0.018)	(0.017)	(0.017)	(0.019)	(0.017)
Bachelor's Degree (E4)	0.140***	0.201***	0.277***	0.266***	0.243***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.017)
Advanced Degree (EA)	0.233***	0.355***	0.376***	0.378***	0.365***
	(0.018)	(0.018)	(0.020)	(0.019)	(0.021)
Experience (Age)	0.050***	0.046***	0.046***	0.049***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.041***	-0.055***	-0.045***	-0.115***	-0.072***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-	-0.049	-0.068	0.079	-0.054
		(0.062)	(0.052)	(0.054)	(0.043)
Asian	-	-0.034	0.019	-0.032	-0.017
		(0.031)	(0.030)	(0.026)	(0.025)
Other	-0.074***	-0.221**	0.049	-	-
	(0.028)	(0.101)	(0.069)		
Hispanic	-0.101***	-0.020	-0.110***	-0.122***	-0.104***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.050***	0.073***	0.078***	0.064***	0.058***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.247***	0.224***	0.258***	0.209***	0.174***
	(0.013)	(0.013)	(0.013)	(0.015)	(0.014)
Part-Time	0.055***	0.085***	0.143***	0.008	-0.009
	(0.016)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.116***	0.147***	0.129***	0.143***	0.134***
	(0.010)	(0.011)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.106***	-0.161***	-0.141***	-0.066***	-0.062***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
South	-0.055***	-0.141***	-0.120***	-0.089***	-0.062***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.047***	-0.056***	-0.032**	-0.032**	-0.018
	(0.014)	(0.016)	(0.015)	(0.016)	(0.015)
R-Square	0.273	0.300	0.302	0.276	0.221

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 8-2
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.905	4.125	4.196	4.212	4.561
	(0.055)	(0.057)	(0.056)	(0.064)	(0.063)
Female (GF) (1=yes)	**-0.256*** **	**-0.243*** **	**-0.222*** **	**-0.257*** **	**-0.233*** **
	(0.013)	(0.014)	(0.015)	(0.018)	(0.018)
Computer use at work (CU)	0.116***	0.116***	0.144***	0.136***	0.130***
	(0.017)	(0.016)	(0.016)	(0.016)	(0.016)
High Computer Usage Occupation (HO)	0.223***	0.257***	0.228***	0.142***	0.194***
	(0.018)	(0.018)	(0.019)	(0.018)	(0.019)
Computer use at work*Female (CUGF)	**0.046*** **	**0.056** **	**0.039***	**0.038**	**0.026**
	(0.023)	(0.022)	(0.021)	(0.024)	(0.024)
High Computer Usage Occupation*Female (HOGF)	**-0.002**	**-0.059** **	**0.026**	**0.072*** **	**0.035**
	(0.023)	(0.023)	(0.024)	(0.023)	(0.024)
Some College But No Degree (E2)	0.031***	0.031**	0.047***	0.056***	0.050***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.084**	0.127***	0.131***	0.136***	0.092***
	(0.018)	(0.018)	(0.017)	(0.019)	(0.017)
Bachelor's Degree (E4)	0.142***	0.201***	0.282***	0.272***	0.246***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.017)
Advanced Degree (EA)	0.236***	0.353***	0.382***	0.389***	0.370***
	(0.018)	(0.018)	(0.020)	(0.019)	(0.021)
Experience (Age)	0.051***	0.047***	0.046***	0.049***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.041**	-0.055***	-0.044***	-0.112***	-0.072***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-	-0.051	-0.070	0.080	-0.054
		(0.062)	(0.052)	(0.054)	(0.043)
Asian	-	-0.035	0.019	-0.031	-0.018
		(0.031)	(0.030)	(0.026)	(0.025)
Other	-0.074***	-0.217**	0.049	-	-
	(0.028)	(0.100)	(0.069)		
Hispanic	-0.101***	-0.020	-0.111***	-0.123***	-0.104***
	(0.024)	(0.023)	(0.021)	(0.021)	(0.019)
Married	0.050***	0.073***	0.079***	0.065***	0.059***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.246***	0.225***	0.255***	0.204***	0.172***
	(0.013)	(0.013)	(0.013)	(0.015)	(0.014)
Part-Time	0.057***	0.087***	0.146***	0.013	-0.006
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.116***	0.147***	0.129***	0.144***	0.135***
	(0.010)	(0.011)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.106***	-0.160***	-0.141***	-0.066***	-0.062***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
South	-0.056***	-0.141***	-0.119***	-0.089***	-0.062***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.047***	-0.056***	-0.032**	-0.033**	-0.018
	(0.014)	(0.016)	(0.015)	(0.016)	(0.015)
R-Square	0.273	0.300	0.302	0.277	0.221

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 9-1
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.887	4.092	4.160	4.171	4.530
	(0.055)	(0.057)	(0.056)	(0.064)	(0.063)
Female (GF) (1=yes)	**-0.244*** **	**-0.244*** **	**-0.200*** **	**-0.214*** **	**-0.210*** **
	(0.011)	(0.011)	(0.010)	(0.011)	(0.011)
Computer use at work (CU)	**0.167*** **	**0.180*** **	**0.198*** **	**0.179*** **	**0.172*** **
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
High Computer Usage Industry (HI)	**0.106*** **	**0.099*** **	**0.112*** **	**0.087*** **	**0.068*** **
	(0.011)	(0.011)	(0.011)	(0.012)	(0.012)
Some College But No Degree (E2)	0.042***	0.040***	0.056***	0.063***	0.064***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.102***	0.147***	0.151***	0.151***	0.116***
	(0.019)	(0.018)	(0.018)	(0.019)	(0.017)
Bachelor's Degree (E4)	0.175***	0.238***	0.316***	0.299***	0.289***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.016)
Advanced Degree (EA)	0.286***	0.407***	0.433***	0.429***	0.435***
	(0.018)	(0.018)	(0.020)	(0.019)	(0.021)
Experience (Age)	0.051***	0.048***	0.047***	0.049***	0.042***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.061***	-0.071***	-0.058***	-0.121***	-0.078***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-	-0.064	-0.090*	0.082	-0.074*
		(0.061)	(0.051)	(0.055)	(0.043)
Asian	-	-0.029	0.030	-0.029	-0.017
		(0.031)	(0.030)	(0.026)	(0.025)
Other	-0.079***	-0.247**	0.027	-	-
	(0.029)	(0.103)	(0.070)		
Hispanic	-0.114***	-0.029	-0.116***	-0.129***	-0.113***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.053***	0.078***	0.077***	0.069***	0.064***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.209***	0.183***	0.210***	0.170***	0.132***
	(0.012)	(0.013)	(0.013)	(0.014)	(0.013)
Part-Time	0.041**	0.069***	0.133***	0.001	-0.020
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.126***	0.155***	0.136***	0.151***	0.142***
	(0.010)	(0.011)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.109***	-0.175***	-0.148***	-0.069***	-0.066***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.058***	-0.149***	-0.129***	-0.095***	-0.066***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.047***	-0.060***	-0.034**	-0.027*	-0.019
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
R-Square	0.257	0.283	0.284	0.266	0.205

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 9-2
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.910	4.115	4.181	4.201	4.545
	(0.055)	(0.058)	(0.057)	(0.064)	(0.063)
Female (GF) (1=yes)	**-0.300*** **	**-0.289*** **	**-0.254*** **	**-0.286*** **	**-0.248*** **
	(0.016)	(0.017)	(0.016)	(0.021)	(0.019)
Computer use at work (CU)	0.163***	0.176***	0.189***	0.164***	0.162***
	(0.017)	(0.016)	(0.015)	(0.016)	(0.016)
High Computer Usage Industry (HI)	0.062***	0.065***	0.075***	0.043***	0.048***
	(0.014)	(0.015)	(0.015)	(0.016)	(0.016)
Computer use at work*Female (CUGF)	**0.006**	**0.007**	**0.021**	**0.032**	**0.022**
	(0.022)	(0.021)	(0.021)	(0.023)	(0.024)
High Computer Usage Industry*Female (HIGF)	**0.095*** **	**0.072*** **	**0.077*** **	**0.091*** **	**0.042***
	(0.021)	(0.021)	(0.021)	(0.023)	(0.023)
Some College But No Degree (E2)	0.042***	0.039**	0.056***	0.065***	0.065***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.103***	0.146***	0.150***	0.151***	0.116***
	(0.019)	(0.018)	(0.018)	(0.019)	(0.017)
Bachelor's Degree (E4)	0.175***	0.239***	0.318***	0.302***	0.291***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.016)
Advanced Degree (EA)	0.290***	0.410***	0.438***	0.436***	0.437***
	(0.018)	(0.018)	(0.021)	(0.019)	(0.021)
Experience (Age)	0.051***	0.048***	0.047***	0.049***	0.042***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.060***	-0.071***	-0.057***	-0.119***	-0.077***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-	-0.064	-0.093*	0.083	-0.075***
		(0.061)	(0.051)	(0.054)	(0.043)
Asian	-	-0.029	0.032	-0.027	-0.017
		(0.031)	(0.030)	(0.027)	(0.025)
Other	-0.079***	-0.242**	0.030	-	-
	(0.029)	(0.103)	(0.070)		
Hispanic	-0.115***	-0.030	-0.118***	-0.131***	-0.113***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)
Married	0.054***	0.078***	0.078***	0.070***	0.065***
	(0.012)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.204***	0.180***	0.206***	0.165***	0.129***
	(0.013)	(0.013)	(0.013)	(0.015)	(0.013)
Part-Time	0.047***	0.072***	0.136***	0.006	-0.017
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.127***	0.155***	0.137***	0.152***	0.143***
	(0.010)	(0.011)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.110***	-0.175***	-0.148***	-0.070***	-0.066***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.059***	-0.150***	-0.129***	-0.096***	-0.066***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.046***	-0.061***	-0.035**	-0.028*	-0.018
	(0.015)	(0.016)	(0.016)	(0.016)	(0.016)
R-Square	0.258	0.284	0.285	0.268	0.205

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

TABLE 10
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.918	4.149	4.205	4.229	4.571
	(0.055)	(0.057)	(0.056)	(0.064)	(0.062)
HOHI*CU(Computer Use at Work)	**-0.088*** **	-0.009	-0.007	-0.035	**0.057**
	(0.032)	(0.031)	(0.033)	(0.038)	(0.039)
HOLI*CU(Computer Use at Work)	-0.030	**-0.069***	0.061	-0.007	0.029
	(0.042)	(0.039)	(0.043)	(0.048)	(0.043)
LOHI*CU(Computer Use at Work)	-0.018	0.001	0.005	**0.047***	**0.051***
	(0.031)	(0.027)	(0.025)	(0.027)	(0.029)
HOHIGF (Female)	**0.083*** **	0.031	**0.092*** **	**0.149*** **	**0.078*** **
	(0.027)	(0.027)	(0.027)	(0.027)	(0.027)
HOLIGF (Female)	-0.010	**-0.069***	0.001	**0.078***	0.000
	(0.039)	(0.037)	(0.040)	(0.042)	(0.039)
LOHIGF (Female)	**0.098*** **	**0.087*** **	**0.068*** **	**0.089*** **	0.029
	(0.024)	(0.024)	(0.023)	(0.027)	(0.027)
HOHI (High C-U Occupation w/ High C-U Industry)	**0.283*** **	**0.285*** **	**0.282*** **	**0.204*** **	**0.183*** **
	(0.024)	(0.027)	(0.032)	(0.036)	(0.037)
HOLI (High C-U Occupation w/ Low C-U Industry)	**0.245*** **	**0.293*** **	**0.172*** **	**0.135*** **	**0.176*** **
	(0.031)	(0.032)	(0.038)	(0.046)	(0.036)
LOHI (Low C-U Occupation w/ High C-U Industry)	**0.048*** **	**0.036** **	**0.047*** **	**0.000**	0.003
	(0.017)	(0.018)	(0.018)	(0.021)	(0.021)
CU (Computer Use at Work)	**0.168*** **	**0.141*** **	**0.145*** **	**0.131*** **	**0.106*** **
	(0.025)	(0.021)	(0.018)	(0.019)	(0.020)
Female (1=yes)	**-0.310*** **	**-0.282*** **	**-0.249*** **	**-0.292*** **	**-0.240*** **
	(0.017)	(0.018)	(0.016)	(0.020)	(0.019)
Some College But No Degree (E2)	0.022	0.024	0.040***	0.052***	0.048***
	(0.015)	(0.015)	(0.013)	(0.014)	(0.013)
Associate Degree (E3)	0.074***	0.116***	0.115***	0.125***	0.087***
	(0.018)	(0.017)	(0.017)	(0.019)	(0.017)
Bachelor's Degree (E4)	0.123***	0.186***	0.261***	0.256***	0.236***
	(0.014)	(0.014)	(0.015)	(0.015)	(0.017)
Advanced Degree (EA)	0.209***	0.330***	0.353***	0.368***	0.353***
	(0.019)	(0.018)	(0.021)	(0.020)	(0.021)
Experience (Age)	0.049***	0.045***	0.046***	0.048***	0.041***
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)
Experience Square (Age2)	-0.0005***	-0.0004***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.045***	-0.060***	-0.049***	-0.114***	-0.074***
	(0.017)	(0.018)	(0.016)	(0.018)	(0.018)
American Indian	-	-0.048	-0.080	0.077	-0.058
	-	(0.061)	(0.051)	(0.053)	(0.043)
Asian	-	-0.034	0.023	-0.027	-0.019
	-	(0.031)	(0.030)	(0.026)	(0.025)
Other	-0.070**	-0.216**	0.037	-	-
	(0.028)	(0.102)	(0.069)	-	-
Hispanic	-0.103***	-0.023	-0.112***	-0.126***	-0.104***
	(0.024)	(0.024)	(0.021)	(0.021)	(0.019)

TABLE 10 - Continued
OLS Estimates of the Impact of Computer Use on Wages: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Married	0.049***	0.072***	0.076***	0.065***	0.059***
	(0.011)	(0.011)	(0.011)	(0.011)	(0.011)
Union Member	0.245***	0.221***	0.248***	0.197***	0.168***
	(0.013)	(0.013)	(0.013)	(0.015)	(0.014)
Part-Time	0.069***	0.090***	0.146***	0.014	-0.005
	(0.017)	(0.016)	(0.016)	(0.024)	(0.022)
Lives in Metropolitan	0.115***	0.145***	0.128***	0.143***	0.133***
	(0.010)	(0.011)	(0.011)	(0.013)	(0.012)
Midwest/North Central	-0.106***	-0.159***	-0.139***	-0.064***	-0.061***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.016)
South	-0.053***	-0.138***	-0.118***	-0.088***	-0.061***
	(0.014)	(0.014)	(0.014)	(0.015)	(0.015)
West	0.050***	-0.051***	-0.029*	-0.029*	-0.015
	(0.014)	(0.016)	(0.015)	(0.016)	(0.015)
R-Square	0.279	0.304	0.307	0.281	0.223

Notes: White standard errors are shown in parentheses. The sample size is 11,633 for 1984, 11,815 for 1989, 12,152 for 1993, 10,953 for 1997, and 12,935 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

FIGURE 1
Computer Use at Work – All Workers, Men & Women, 1984-2001

FIGURE 2
Computer Use at Work – Education, 1984-2001

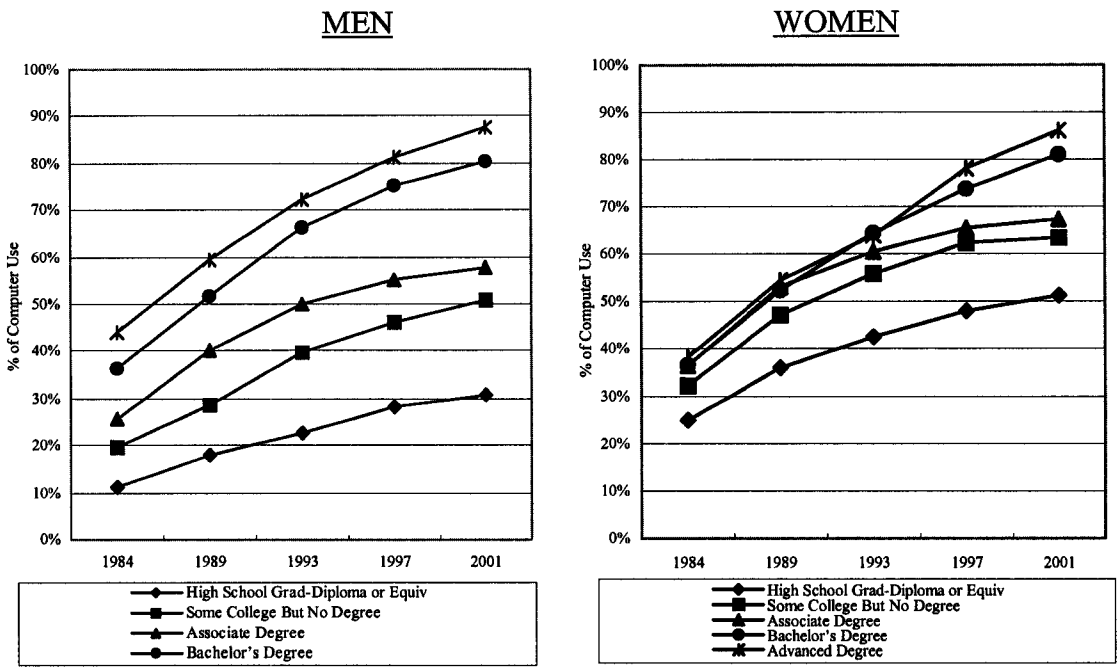


FIGURE 3

Computer Usage by Occupation: 1984-2001

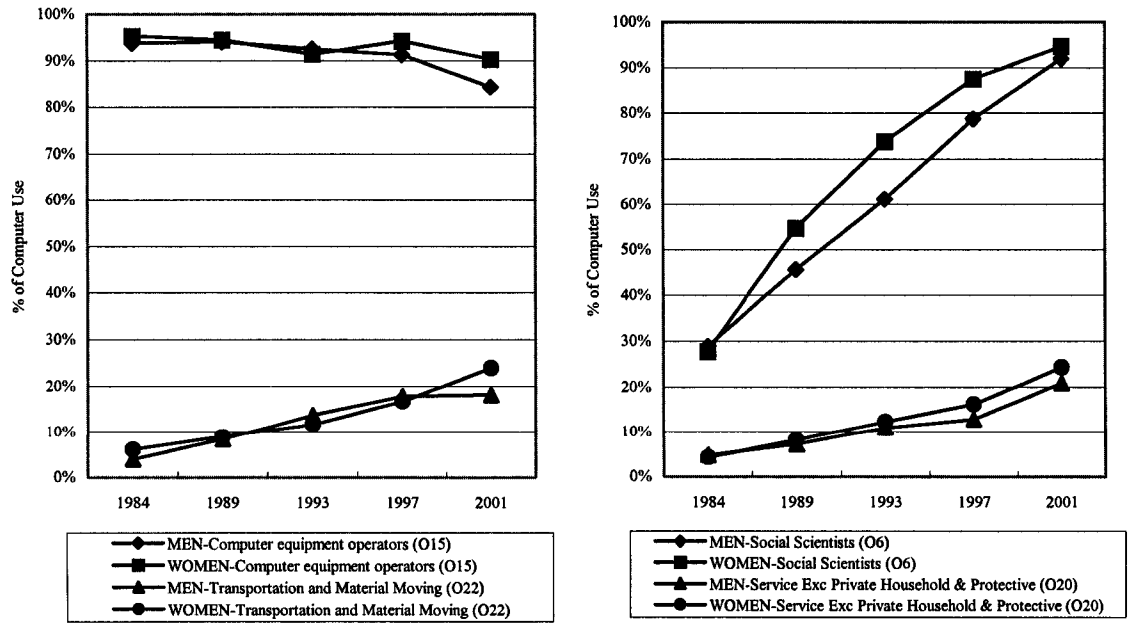
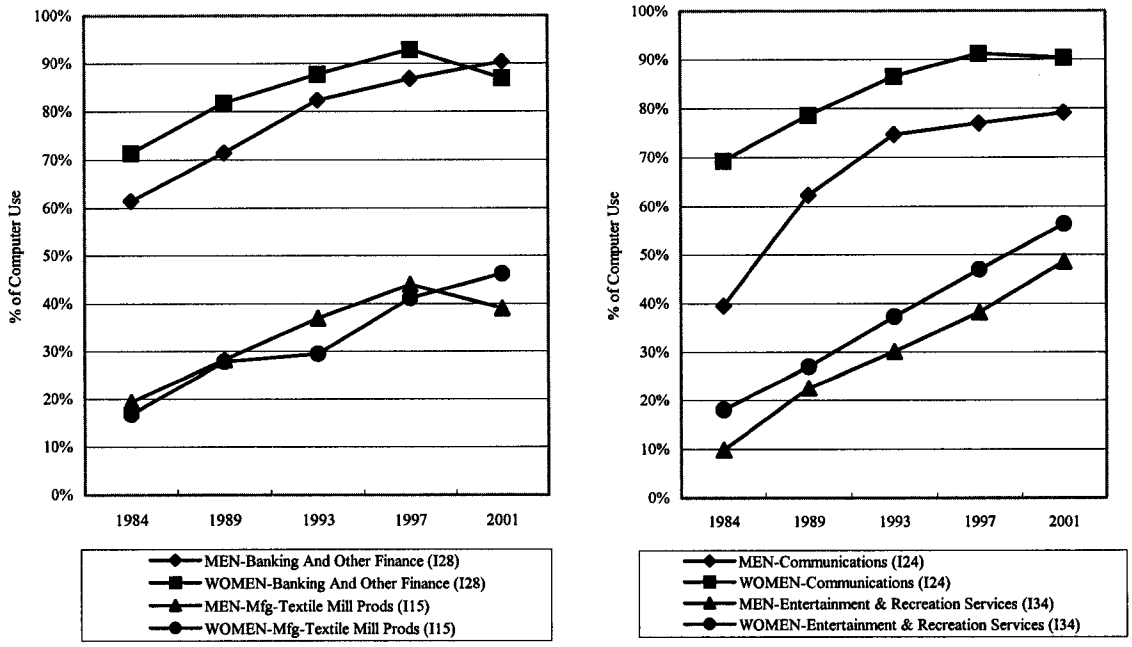


FIGURE 4

Computer Usage by Industry: 1984-2001



APPENDIX A: CPS DATA SETS – 1984-2001

1. Detailed Data Description for Descriptive Analysis

Section II in this paper uses the individual level earnings data from the October CPS data for the years 1984, 1989, 1993 and 1997 and the September survey for the year 2001. The data for this microdata file come from two sources: (1) the basic CPS; and (2) the Supplement Questions on Computer Use. The basic CPS data collects information on the demographic status of the population (such as age, sex, race, marital status, educational attainment, family structure, wage, and weeks worked). The Supplement Questions on Computer Use data gathers information on the use of computers at work. In this data, interviewers asked the following eight specific questions on computers in which computers are used at work for: (1) in general (yes or no); (2) Internet and/or, email; (3) programming; (4) graphic and design; (5) spreadsheets and databases; (6) word-processing; and (7) "other," and (8) a calendar or do scheduling. The CPS data sample used for the descriptive analysis is restricted to individuals between age 18 and 65, who have at least a high school diploma or equivalent (GED), and who are currently employed (both full and part-time with both pay and no pay) in the labor force.

The weekly earning in the 1984 CPS is top coded at $999, that in the 1989, 1993 and 1997 CPS are top coded at $1,923 and the weekly earning in the 2001 CPS are top coded at $2884.61. In order to make the earning comparable over time, the weekly earnings data in the 1984, 1989, 1993 and 1997 CPS data are converted into 1984 dollars using the CPE deflator as follows.

Real Weekly Earning for Year t = (Nominal Weekly Earning for Year t) * (100/CPE Index for Year 2001)

2. Detailed Data Description for Analysis on Computer Use & Wages

The CPS data sample used in Section III and Section IV of this paper is restricted to individuals between age 18 and 65, who have at least a high school diploma or equivalent (GED), and who are currently employed in the labor force. In addition, this data sample focuses only on individuals who have reported a "weekly earning" greater than zero. The weekly earnings data in the 1984, 1989, 1993 and 1997 CPS data are converted into 1984 dollars using the CPE deflator as in Section II. The mean log hourly wage, which is a dependent variable, is then calculated based on the converted weekly earning for each year.

3. Detailed Description for Dummy Variables

Control variables (X_i)	X_i	Length of Experience (Age) for Worker *i*
	X^2_i	Length of Experience (Age) Squared
	E_{ie}	Level of Education for Worker *i* - Five Levels: (i) Some college but no diploma; (ii) Associate degree; (iii) Bachelor's degree; (vi) Advanced degree
	G_i	Gender of Worker *i*
	R_i	Race of Worker *i* (White, Black, American Indian, and Asian)
	H_i	Ethnicity of Worker *i* (Hispanic or Non-Hispanic)
	ME_i	Metropolitan Living Status of Worker *i* - a dummy variable that equals one if an individual lives in metropolitan area and zero otherwise
	MS_i	Marital Status of Worker *i* - a dummy variable that equals one if an individual is married and zero otherwise
	L_i	Labor Force Status of Worker *i* (full-time or part-time)
	U_i	Union Member Status of Worker *i*
	RE_i	Region of Worker *i* (Northeast, Midwest, South and West)
Computer Application	CU_i	Dummy variable for the use of computers for any purpose at work ("yes=1" if an individual uses a computer for any purpose at work, and zero otherwise)
	CC_{ic}	Five Dummy variables for the use of each computer application at work ("yes=1" if an individual uses a computer for (i) the computer mediated communication (CMC) system (includes Internet, e-mail, a calendar, scheduling); (ii) graphic & design; (iii) programming; and (vi) spreadsheets & databases; (v) word processing at work, and zero otherwise)
Computer-Usage Occupation	HO LO	Worker i's computer-usage occupation (which is also defined as worker i's occupation *j*) at time t. It is divided into two groups: (i) "high computer-usage occupation" group; and (ii) "low computer-usage occupation" group (based on SOC code)
Computer-Usage Industry	HI LI	Worker i's computer-usage industry (which is also defined as worker i's industry *k*) at time t. It is divided into two groups: (i) "high computer-usage industry" group; and (ii) "low computer-usage industry" group (based on SIC code)
"Computer-Usage Occupation and Industry interacted" groups	HOHI HOLI LOHI LOLI	Worker i's Occupation *j* interacted with Worker i's Industry *k*. It is divided into four groups: (i) "*high* computer-usage *occupation* interacted with *high* computer-usage *industry*" group; (ii) "*high* computer-usage *occupation* interacted with *low* computer-usage *industry*" group; (iii) "*low* computer-usage *occupation* interacted with *high* computer-usage *industry*" group; and (vi) "*low* computer-usage *occupation* interacted with *low* computer-usage *industry*" group.

PART IV

CONCLUSION AND REMARKS

CONCLUSION

Applying two distinct approaches (Krueger's (1993) method and a new empirical method of grouping workers into high and low-computer use occupations and industries) with cross-sectional estimations, this dissertation examines the impact on wages of the diffusion of computers and further analyzes the effect on wages of the differences in the use of a computer, worker characteristics, occupations, and industries for the period 1984-2001 using the U.S. Current Population Survey data.

The empirical results in the first study conclude that at the aggregate level, computer use on the job generates an average wage premium of 20% to 25%. However, at the micro level, the computer-use wage premium varies depending on how computers are used by up to an additional 11 percentage points. The premium also varies according to worker characteristics, occupations and industries. The empirical results further suggest that the effect of experience on wages (and thus the resulting wage premium) decreases with the diffusion of computers but at rates that depend on occupations and industries.

The estimation results in the second study find that female wages overall were 20-36% lower than male wages during the period. The empirical results also suggest that the effect on female wages of using a computer on the job reduced the penalty associated with being a female worker by 4-6 percentage points during the 1990s, and that the way computers were used on the job did not affect female wages during the full period. However, estimates show that occupational differences affected female wages, and more

importantly, the industry that women worked in had a significant impact on female wages during the period.

The cross-sectional estimations in this dissertation show large and consistent results. In addition, a comparison over time of the computer wage premium, focusing on trends, is relevant in assessing the purpose of the effect of the diffusion of computers if the bias of the estimates, even though present, does not vary systematically over the years observed. Therefore, the empirical findings in this dissertation provide direct evidence of a wage premium from using computers and of the presence of both occupation and industry wage differentials for the period 1984-2001. The estimation results further illustrate the role of the "computer revolution" in the new economy and demonstrate the importance of policies that reduce the occupational and industry segregation in order to narrow the wage differentials in the U.S. labor market.

FUTURE RESEARCH

Several extensions of the empirical research presented in this dissertation merit future consideration. As a future research agenda, re-specifications in the existing empirical analysis could avoid possible omitted variable bias and thus provide more reliable results and conclusions. Also, the empirical model of grouping workers into high and low-computer use occupations and industries presented in this dissertation could be extended in order for the model to allow for an analysis of single digit occupation and industry level.

As extensions for the first study in this dissertation, the current analysis on the relationships between computers, skill premium and wages could offer additional research agendas in at least two ways. One could examine the differences in skill premium among different age groups and its relation to wages. The other could investigate the educational attainment and its relation to skill premium. These analyses could provide a better understanding of the changes in the returns to experience with computerization. In addition, the empirical analysis in this dissertation could be extended to investigate the decrease in returns to computer use with a particular focus on both analyzing the return to specific computer applications and on examining a supply of skills and/or demand for skills explanation with the year 2005 data.

Finally, as for future research agendas in the second study in this dissertation, the empirical analysis has posed a few interesting questions. One is to investigate the possible explanation for the insignificant impact of using a computer on female wages over time. The other is to examine changes in employment growth in each occupation and industry and to investigate its relation to computer usage and wages by gender. This allows us to further assess the analyses in examining the occupational and industry wage differentials that are associated with the diffusion of computers.

APPENDIX

APPENDIX 1-1

Computer Usage at Work by Occupation - Men: 1984-2001 (sorted by 2001)

Computer Use Level	Occupation		1984	1989	1993	1997	2001
HIGH	Teachers, college and university	O7	48.16%	69.86%	79.09%	85.34%	92.43%
HIGH	Secretaries, stenographers, and typists	O16	36.51%	67.44%	69.23%	77.78%	92.31%
HIGH	Social Scientists	O6	28.89%	45.68%	61.09%	78.79%	91.96%
HIGH	Engineers	O4	59.27%	76.02%	84.62%	91.53%	90.09%
HIGH	Management related occupations	O3	53.19%	71.23%	79.80%	85.82%	87.72%
HIGH	Officials & Administrators, pub. admin.	O1	37.06%	64.04%	82.41%	83.52%	87.61%
HIGH	Natural Scientists	O5	46.48%	63.85%	74.50%	80.31%	85.35%
HIGH	Computer equipment operators	O15	93.81%	94.08%	92.55%	91.30%	84.29%
HIGH	Engineering and science technicians	O11	57.59%	70.06%	74.85%	84.10%	83.10%
HIGH	Teachers, except college and university	O8	31.75%	46.31%	54.10%	70.42%	80.80%
HIGH	Other professional specialty occupations	O9	24.30%	47.54%	57.68%	71.46%	79.16%
HIGH	Other executive, admin. & Managerial	O2	37.79%	51.72%	62.11%	71.79%	77.75%
LOW	Supervisors, admin. Support	O14	54.86%	65.09%	77.44%	80.34%	77.31%
LOW	Supervisors and proprietors, sales occupations	O12	28.04%	43.51%	55.94%	67.27%	72.61%
LOW	Sales related occupations	O13	26.19%	41.61%	51.18%	61.39%	66.87%
LOW	Health technologists and technicians	O10	39.45%	55.00%	53.74%	66.40%	62.34%
LOW	Other admin support	O17	32.60%	46.21%	59.36%	63.66%	62.13%
LOW	Protective service	O19	21.81%	35.47%	43.61%	53.98%	57.26%
LOW	Precision Product, Craft and Repair	O21	10.99%	16.42%	23.23%	27.63%	33.32%
LOW	Farming, Forestry and Fishing	O24	4.35%	6.52%	11.10%	13.93%	23.73%
LOW	Service Occupation excluding Private Household and Protective	O20	4.72%	7.11%	10.92%	12.91%	20.90%
LOW	Handlers, Equipment Cleaners, Helper and Laborers	O23	3.76%	9.50%	13.38%	16.30%	18.83%
LOW	Transportation and Material Moving	O22	3.89%	8.32%	13.78%	17.82%	18.17%
LOW	Private household service occupations	O18	0.00%	0.00%	0.00%	0.00%	0.00%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

APPENDIX 1-2

Computer Usage at Work by Occupation - Women: 1984-2001 (sorted by 2001)

Computer Use Level	Occupation		1984	1989	1993	1997	2001
HIGH	Social Scientists	O6	27.71%	54.78%	73.79%	87.50%	94.67%
HIGH	Engineers	O4	77.59%	82.50%	87.64%	98.68%	92.59%
HIGH	Computer equipment operators	O15	95.31%	94.46%	91.45%	94.29%	90.32%
HIGH	Officials & administrators, pub. admin.	O1	40.00%	74.38%	88.34%	95.24%	90.10%
HIGH	Management related occupations	O3	62.09%	79.09%	88.55%	90.61%	88.76%
HIGH	Engineering and science technicians	O11	67.72%	76.04%	81.64%	87.15%	87.97%
HIGH	Teachers, college and university	O7	29.41%	58.60%	65.63%	77.07%	87.88%
HIGH	Supervisors, admin. Support	O14	71.58%	77.18%	89.09%	89.07%	87.16%
HIGH	Secretaries, stenographers, and typists	O16	45.18%	72.69%	82.42%	89.25%	84.52%
HIGH	Other executive, admin. & Managerial	O2	39.27%	56.30%	68.38%	80.54%	84.22%
HIGH	Other professional specialty occupations	O9	28.44%	42.29%	58.06%	69.19%	79.27%
HIGH	Other admin support	O17	46.97%	64.08%	74.45%	80.19%	78.45%
LOW	Natural Scientists	O5	30.69%	51.00%	60.63%	71.20%	76.83%
LOW	Teachers, except college and university	O8	28.29%	36.78%	46.99%	59.06%	73.03%
LOW	Supervisors and proprietors, sales occupations	O12	23.42%	34.74%	54.13%	63.91%	70.68%
LOW	Health technologists and technicians	O10	26.80%	44.33%	53.16%	62.42%	64.30%
LOW	Sales related occupations	O13	20.13%	31.01%	39.64%	49.55%	54.40%
LOW	Protective service	O19	18.87%	28.89%	38.67%	35.44%	51.01%
LOW	Farming, Forestry and Fishing	O24	4.11%	5.78%	18.94%	19.76%	39.66%
LOW	Precision Product, Craft and Repair	O21	9.23%	13.96%	21.43%	26.20%	36.91%
LOW	Service Occupation excluding Private Household and Protective	O20	4.21%	8.14%	12.38%	16.22%	24.28%
LOW	Transportation and Material Moving	O22	6.01%	8.93%	11.69%	16.75%	23.85%
LOW	Handlers, Equipment Cleaners, Helper and Laborers	O23	6.44%	13.90%	21.43%	23.66%	23.18%
LOW	Private household service occupations	O18	1.44%	1.52%	1.88%	5.70%	11.00%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

APPENDIX 2-1

Computer Usage at Work by Industry - Men: 1984-2001 (sorted by 2001)

Computer Use Level	Industry		1984	1989	1993	1997	2001
HIGH	Banking And Other Finance	I28	61.53%	71.47%	82.36%	86.83%	90.28%
HIGH	Admin Of Human Resource Programs	I40	45.83%	65.52%	67.24%	77.39%	84.68%
HIGH	Other Professional Services	I38	33.12%	52.35%	65.79%	78.50%	83.46%
HIGH	Mfg-Petroleum & Coal Prods	I20	42.99%	44.78%	52.83%	73.53%	80.85%
HIGH	National Security & Internal Affairs	I41	35.06%	65.91%	70.28%	81.68%	80.10%
HIGH	Communications	I24	39.54%	62.32%	74.66%	76.96%	79.11%
HIGH	Measuring, Analyzing, and Controlling Instruments	I11	44.39%	57.58%	64.44%	74.60%	76.50%
HIGH	Other Public Administration	I42	37.50%	60.71%	73.11%	72.82%	76.29%
HIGH	Mfg-Chemicals & Allied Prods	I19	34.09%	54.85%	63.68%	70.06%	75.29%
HIGH	Educational Services	I36	32.97%	47.95%	55.80%	66.71%	74.13%
HIGH	Insurance And Real Estate	I29	37.80%	54.31%	61.32%	69.70%	73.39%
HIGH	Mfg-Electrical Machinery, Equip Supplies	I9	43.91%	56.16%	65.20%	75.40%	71.21%
HIGH	Business Services	I31	36.90%	50.37%	53.04%	67.59%	70.86%
HIGH	Justice, Public Order & Safety	I39	26.58%	45.12%	56.82%	64.72%	69.82%
HIGH	Health Services	I35	23.62%	38.30%	50.26%	57.22%	67.70%
HIGH	Mfg-Printing, Publishing & Allied Inds	I18	26.67%	38.56%	50.59%	59.51%	63.39%
HIGH	Wholesale Trade	I26	25.14%	37.15%	45.98%	54.05%	60.42%
HIGH	Mfg-Machinery, Ex Electrical	I8	42.16%	48.67%	55.86%	57.40%	59.61%
HIGH	Mfg-Paper & Allied Products	I17	19.47%	36.58%	44.40%	49.46%	56.55%
HIGH	Mfg-Leather & Leather Prods	I22	23.68%	19.23%	33.33%	36.84%	56.52%
HIGH	Utilities & Sanitary Services	I25	24.55%	36.71%	48.55%	54.69%	56.35%
LOW	Transportation Equipment	I10	32.71%	41.66%	51.46%	55.51%	54.40%
LOW	Social Services	I37	16.15%	32.54%	37.31%	47.56%	53.70%
LOW	Mfg-Rubber & Misc Plastic Prods	I21	24.36%	29.36%	39.57%	43.30%	52.97%
LOW	Mis Manufacturing Industries	I12	17.02%	21.82%	28.70%	38.76%	52.29%
LOW	Entertainment & Recreation Services	I34	9.90%	22.55%	30.11%	38.19%	48.62%
LOW	Mfg-Primary Metals	I6	19.25%	30.42%	33.62%	45.60%	48.52%
LOW	Mfg-Fabricated Metals	I7	17.23%	28.24%	35.01%	41.18%	47.89%
LOW	Retail Trade	I27	16.55%	26.55%	34.47%	43.21%	46.25%
LOW	Personal Serv Exc Private Households	I33	10.34%	19.15%	27.49%	36.07%	44.51%
LOW	Mfg-Apparel & Other Finished Textile Pr	I16	14.10%	25.00%	27.84%	31.25%	43.64%
LOW	Mfg-Stone, Clay, Concrete, Glass Prods	I5	12.25%	23.58%	31.49%	35.98%	42.86%
LOW	Automobile And Repair Services	I32	7.82%	14.16%	22.58%	31.17%	39.86%
LOW	Mfg-Textile Mill Prods	I15	19.38%	28.26%	36.91%	43.93%	39.02%
LOW	Mfg-Furniture & Fixtures	I4	11.11%	16.37%	26.02%	30.61%	38.71%
LOW	Mfg-Food & Kindred Prods	I13	14.29%	22.11%	31.46%	36.88%	37.78%
LOW	Transportation	I23	14.70%	22.48%	29.55%	33.82%	36.01%
LOW	Agriculture, Forestry, Fishing and Mining	I1	11.03%	15.54%	21.27%	24.73%	31.59%
LOW	Mfg-Lumber & Wood Prods, Ex Furniture	I3	6.27%	10.70%	12.01%	19.63%	28.86%
LOW	Construction	I2	6.34%	11.02%	13.76%	18.36%	26.44%
LOW	Mfg-Tobacco Prods	I14	33.33%	40.00%	60.00%	75.00%	25.00%
LOW	Private Household Services	I30	0.00%	6.25%	0.00%	4.55%	15.00%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

APPENDIX 2-2

Computer Usage at Work by Industry - Women: 1984-2001 (sorted by 2001)

Computer Use Level	Industry		1984	1989	1993	1997	2001
HIGH	Communications	I24	69.35%	78.57%	86.54%	91.20%	90.31%
HIGH	Other Public Administration	I42	51.02%	74.79%	82.59%	90.87%	88.09%
HIGH	Utilities & Sanitary Services	I25	60.65%	77.11%	81.03%	91.60%	87.32%
HIGH	Banking And Other Finance	I28	71.42%	81.83%	87.76%	92.88%	86.93%
HIGH	Other Professional Services	I38	39.31%	62.85%	74.72%	81.04%	86.04%
HIGH	Admin Of Human Resource Programs	I40	48.93%	70.56%	80.75%	84.65%	85.95%
HIGH	Insurance And Real Estate	I29	51.99%	70.66%	81.30%	85.15%	85.16%
HIGH	Mfg-Chemicals & Allied Prods	I19	55.06%	60.62%	66.32%	75.43%	79.68%
HIGH	Justice, Public Order & Safety	I39	38.00%	57.59%	73.83%	76.85%	79.42%
HIGH	National Security & Internal Affairs	I41	48.78%	79.78%	83.94%	88.89%	78.57%
HIGH	Mfg-Primary Metals	I6	39.06%	53.85%	58.14%	61.54%	77.55%
HIGH	Mfg-Machinery, Ex Electrical	I8	54.29%	67.45%	72.80%	71.25%	76.58%
HIGH	Wholesale Trade	I26	40.48%	56.28%	68.54%	75.87%	76.43%
HIGH	Mfg-Printing, Publishing & Allied Inds	I18	38.56%	53.11%	62.03%	75.71%	74.85%
HIGH	Measuring, Analyzing, and Controlling Instruments	I11	39.33%	51.43%	51.83%	57.35%	73.75%
HIGH	Educational Services	I36	30.80%	45.63%	54.59%	65.37%	73.70%
HIGH	Business Services	I31	37.92%	52.73%	63.46%	70.65%	71.67%
HIGH	Construction	I2	24.92%	46.60%	60.83%	67.70%	70.31%
HIGH	Mfg-Petroleum & Coal Prods	I20	56.25%	68.75%	76.92%	88.24%	69.23%
HIGH	Health Services	I35	24.64%	42.59%	50.84%	60.83%	65.13%
HIGH	Mfg-Fabricated Metals	I7	27.85%	45.08%	53.33%	57.89%	65.08%
HIGH	Mfg-Stone, Clay, Concrete, Glass Prods	I5	31.94%	40.91%	39.62%	58.18%	65.00%
LOW	Automobile And Repair Services	I32	22.61%	38.26%	41.30%	63.56%	64.66%
LOW	Mfg-Electrical Machinery, Equip Supplies	I9	35.34%	44.38%	52.00%	58.91%	63.20%
LOW	Transportation	I23	40.11%	47.96%	58.44%	65.49%	61.55%
LOW	Mfg-Leather & Leather Prods	I22	11.11%	28.21%	36.00%	34.78%	61.11%
LOW	Transportation Equipment	I10	44.29%	55.77%	60.36%	57.84%	60.81%
LOW	Mfg-Tobacco Prods	I14	0.00%	55.56%	44.44%	100.00%	57.14%
LOW	Mfg-Rubber & Misc Plastic Prods	I21	25.74%	39.29%	42.45%	54.08%	56.57%
LOW	Mfg-Lumber & Wood Prods, Ex Furniture	I3	28.00%	16.07%	37.93%	35.09%	56.52%
LOW	Agriculture, Forestry, Fishing and Mining	I1	22.15%	27.84%	41.56%	44.58%	56.42%
LOW	Entertainment & Recreation Services	I34	18.08%	27.00%	37.24%	46.96%	56.39%
LOW	Mfg-Paper & Allied Products	I17	26.58%	49.25%	67.06%	62.12%	53.45%
LOW	Mis Manufacturing Industries	I12	19.44%	30.43%	37.66%	45.71%	53.26%
LOW	Mfg-Food & Kindred Prods	I13	27.16%	28.35%	35.87%	37.04%	51.04%
LOW	Social Services	I37	11.13%	22.39%	30.07%	36.72%	49.35%
LOW	Mfg-Textile Mill Prods	I15	16.80%	27.89%	29.46%	41.10%	46.25%
LOW	Retail Trade	I27	14.94%	25.95%	34.80%	41.76%	46.15%
LOW	Mfg-Furniture & Fixtures	I4	21.15%	35.14%	41.18%	47.06%	45.16%
LOW	Personal Serv Exc Private Households	I33	8.67%	13.95%	22.51%	34.23%	39.63%
LOW	Mfg-Apparel & Other Finished Textile Pr	I16	8.97%	11.82%	17.52%	25.82%	39.53%
LOW	Private Household Services	I30	1.56%	1.29%	3.59%	5.58%	11.71%

Source: Author's tabulations of Current Population Surveys. The Sample size is 53,328 for 1984, 55,884 for 1989, 55,191 for 1993, 49,348 for 1997, and 58,334 for 2001.

APPENDIX 3-1

The Results of Equality Between Sets of Coefficients Using Chow-test; 1984-2001

Part II: "The Diffusion of Computers and Wages in The U.S.: Occupation and Industry Analysis, 1984-2001"

(1) Overall Coefficient Test (include all variables)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	F(19, 23,410) = 29.14***	F(19, 23,929) = 17.30***	F(19, 23,067) = 3.63***	F(19, 23,850) = 31.70***
Table 6	N/A	F(24, 23,919) = 13.31***	F(24, 23,057) = 3.58***	F(24, 23,840) = 19.71***
Table 7	F(25, 23,398) = 10.49***	F(25, 23,917) = 9.23***	F(25, 23,055) = 3.56***	F(25, 23,838) = 17.65***
Table 8	F(25, 23,399) = 47.00***	F(25, 23,918) = 30.89***	F(25, 23,056) = 21.86***	F(25, 23,839) = 38.17***
Table 9	N/A	F(45, 23,877) = 8.44***	F(45, 23,015) = 2.65***	F(45, 23,798) = 12.55***
Table 10	F(60, 23,328) = 12.11***	F(60, 23,847) = 6.61***	F(60, 22,985) = 2.33***	F(60, 23,768) = 10.45***

(2) Specific Coefficient Test - Computer use (CU)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	F(2, 23410) = 3.31**	F(2, 23929) = 1.53	F(2, 23067) = 1.01	F(2, 23850) = 8.32***
Table 6	N/A	F(2, 23919) = 0.80	F(2, 23057) = 0.80	F(2, 23840) = 9.60***
Table 7	F(2, 23398) = 2.85***	F(2, 23917) = 1.20	F(2, 23055) = 1.87	F(2, 23838) = 0.44
Table 8	F(2, 23399) = 7.20***	F(2, 23918) = 1.39	F(2, 23056) = 0.41	F(2, 23839) = 9.17***
Table 9	N/A	F(2, 23877) = 1.05	F(2, 23015) = 0.15	F(2, 23798) = 7.49***
Table 10	F(2, 23328) = 9.01***	F(2, 23847) = 2.11	F(2, 22985) = 0.73	F(2, 23768) = 14.44***

Notes: Race variable is divided into three, Whites, Blacks and Others, in this analysis. The sample size for each year is shown in the table. ***, **, * indicate significant at the 1%, 5%, and 10% level, respectively.

APPENDIX 3-1 - Continued

The Results of Equality Between Sets of Coefficients Using Chow-test; 1984-2001

Part II: "The Diffusion of Computers and Wages in The U.S.: Occupation and Industry Analysis, 1984-2001"

(3) Specific Coefficient Test - Experience (Age)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	F(3, 23410) = 12.61***	F(3, 23929) = 1.47	F(3, 23067) = 1.57*	F(3, 23850) = 18.83***
Table 6	N/A	F(3, 23919) = 2.02	F(3, 23057) = 1.59*	F(3, 23840) = 17.37***
Table 7	F(3, 23398) = 2.91**	F(3, 23917) = 2.53*	F(3, 23055) = 3.53**	F(3, 23838) = 9.07***
Table 8	F(3, 23399) = 36.23***	F(3, 23918) = 11.91***	F(3, 23056) = 7.69***	F(3, 23839) = 30.15***
Table 9	N/A	F(3, 23877) = 2.66**	F(3, 23015) = 1.64	F(3, 23798) = 16.32***
Table 10	F(5, 23328) = 6.58***	F(5, 23847) = 2.39**	F(5, 22985) = 0.53	F(5, 23768) = 8.10***

(4) Specific Coefficient Test - Occupation-Industry Interacted Group (CU, HOHI, HOLI, LOHI, HOHICU, HOLICU, LOHICU)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	N/A	N/A	N/A	N/A
Table 6	N/A	N/A	N/A	N/A
Table 7	N/A	N/A	N/A	N/A
Table 8	F(8, 23399) = 4.27***	F(8, 23918) = 4.36***	F(8, 23056) = 2.50**	F(8, 23839) = 3.46***
Table 9	N/A	F(8, 23877) = 1.49	F(8, 23015) = 1.24	F(8, 23798) = 3.33***
Table 10	F(8, 23328) = 5.94***	F(8, 23847) = 2.96***	F(8, 22985) = 1.07	F(8, 23768) = 6.92***

Notes: Race variable is divided into three, Whites, Blacks and Others, in this analysis. The sample size for each year is shown in the table. ***, **, * indicate significant at the 1%, 5%, and 10% level, respectively.

APPENDIX 3-2

The Results of Equality Between Sets of Coefficients Using Chow-test; 1984-2001

Part III: "How Does The Diffusion of Computers Affect Female Wages in The U.S.?"

(1) Overall Coefficient Test (include all variables)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	F(18, 23,412) = 39.06***	F(18, 23,931) = 22.59***	F(18, 23,069) = 4.01***	F(18, 23,852) = 33.83***
Table 6	F(20, 23,408) = 27.66***	F(20, 23,927) = 16.40***	F(20, 23,065) = 3.56***	F(20, 23,848) = 30.27***
Table 7-1	N/A	F(24, 23,919) = 13.31***	F(24, 23,057) = 3.58***	F(24, 23,840) = 19.71***
Table 7-2	N/A	F(30, 23,907) = 10.98***	F(30, 23,045) = 3.01***	F(30, 23,828) = 16.21***
Table 8-1	F(20, 23,408) = 30.82***	F(20, 23,927) = 18.36***	F(20, 23,065) = 4.29***	F(20, 23,848) = 31.28***
Table 8-2	F(22, 23,404) = 28.15***	F(22, 23,923) = 16.86***	F(22, 23,061) = 4.09***	F(22, 23,844) = 28.66***
Table 9-1	F(20, 23,408) = 28.66***	F(20, 23,927) = 16.89***	F(20, 23,065) = 3.50***	F(20, 23,848) = 30.61***
Table 9-2	F(22, 23,404) = 26.03***	F(22, 23,923) = 15.44***	F(22, 23,061) = 3.28***	F(22, 23,844) = 28.04***
Table 10	F(28, 23,392) = 23.12***	F(28, 23,911) = 13.83***	F(28, 23,049) = 3.45***	F(28, 23,832) = 23.03***

(2) Specific Coefficient Test - Computer use (CU)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	N/A	N/A	N/A	N/A
Table 6	F(2, 23408) = 3.22**	F(2, 23927) = 0.81	F(2, 23065) = 1.06	F(2, 23848) = 7.96***
Table 7-1	N/A	F(2, 23919) = 0.80	F(2, 23057) = 0.80	F(2, 23840) = 9.60***
Table 7-2	N/A	F(2, 23907) = 0.81	F(2, 23045) = 0.82	F(2, 23828) = 7.99***
Table 8-1	F(2, 23408) = 4.05**	F(2, 23927) = 0.85	F(2, 23065) = 0.22	F(2, 23848) = 8.10***
Table 8-2	F(2, 23404) = 3.90**	F(2, 23923) = 1.22	F(2, 23061) = 0.09	F(2, 23844) = 7.63***
Table 9-1	F(2, 23408) = 3.65**	F(2, 23927) = 1.03	F(2, 23065) = 0.68	F(2, 23848) = 8.06***
Table 9-2	F(2, 23404) = 3.46**	F(2, 23923) = 0.49	F(2, 23061) = 0.64	F(2, 23844) = 7.36***
Table 10	F(2, 23392) = 4.57**	F(2, 23911) = 0.26	F(2, 23049) = 0.16	F(2, 23832) = 7.58***

Notes: Race variable is divided into three, Whites, Blacks and Others, in this analysis. The sample size for each year is shown in the table. ***, **, * indicate significant at the 1%, 5%, and 10% level, respectively.

APPENDIX 3-2 - Continued

The Results of Equality Between Sets of Coefficients Using Chow-test; 1984-2001

Part III: "How Does The Diffusion of Computers Affect Female Wages in The U.S.?"

(3) Specific Coefficient Test - Computer usage*gender (CUGF)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	N/A	N/A	N/A	N/A
Table 6	F(2, 23408) = 2.97*	F(2, 23927) = 0.61	F(2, 23065) = 0.16	F(2, 23848) = 8.50***
Table 7-1	N/A	N/A	N/A	N/A
Table 7-2	N/A	F(2, 23907) = 0.82	F(2, 23045) = 0.09	F(2, 23828) = 7.49***
Table 8-1	N/A	N/A	N/A	N/A
Table 8-2	F(2, 23404) = 3.94**	F(2, 23923) = 0.60	F(2, 23061) = 0.02	F(2, 23844) = 7.79***
Table 9-1	N/A	N/A	N/A	N/A
Table 9-2	F(2, 23404) = 3.33**	F(2, 23923) = 0.42	F(2, 23061) = 0.10	F(2, 23844) = 7.46***
Table 10	N/A	N/A	N/A	N/A

(4) Specific Coefficient Test - Experience (Age)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	F(3, 23412) = 14.43***	F(3, 23931) = 1.62	F(3, 23069) = 1.36	F(3, 23852) = 18.38***
Table 6	F(3, 23408) = 12.45***	F(3, 23927) = 1.57	F(3, 23065) = 1.76	F(3, 23848) = 17.30***
Table 7-1	N/A	F(3, 23919) = 2.02	F(3, 23057) = 1.59	F(3, 23840) = 17.37***
Table 7-2	N/A	F(3, 23907) = 2.02	F(3, 23045) = 1.83	F(3, 23828) = 16.17***
Table 8-1	F(3, 23408) = 14.19***	F(3, 23927) = 1.72	F(3, 23065) = 1.55	F(3, 23848) = 17.96***
Table 8-2	F(3, 23404) = 12.96***	F(3, 23923) = 2.15*	F(3, 23061) = 1.84	F(3, 23844) = 16.32***
Table 9-1	F(3, 23408) = 13.57***	F(3, 23927) = 1.58	F(3, 23065) = 1.51	F(3, 23848) = 19.05***
Table 9-2	F(3, 23404) = 12.14***	F(3, 23923) = 1.60	F(3, 23061) = 1.73	F(3, 23844) = 16.07***
Table 10	F(3, 23392) = 12.63***	F(3, 23911) = 2.20*	F(3, 23049) = 2.03	F(3, 23832) = 15.21***

Notes: Race variable is divided into three, Whites, Blacks and Others, in this analysis. The sample size for each year is shown in the table. ***, **, * indicate significant at the 1%, 5%, and 10% level, respectively.

APPENDIX 3-2 - Continued

The Results of Equality Between Sets of Coefficients Using Chow-test; 1984-2001

Part III: "How Does The Diffusion of Computers Affect Female Wages in The U.S.?"

(5) Specific Coefficient Test - Occupation-Industry Interacted Group (CU, HOHI, HOLI, LOHI, HOHICU, HOLICU, LOHICU)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	N/A	N/A	N/A	N/A
Table 6	N/A	N/A	N/A	N/A
Table 7-1	N/A	N/A	N/A	N/A
Table 7-2	N/A	N/A	N/A	N/A
Table 8-1	N/A	N/A	N/A	N/A
Table 8-2	N/A	N/A	N/A	N/A
Table 9-1	N/A	N/A	N/A	N/A
Table 9-2	N/A	N/A	N/A	N/A
Table 10	F(8, 23392) = 2.12**	F(8, 23911) = 1.12	F(8, 23049) = 2.68***	F(8, 23832) = 2.70***

(6) Specific Coefficient Test-Occupation-Industry Interacted Group (GF,HOHI,HOLI,LOHI,HOHIGF,HOLIGF, LOHIGF)

Table	1984-1989 n=2,3448	1989-1993 n=23,967	1993-1997 n=23,105	1997-2001 n=23,888
Table 5	N/A	N/A	N/A	N/A
Table 6	N/A	N/A	N/A	N/A
Table 7-1	N/A	N/A	N/A	N/A
Table 7-2	N/A	N/A	N/A	N/A
Table 8-1	N/A	N/A	N/A	N/A
Table 8-2	N/A	N/A	N/A	N/A
Table 9-1	N/A	N/A	N/A	N/A
Table 9-2	N/A	N/A	N/A	N/A
Table 10	F(8, 23392) = 1.72*	F(8, 23911) = 2.86***	F(8, 23049) = 1.09	F(8, 23832) = 2.70***

Notes: Race variable is divided into three, Whites, Blacks and Others, in this analysis. The sample size for each year is shown in the table. ***, **, * indicate significant at the 1%, 5%, and 10% level, respectively.

APPENDIX 4-1

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	**1984**	**1989**	**1993**	**1997**	**2001**
Intercept	3.558	3.969	4.100	4.170	4.524
	(0.081)	(0.087)	(0.082)	(0.064)	(0.087)
Computer use at work (CU)	**0.177*** **	**0.187*** **	**0.209*** **	**0.180*** **	**0.169*** **
	(0.017)	(0.016)	(0.016)	(0.016)	(0.015)
Some College But No Degree (E2)	0.025	0.000	0.022	0.034*	0.071***
	(0.021)	(0.021)	(0.018)	(0.019)	(0.018)
Associate Degree (E3)	0.085***	0.118***	0.070***	0.130***	0.085***
	(0.025)	(0.026)	(0.025)	(0.024)	(0.023)
Bachelor's Degree (E4)	0.163***	0.217***	0.299***	0.252***	0.279***
	(0.019)	(0.020)	(0.021)	(0.021)	(0.023)
Advanced Degree (EA)	0.225***	0.391***	0.403***	0.372***	0.433***
	(0.023)	(0.025)	(0.028)	(0.025)	(0.031)
Experience (Age)	0.068***	0.054**	0.049***	0.052***	0.041***
	(0.005)	(0.005)	(0.004)	(0.005)	(0.004)
Experience Square (Age2)	-0.0007***	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.121***	-0.135***	-0.129***	-0.193***	-0.157***
	(0.026)	(0.026)	(0.024)	(0.029)	(0.029)
American Indian	-	-0.113	-0.111	0.051	-0.152**
		(0.086)	(0.076)	(0.075)	(0.069)
Asian	-	-.0804101*	-0.009	-0.073*	-0.039
		(0.046)	(0.043)	(0.038)	(0.036)
Other	-0.141***	-0.331**	-0.003	-	-
	(0.040)	(0.153)	(0.100)	-	-
Hispanic	-0.149***	-0.079**	-0.141***	-0.154***	-0.137***
	(0.035)	(0.034)	(0.028)	(0.030)	(0.026)
Married	0.089***	0.104***	0.100***	0.114***	0.115***
	(0.017)	(0.017)	(0.016)	(0.016)	(0.018)
Union Member	0.175***	0.153***	0.200***	0.165***	0.130***
	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)
Part-Time	0.108**	0.038	0.120***	-0.032	-0.050
	(0.035)	(0.036)	(0.032)	(0.045)	(0.046)
Lives in Metropolitan	0.118***	0.139***	0.125***	0.160***	0.126***
	(0.014)	(0.016)	(0.016)	(0.018)	(0.016)
Midwest/North Central	-0.089***	-0.148***	-0.116***	-0.050**	-0.054**
	(0.019)	(0.020)	(0.019)	(0.020)	(0.024)
South	-0.062***	-0.134***	-0.103***	-0.078***	-0.019
	(0.019)	(0.020)	(0.019)	(0.020)	(0.022)
West	0.055***	-0.040*	-0.025***	-0.023	0.012
	(0.020)	(0.022)	(0.021)	(0.022)	(0.022)
R-Squared	0.253	0.281	0.277	0.284	0.195

Notes: White standard errors are shown in parentheses. The sample size is 6,100 for 1984, 5,948 for 1989, 6,121 for 1993, 5,476 for 1997, and 6,493 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

APPENDIX 4-2

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Intercept	3.998	4.148	4.139	4.550
	(0.087)	(0.082)	(0.088)	(0.086)
Computer use at work (CU)	**0.110*** **	**0.111*** **	**0.068*** **	0.026
	(0.019)	(0.018)	(0.019)	(0.022)
Computer use at work for CMC System (C1)	0.040	0.041*	0.101***	0.092***
	(0.026)	(0.024)	(0.027)	(0.025)
Computer use at work for graphics & design (C2)	0.124***	0.043*	0.025	0.028
	(0.031)	(0.026)	(0.024)	(0.026)
Computer use at work for programming (C3)	-0.009	0.085***	0.017	0.087***
	(0.030)	(0.028)	(0.030)	(0.027)
Computer use at work for spreadsheets & databases (C4)	0.113***	0.050*	0.070***	0.089***
	(0.027)	(0.026)	(0.024)	(0.026)
Computer use at work for word processing (C5)	-0.019	0.116***	0.035	-0.008
	(0.026)	(0.027)	(0.024)	(0.023)
Some College But No Degree (E2)	-0.003	0.015	0.028	0.066***
	(0.021)	(0.018)	(0.019)	(0.018)
Associate Degree (E3)	0.112***	0.060**	0.123***	0.079***
	(0.026)	(0.025)	(0.024)	(0.023)
Bachelor's Degree (E4)	0.201***	0.267***	0.213***	0.245***
	(0.020)	(0.021)	(0.021)	(0.023)
Advanced Degree (EA)	0.365***	0.349***	0.321***	0.399***
	(0.026)	(0.029)	(0.026)	(0.032)
Experience (Age)	0.052***	0.047***	0.051***	0.040***
	(0.005)	(0.004)	(0.005)	(0.004)
Experience Square (Age2)	-0.0005***	-0.0004***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.129***	-0.121***	-0.189***	-0.155***
	(0.026)	(0.024)	(0.029)	(0.029)
American Indian	-0.112	-0.108	0.036	-0.144**
	(0.085)	(0.077)	(0.075)	(0.069)
Asian	-0.083*	-0.005	-0.069*	-0.034
	(0.045)	(0.042)	(0.037)	(0.035)
Other	-0.297**	-0.001	-	-
	(0.148)	(0.096)		
Hispanic	-0.078**	-0.134***	-0.152***	-0.132***
	(0.034)	(0.028)	(0.029)	(0.026)
Married	0.102***	0.101***	0.110***	0.109***
	(0.017)	(0.016)	(0.016)	(0.018)
Union Member	0.158***	0.212***	0.174***	0.144***
	(0.017)	(0.017)	(0.018)	(0.018)
Part-Time	0.043	0.125***	-0.027	-0.040
	(0.036)	(0.031)	(0.045)	(0.046)
Lives in Metropolitan	0.137***	0.118***	0.151***	0.120***
	(0.016)	(0.016)	(0.018)	(0.016)
Midwest/North Central	-0.145***	-0.116 ***	-0.055***	-0.053**
	(0.020)	(0.019)	(0.020)	(0.024)
South	-0.131***	-0.105***	-0.078***	-0.017
	(0.020)	(0.019)	(0.020)	(0.021)
West	-0.036	-0.031	-0.028	0.013
	(0.022)	(0.021)	(0.022)	(0.022)
R-Squared	0.289	0.306	0.293	0.202

Notes: White standard errors are shown in parentheses. The sample size is 6,100 for 1984, 5,948 for 1989, 6,121 for 1993, 5,476 for 1997, and 6,493 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

APPENDIX 4-3

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001 (Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.929	4.517	4.111	4.151	4.026
	(0.137)	(0.206)	(0.266)	(0.105)	(0.616)
Computer use at work (CU)	**0.179*** **	**0.188*** **	**0.211*** **	**0.182*** **	**0.168*** **
	(0.017)	(0.016)	(0.016)	(0.016)	(0.015)
Some College But No Degree (E2)	**0.090** **	**-0.040**	**0.074*** **	**0.029**	**0.080*** **
	(0.036)	(0.032)	(0.026)	(0.026)	(0.022)
Associate Degree (E3)	**0.121*** **	**0.139*** **	**0.054**	**0.109*** **	**0.072** **
	(0.041)	(0.037)	(0.034)	(0.032)	(0.028)
Bachelor's Degree (E4)	**0.256*** **	**0.254*** **	**0.352*** **	**0.268*** **	**0.256*** **
	(0.029)	(0.028)	(0.028)	(0.027)	(0.032)
Advanced Degree (EA)	**0.260*** **	**0.403*** **	**0.435*** **	**0.406*** **	**0.435*** **
	(0.029)	(0.032)	(0.032)	(0.029)	(0.030)
Some College But No Degree (E2') (Age < 35 as of time t)	-0.106**	0.070*	-0.100***	0.012	-0.022
	(0.043)	(0.042)	(0.034)	(0.037)	(0.034)
Associate Degree (E3') (Age < 35 as of time t)	-0.072	-0.044	0.027	0.051	0.024
	(0.049)	(0.050)	(0.048)	(0.046)	(0.044)
Bachelor's Degree (E4') (Age < 35 as of time t)	-0.174***	-0.070**	-0.119***	-0.038	0.055
	(0.036)	(0.036)	(0.037)	(0.039)	(0.043)
Advanced Degree (EA') (Age < 35 as of time t)	-0.068	-0.028	-0.088	-0.128**	-0.035
	(0.043)	(0.046)	(0.056)	(0.050)	(0.098)
Experience (Age)	0.040***	0.015	0.046***	0.049***	0.070*
	(0.009)	(0.013)	(0.018)	(0.005)	(0.041)
Experience (Age") Post 1974	**0.030** **	**0.024** **	**0.020***	**0.000**	**-0.009**
	(0.014)	(0.011)	(0.012)	(0.006)	(0.026)
Experience Square (Age2)	-0.0004***	-0.0009	-0.0004***	-0.0005***	-0.0007***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Experience Post 1974 Square (Age'2)	-0.001	0.000	-0.001***	0.000	0.000
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.121***	-0.137***	-0.129***	-0.194***	-0.158***
	(0.026)	(0.026)	(0.024)	(0.029)	(0.029)
American Indian	-	-0.104	-0.107	0.051	-0.156**
		(0.086)	(0.075)	(0.075)	(0.069)
Asian	-	-0.081*	-0.010	-0.071*	-0.038
		(0.046)	(0.043)	(0.038)	(0.035)
Other	-0.140***	-0.341**	-0.005	-	-
	(0.040)	(0.158)	(0.099)		
Hispanic	-0.149***	-0.082**	-0.145***	-0.157***	-0.138***
	(0.035)	(0.034)	(0.028)	(0.030)	(0.026)
Married	0.083***	0.098***	0.099***	0.113***	0.111***
	(0.017)	(0.017)	(0.016)	(0.016)	(0.017)
Union Member	0.180***	0.154***	0.203***	0.165***	0.131***
	(0.016)	(0.017)	(0.017)	(0.018)	(0.018)
Part-Time	0.131***	0.041***	0.133***	-0.034	-0.035
	(0.035)	(0.037)	(0.032)	(0.046)	(0.046)
Lives in Metropolitan	0.117***	0.139***	0.125***	0.161***	0.125***
	(0.014)	(0.016)	(0.016)	(0.018)	(0.016)
Midwest/North Central	-0.091***	-0.148***	-0.117***	-0.051**	-0.053**
	(0.019)	(0.020)	(0.019)	(0.020)	(0.024)
South	-0.061***	-0.135***	-0.105***	-0.078***	-0.019
	(0.019)	(0.020)	(0.019)	(0.020)	(0.022)
West	0.052***	-0.041*	-0.027	-0.023	0.013
	(0.020)	(0.022)	(0.021)	(0.022)	(0.022)
R-Squared	0.257	0.283	0.296	0.285	0.196

Notes: White standard errors are shown in parentheses. The sample size is 6,100 for 1984, 5,948 for 1989, 6,121 for 1993, 5,476 for 1997, and 6,493 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

APPENDIX 4-4

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001 (Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	3.555	3.993	4.091	4.127	4.552
	(0.080)	(0.086)	(0.081)	(0.088)	(0.086)
HOHI*CU(Computer Use at Work)	-0.025	0.027	**0.106*** **	0.007	**0.144** **
	(0.045)	(0.045)	(0.052)	(0.050)	(0.059)
HOLI*CU(Computer Use at Work)	0.064	-0.050	**0.169*** **	-0.012	0.045
	(0.056)	(0.053)	(0.056)	(0.073)	(0.056)
LOHI*CU(Computer Use at Work)	-0.019	0.052	**0.074*** **	**0.082** **	**0.096** **
	(0.044)	(0.038)	(0.035)	(0.035)	(0.038)
HOHI (High C-U Occupation w/ High C-U Industry)	**0.282*** **	**0.283*** **	**0.237*** **	**0.200*** **	**0.131** **
	(0.029)	(0.035)	(0.045)	(0.045)	(0.053)
HOLI (High C-U Occupation w/ Low C-U Industry)	**0.216*** **	**0.290*** **	**0.121*** **	**0.157*** **	**0.175*** **
	(0.035)	(0.037)	(0.044)	(0.060)	(0.040)
LOHI (Low C-U Occupation w/ High C-U Industry)	**0.051*** **	0.021	0.030	-0.011	-0.013
	(0.018)	(0.019)	(0.020)	(0.024)	(0.023)
CU (Computer Use at Work)	**0.126*** **	**0.102*** **	**0.082*** **	**0.106*** **	**0.068*** **
	(0.033)	(0.028)	(0.025)	(0.023)	(0.025)
Some College But No Degree (E2)	-0.003	-0.021	0.007	0.021	0.051***
	(0.021)	(0.021)	(0.018)	(0.019)	(0.018)
Associate Degree (E3)	0.048**	0.076***	0.036	0.111***	0.054**
	(0.024)	(0.026)	(0.025)	(0.024)	(0.023)
Bachelor's Degree (E4)	0.086***	0.139***	0.220***	0.196***	0.209***
	(0.020)	(0.020)	(0.022)	(0.022)	(0.026)
Advanced Degree (EA)	0.097***	0.261 ***	0.272***	0.275***	0.316***
	(0.025)	(0.026)	(0.029)	(0.027)	(0.032)
Experience (Age)	0.067***	0.051***	0.050***	0.051***	0.039***
	(0.004)	(0.005)	(0.004)	(0.005)	(0.004)
Experience Square (Age2)	-0.0007***	-0.0005***	-0.0005***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.113***	-0.126***	-0.123***	-0.196***	-0.149***
	(0.025)	(0.025)	(0.024)	(0.029)	(0.030)
American Indian	-	-0.109	-0.109	0.034	-0.146**
	-	(0.083)	(0.077)	(0.074)	(0.067)
Asian	-	-0.092**	-0.011	-0.076**	-0.039
	-	(0.044)	(0.041)	(0.037)	(0.035)
Other	-0.136***	-0.278*	0.000	-	-
	(0.039)	(0.145)	(0.095)	-	-
Hispanic	-0.141***	-0.070**	-0.134***	-0.153***	-0.130***
	(0.034)	(0.034)	(0.028)	(0.029)	(0.026)
Married	0.083***	0.097***	0.096***	0.107***	0.108***
	(0.017)	(0.017)	(0.016)	(0.016)	(0.017)
Union Member	0.217***	0.194***	0.234***	0.190***	0.160***
	(0.016)	(0.017)	(0.017)	(0.018)	(0.019)
Part-Time	0.136***	0.063*	0.128***	-0.030	-0.036
	(0.035)	(0.035)	(0.031)	(0.045)	(0.046)
Lives in Metropolitan	0.110***	0.131***	0.114***	0.149***	0.115***
	(0.014)	(0.016)	(0.016)	(0.018)	(0.016)
Midwest/North Central	-0.080***	-0.127***	-0.107***	-0.045**	-0.047**
	(0.019)	(0.020)	(0.019)	(0.020)	(0.024)
South	-0.051***	-0.117***	-0.092***	-0.073***	-0.016
	(0.019)	(0.019)	(0.019)	(0.020)	(0.021)
West	0.065***	-0.023	-0.016	-0.019	0.015
	(0.020)	(0.022)	(0.021)	(0.022)	(0.022)
R-Squared	0.276	0.307	0.317	0.295	0.210

Notes: White standard errors are shown in parentheses. The sample size is 6,100 for 1984, 5,948 for 1989, 6,121 for 1993, 5,476 for 1997, and 6,493 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

APPENDIX 4-5

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Intercept	4.017	4.128	4.148	4.557
	(0.087)	(0.081)	(0.088)	(0.086)
HOHI*CU(Computer Use at Work)	-0.044	0.045	-0.029	-0.062
	(0.054)	(0.060)	(0.061)	(0.081)
HOLI*CU(Computer Use at Work)	-0.042	**0.152****	-0.063	0.096
	(0.064)	(0.069)	(0.098)	(0.095)
LOHI*CU(Computer Use at Work)	**0.079***	0.036	0.068	0.057
	(0.046)	(0.044)	(0.045)	(0.050)
HOHI (High C-U Occupation w/ High C-U Industry)	**0.289*****	**0.248*****	**0.211*****	**0.139*****
	(0.035)	(0.045)	(0.045)	(0.054)
HOLI (High C-U Occupation w/ Low C-U Industry)	**0.294*****	**0.127*****	**0.163*****	**0.181*****
	(0.037)	(0.044)	(0.061)	(0.041)
LOHI (Low C-U Occupation w/ High C-U Industry)	0.022	0.032	-0.010	-0.012
	(0.019)	(0.020)	(0.024)	(0.023)
CU (Computer Use at Work)	**0.058***	**0.036*****	0.031	0.014
	(0.032)	(0.030)	(0.029)	(0.033)
HOHI*C1(Computer Use for CMC System)	0.032	0.060	0.036	0.080
	(0.072)	(0.065)	(0.057)	(0.070)
HOLI*C1(Computer Use for CMC System)	0.004	-0.004	0.166	-0.102
	(0.088)	(0.083)	(0.141)	(0.101)
LOHI*C1(Computer Use for CMC System)	-0.025	**0.127***	-0.024	-0.055
	(0.077)	(0.065)	(0.058)	(0.056)
C1 (Computer use at work for CMC System)	0.039	-0.012	0.062	**0.086****
	(0.060)	(0.050)	(0.043)	(0.040)
HOHI*C2(Computer Use for graphics & design)	-0.100	**-0.172****	**-0.110***	0.015
	(0.121)	(0.076)	(0.059)	(0.071)
HOLI*C2(Computer Use for graphics & design)	-0.054	**-0.155****	-0.017	0.158
	(0.141)	(0.092)	(0.093)	(0.110)
LOHI*C2(Computer Use for graphics & design)	-0.100	**-0.185****	-0.109	0.061
	(0.134)	(0.085)	(0.069)	(0.083)
C2 (Computer use at work for graphics & design)	**0.189***	**0.166****	**0.095***	-0.029
	(0.114)	(0.065)	(0.050)	(0.065)
HOHI*C3(Computer Use for programming)	0.027	-0.053	0.065	0.006
	(0.098)	(0.089)	(0.064)	(0.065)
HOLI*C3(Computer Use for programming)	0.103	-0.038	-0.116	-0.024
	(0.119)	(0.104)	(0.143)	(0.132)
LOHI*C3(Computer Use for programming)	0.021	**-0.171***	0.095	-0.010
	(0.110)	(0.096)	(0.078)	(0.076)
C3 (Computer use at work for programming)	-0.063	**0.140***	-0.026	0.062
	(0.089)	(0.079)	(0.056)	(0.057)
HOHI*C4(Computer Use for spreadsheets & databases)	-0.043	0.086	0.026	0.100
	(0.082)	(0.070)	(0.060)	(0.071)
HOLI*C4(Computer Use for spreadsheets & databases)	-0.152	-0.002	0.028	-0.035
	(0.098)	(0.086)	(0.113)	(0.085)
LOHI*C4(Computer Use for spreadsheets & databases)	-0.088	0.079	-0.021	-0.001
	(0.092)	(0.074)	(0.065)	(0.064)
C4 (Computer use at work for spreadsheets & databases)	**0.161****	-0.012	0.055	0.053
	(0.072)	(0.057)	(0.051)	(0.046)
HOHI*C5(Computer Use for word processing)	0.088	-0.082	**-0.119***	0.043
	(0.083)	(0.077)	(0.065)	(0.069)
HOLI*C5(Computer Use for word processing)	-0.013	-0.001	**-0.199***	0.001
	(0.102)	(0.096)	(0.105)	(0.084)
LOHI*C5(Computer Use for word processing)	0.036	-0.051	0.021	0.111
	(0.093)	(0.080)	(0.069)	(0.068)
C5 (Computer use at work for word processing)	-0.090	**0.127****	0.090	-0.069
	(0.075)	(0.065)	(0.057)	(0.055)

APPENDIX 4-5 - Continued

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001

(Dependent Variable: ln (Hourly Wage))

Independent Variables	1989	1993	1997	2001
Some College But No Degree (E2)	-0.021	0.003	0.016	0.050***
	(0.021)	(0.018)	(0.019)	(0.018)
Associate Degree (E3)	0.073***	0.030	0.106***	0.051**
	(0.026)	(0.025)	(0.024)	(0.023)
Bachelor's Degree (E4)	0.132***	0.204***	0.173***	0.188***
	(0.021)	(0.022)	(0.022)	(0.025)
Advanced Degree (EA)	0.250***	0.249***	0.251***	0.302***
	(0.026)	(0.030)	(0.028)	(0.032)
Experience (Age)	0.050***	0.048***	0.050***	0.039***
	(0.005)	(0.004)	(0.005)	(0.004)
Experience Square (Age2)	-0.0005***	-0.0004***	-0.0005***	-0.0004***
	(0.000)	(0.000)	(0.000)	(0.000)
Black	-0.120***	-0.118***	-0.192***	-0.147***
	(0.025)	(0.024)	(0.029)	(0.030)
American Indian	-0.112	-0.107	0.016	-0.143**
	(0.084)	(0.078)	(0.074)	(0.067)
Asian	-0.091**	-0.009	-0.071*	-0.034
	(0.043)	(0.041)	(0.037)	(0.035)
Other	-0.256*	0.003	-	-
	(0.144)	(0.091)	-	-
Hispanic	-0.070**	-0.129***	-0.151***	-0.125***
	(0.034)	(0.028)	(0.029)	(0.026)
Married	0.096***	0.098***	0.104***	0.104***
	(0.017)	(0.016)	(0.015)	(0.017)
Union Member	0.196***	0.242***	0.193***	0.168***
	(0.017)	(0.017)	(0.018)	(0.019)
Part-Time	0.067*	0.132***	-0.028	-0.030
	(0.036)	(0.031)	(0.045)	(0.046)
Lives in Metropolitan	0.129***	0.109***	0.143***	0.113***
	(0.016)	(0.016)	(0.018)	(0.016)
Midwest/North Central	-0.128***	-0.109***	-0.048**	-0.045*
	(0.020)	(0.019)	(0.020)	(0.024)
South	-0.117***	-0.094***	-0.072***	-0.015
	(0.019)	(0.019)	(0.020)	(0.021)
West	-0.021	-0.021	-0.022	0.015
	(0.022)	(0.021)	(0.022)	(0.022)
R-Squared	0.314	0.325	0.304	0.216

Notes: White standard errors are shown in parentheses. The sample size is 6,100 for 1984, 5,948 for 1989, 6,121 for 1993, 5,476 for 1997, and 6,493 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

APPENDIX 4-6

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001
(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
Intercept	4.576	4.728	4.828	4.917	5.213
	(0.038)	(0.046)	(0.043)	(0.045)	(0.050)
HOHI*CU(Computer Use at Work)	-0.075	.0095855	**0.121****	0.012	**0.144****
	(0.046)	(0.046)	(0.052)	(0.052)	(0.060)
HOLI*CU(Computer Use at Work)	0.054	-0.080	**0.154*****	-0.005	0.033
	(0.056)	(0.055)	(0.057)	(0.075)	(0.058)
LOHI*CU(Computer Use at Work)	-0.057	0.019	0.057	**0.090****	**0.105*****
	(0.045)	(0.040)	(0.036)	(0.036)	(0.038)
HOHI (High C-U Occupation w/ High C-U Industry)	**0.279*****	**0.191***	**0.202****	0.158	0.115
	(0.086)	(0.099)	(0.102)	(0.097)	(0.099)
HOLI (High C-U Occupation w/ Low C-U Industry)	**-0.296*****	0.081	-0.294**	-0.209	-0.080
	(0.099)	(0.120)	(0.124)	(0.164)	(0.116)
LOHI (Low C-U Occupation w/ High C-U Industry)	0.042	0.062	0.086	0.024	-0.004
	(0.065)	(0.075)	(0.076)	(0.081)	(0.087)
CU (Computer Use at Work)	**0.183*****	**0.162*****	**0.133*****	**0.142*****	**0.115*****
	(0.034)	(0.029)	(0.025)	(0.023)	(0.026)
HOHI*EA(Advanced Degree)	0.064	0.145	0.008	-0.031	-0.010
	(0.096)	(0.090)	(0.098)	(0.125)	(0.095)
HOLI*EA(Advanced Degree)	0.086	0.174*	0.079	0.102	0.084
	(0.107)	(0.105)	(0.124)	(0.151)	(0.110)
LOHI*EA(Advanced Degree)	0.064	0.082	0.120	-0.054	0.051
	(0.099)	(0.095)	(0.107)	(0.130)	(0.104)
EA	0.027	0.085	0.124	0.177	0.179**
	(0.091)	(0.083)	(0.092)	(0.121)	(0.086)
HOHI*AGE(Experience)	0.005***	0.006***	0.007***	0.004**	0.002
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
HOLI*AGE(Experience)	0.018***	0.007***	0.008***	0.004	0.005**
	(0.002)	(0.003)	(0.003)	(0.003)	(0.003)
LOHI*AGE(Experience)	0.004**	0.004**	0.001	0.001	0.001
	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
AGE	0.008***	0.010***	0.010***	0.009***	0.006***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
HOHI*R2(Black)	0.000	0.009	-0.154*	-0.108	-0.174*
	(0.084)	(0.084)	(0.081)	(0.087)	(0.105)
HOLI*R2(Black)	0.156	0.004	-0.134	0.070	0.037
	(0.099)	(0.105)	(0.124)	(0.107)	(0.089)
LOHI*R2(Black)	-0.061	-0.026	-0.025	-0.014	-0.025
	(0.057)	(0.057)	(0.052)	(0.066)	(0.065)
R2	-0.073*	-0.116***	-0.091***	-0.176***	-0.110**
	(0.039)	(0.036)	(0.035)	(0.045)	(0.046)
HOHI*R3(American Indian)	-	-0.114	-0.233	0.155	0.075
		(0.350)	(0.256)	(0.203)	(0.215)
HOLI*R3(American Indian)	-	-0.296***	-0.568**	-0.221	0.268*
		(0.115)	(0.283)	(0.284)	(0.149)
LOHI*R3(American Indian)	-	-0.212	0.147	0.096	0.080
		(0.186)	(0.180)	(0.207)	(0.141)
R3	-	-0.005	-0.113	-0.005	-0.202*
		(0.090)	(0.098)	(0.094)	(0.115)

APPENDIX 4-6 - Continued

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001

(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
HOHI*R4(Asian)	-	0.157	0.207**	0.158*	0.222***
		(0.106)	(0.099)	(0.086)	(0.083)
HOLI*R4(Asian)	-	0.189	-0.015	0.107	0.087
		(0.126)	(0.191)	(0.157)	(0.131)
LOHI*R4(Asian)	-	0.007	-0.103	-0.040	0.032
		(0.112)	(0.110)	(0.107)	(0.093)
R4	-	-0.145**	-0.028	-0.107*	-0.114**
		(0.065)	(0.054)	(0.065)	(0.057)
HOHI*R5(Other)	-0.035	0.514***	0.073	-	-
	(0.093)	(0.128)	(0.268)		
HOLI*R5(Other)	0.067	0.106	N/A	-	-
	(0.155)	(0.122)			
LOHI*R5(Other)	0.090	0.601***	-0.091	-	-
	(0.094)	(0.210)	(0.203)		
R5	-0.129**	-0.634**	0.005	-	-
	(0.061)	(0.045)	(0.180)		
HOHI*H(Hispanic)	0.008	-0.072	-0.119	0.053	0.085
	(0.098)	(0.104)	(0.085)	(0.072)	(0.069)
HOLI*H(Hispanic)	-0.037	-0.062	0.168	0.058	0.125
	(0.153)	(0.111)	(0.135)	(0.158)	(0.120)
LOHI*H(Hispanic)	-0.103	-0.241**	-0.034	-0.119	0.018
	(0.079)	(0.077)	(0.068)	(0.074)	(0.059)
H(Hispanic)	-0.108**	0.000	-0.138**	-0.156***	-0.173***
	(0.048)	(0.046)	(0.036)	(0.037)	(0.039)
HOHI*MAS(Married)	-0.081*	-0.049	-0.105**	-0.062	-0.021
	(0.048)	(0.046)	(0.047)	(0.040)	(0.045)
HOLI*MAS(Married)	-0.139**	-0.043	0.015	-0.042	0.034
	(0.060)	(0.059)	(0.060)	(0.067)	(0.056)
LOHI*MAS(Married)	-0.085**	-0.088**	0.038	-0.037	0.006
	(0.038)	(0.039)	(0.037)	(0.038)	(0.040)
MAS	0.183***	0.165***	0.137***	0.157***	0.132***
	(0.024)	(0.024)	(0.021)	(0.024)	(0.028)
HOHI*UM(Union Member)	-0.386***	-0.303***	-0.222***	-0.276***	-0.277***
	(0.054)	(0.055)	(0.065)	(0.054)	(0.056)
HOLI*UM(Union Member)	-0.219***	-0.181**	-0.035	-0.131	-0.198**
	(0.081)	(0.090)	(0.087)	(0.091)	(0.097)
LOHI*UM(Union Member)	-0.211***	-0.173***	-0.188***	-0.163***	-0.158***
	(0.035)	(0.039)	(0.037)	(0.041)	(0.042)
UM	0.362***	0.314***	0.328***	0.289***	0.267***
	(0.022)	(0.026)	(0.023)	(0.025)	(0.025)
HOHI*PT(Part Time)	-0.418***	-0.381***	-0.131	-0.222	-0.221
	(0.115)	(0.112)	(0.115)	(0.146)	(0.155)
HOLI*PT(Part Time)	0.228	-0.125	0.183	0.048	0.282
	(0.336)	(0.175)	(0.150)	(0.232)	(0.282)
LOHI*PT(Part Time)	-0.252***	-0.344***	-0.008	-0.209*	-0.042
	(0.078)	(0.073)	(0.072)	(0.107)	(0.112)
PT	0.184***	0.164***	0.081***	-0.021	-0.060
	(0.039)	(0.047)	(0.036)	(0.053)	(0.054)

APPENDIX 4-6 - Continued

OLS Estimates of the Impact of Computer Use on Wages – Men Only: 1984-2001

(Dependent Variable: ln (Hourly Wage))

Independent Variables	1984	1989	1993	1997	2001
HOHI*MLS(Lives in Metropolitan)	0.097**	0.009	0.013	0.095*	0.100**
	(0.040)	(0.049)	(0.050)	(0.049)	(0.047)
HOLI*MLS(Lives in Metropolitan)	0.028	0.019	0.121*	0.286***	-0.013
	(0.055)	(0.059)	(0.064)	(0.108)	(0.057)
LOHI*MLS(Lives in Metropolitan)	0.075***	0.028	0.033	0.051	0.014
	(0.034)	(0.037)	(0.026)	(0.040)	(0.038)
MLS	0.066***	0.120***	0.101***	0.105***	0.103***
	(0.020)	(0.024)	(0.022)	(0.024)	(0.024)
HOHI*RE2(Midwest/North Central)	-0.152***	-0.020	-0.120**	-0.036	-0.075
	(0.052)	(0.057)	(0.053)	(0.047)	(0.060)
HOLI*RE2(Midwest/North Central)	-0.022	0.037	0.162**	0.038	0.136
	(0.071)	(0.074)	(0.075)	(0.120)	(0.105)
LOHI*RE2(Midwest/North Central)	0.016	-0.061	-0.126**	-0.014	0.016
	(0.045)	(0.048)	(0.045)	(0.049)	(0.058)
RE2	-0.065**	-0.111***	-0.069**	-0.045	-0.053
	(0.028)	(0.032)	(0.028)	(0.031)	(0.034)
HOHI*RE3(South)	-0.033	0.025	-0.026	-0.041	-0.016
	(0.054)	(0.051)	(0.052)	(0.048)	(0.051)
HOLI*RE3(South)	0.055	0.097	0.062	0.041	0.131
	(0.066)	(0.070)	(0.072)	(0.110)	(0.104)
LOHI*RE3(South)	0.010	-0.014	-0.066	-0.012	0.001
	(0.046)	(0.049)	(0.045)	(0.050)	(0.057)
RE3	-0.060**	-0.123***	-0.079***	-0.071**	-0.032
	(0.029)	(0.031)	(0.027)	(0.032)	(0.030)
HOHI*RE4(West)	-0.034	-0.088	-0.144**	-0.115**	-0.054
	(0.052)	(0.057)	(0.061)	(0.051)	(0.051)
HOLI*RE4(West)	-0.066	0.049	0.073	0.158	0.079
	(0.071)	(0.080)	(0.081)	(0.109)	(0.106)
LOHI*RE4(West)	0.012	-0.052	-0.063	-0.009	0.006
	(0.048)	(0.055)	(0.051)	(0.057)	(0.059)
RE4	0.074**	0.016*	0.027	-0.002	0.018
	(0.029)	(0.035)	(0.030)	(0.033)	(0.032)
R-Squared	0.274	0.303	0.305	0.281	0.200

Notes: White standard errors are shown in parentheses. The sample size is 6,100 for 1984, 5,948 for 1989, 6,121 for 1993, 5,476 for 1997, and 6,493 for 2001. ***, **, * indicate significant at the 1%, 5% and 10% level, respectively.

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