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Abstract: This study examines whether there are differences in men's and women's use of computers and the Internet in the United States and Japan and how any such gender gaps have changed over time. The authors focus on these two countries because information technology is widely used in both, but there are substantial differences in institutions and social organizations. They use microdata from several surveys during the 1997–2001 period to examine differences and trends in computer and Internet usage in the two countries. Their results indicate that there were significant gender differences in computer and Internet usage in both countries during the mid-1990s. By 2001, these gender differences had disappeared or were even reversed in the United States but remained in Japan. People not currently working have lower levels of IT use and skills in both countries regardless of gender, but working women in Japan have lower levels of IT use and skills than working men, a difference that generally does not occur in the United States. This finding suggests that employment status per se does not play a large role in the gender gap in Japan, but type of employment does. The prevalence of nonstandard employment among female workers in Japan accounts for much of the gender gap in IT use and skills in that country.

JEL classification: O33, L86, J16

Key words: computers, Internet, gender, nonstandard employment

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Gender Differences in Information Technology Usage: A U.S.- Japan Comparison

Introduction

This study examines the relationship between gender, work and information technology (IT) use in the United States and Japan. We view digital inequality—unequal access and use of IT across demographic groups—as a social phenomenon and argue that understanding cross-country differences in IT access and use requires a nuanced understanding of social organizations and the institutional context in which inequality is generated.

Our general hypothesis is that gender differences in IT access and use—both at work and at home—reflect gender differences in labor force participation and in types of jobs held. We focus on the U.S. and Japan because IT is widely used in both countries, but there are notable differences between the two countries in institutions and social organizations. In particular, Japan has larger gender differences in wages, labor force participation, and occupational distribution than the U.S. In addition, women in Japan are more likely to be employed in "nonstandard" positions such as part-time jobs and self employment and to have lower human capital investments relative to men than in the U.S. These different social and institutional contexts in Japan and the U.S. may lead to cross-country gender-related differences in IT use. Although several studies have examined whether there is a gender gap in computer and Internet use in the U.S., researchers have not examined the role of work in any such gaps, either within the U.S. or in a cross-country framework.

Our study is motivated by previous studies that link IT use and economic advancement. As IT has become more prevalent, computer literacy—broadly defined as the ability to use information technology and process information—has become an important form of human capital that affects economic success (Levy and Murnane 1996; Reilly 1995). Research has established a positive association between computer use and wages, although the causal linkage is not clear (e.g., DiNardo and Pischke 1997; Krueger 1993, 2000). The digital divide, or the separation of information have's from the have-not's, has become a serious concern because of its potential economic consequences (OECD 2001). In addition, not having computer skills leads to social exclusion as well as economic penalties (Haisken-DeNew and D'Ambrosio 2003), making it important to identify groups that do not have access to IT. This study focuses on gender, using a cross-country analysis to explore the role of work in the digital divide across the sexes.

The next section briefly surveys gender differences in labor force outcomes and patterns of IT usage in the U.S. and Japan. We then describe the data used here to analyze IT use and skills in the two countries and explain the empirical methodology. The results indicate that gender differences in IT use and skills are considerably smaller in the U.S. than in Japan and in many cases non-existent in the U.S. People not currently working tend to have lower levels of IT use and skills in both countries regardless of gender, but working women in Japan have lower levels of IT use and skills than working men, a difference that generally does not occur in the U.S. This suggests that employment status per se does not play a large role in the gender gap in Japan, but type of employment does. We find that the prevalence of nonstandard employment among female workers in Japan accounts for much of the gender gap in IT use and skills in that country.

Background

By almost any measure, gender inequality is greater in Japan than in the U.S. Statistics from the International Labour Office (ILO 2001) indicate that Japanese women are less likely to be in the labor force than U.S. women, with less than 50% of women in Japan in the labor force versus 60% in the U.S. When employed, Japanese women are less likely to be in professional and technical positions than their U.S. counterparts; only 45% are professional or technical workers in Japan versus 54% in the U.S. The gender wage gap is also more pronounced in Japan than in the U.S.; the female-to-male earnings ratio is 62 percent in the U.S. compared with 44 percent in Japan. In addition, whereas women are currently more likely than men to go to college in the U.S., the opposite is true in Japan.

Does the greater gender inequality in the Japanese labor market translate into greater gender inequality in IT access and use in Japan relative to the U.S.? There are several reasons why this might be the case. First, because computer use at work contributes to overall computer use rates, gender differences in labor force participation may lead to gender differences in overall computer usage. In other words, people who do not work do not have the opportunity to use a computer at work, which may be reflected in overall usage statistics. Because women are less likely to work than men, their rate of overall IT use may be lower than men's IT use. We therefore investigate the role of employment status in IT usage, such as to what extent working affects the likelihood that an individual uses a computer or the Internet anywhere.

Further, differences in employment status may lead to differences in computer usage at home. As people develop information literacy and familiarity with computers at work, the costs of using a computer elsewhere fall because many computer skills gained at work carry over to computer use at other locations. This may cause IT use at home to be higher among workers than among non-workers, a possibility that we examine for both Internet use and computer use more generally. In addition, the cross-country differences in employment suggest that gender differences in computer use at home will be smaller in the U.S. than in Japan. We therefore examine, among other questions, whether the higher female labor force participation rate in the U.S. translates into a smaller gender gap in computer use at home than in Japan.

Previous studies of digital inequality have focused on computer use at home, but work is likely to be an important arena in which differences in computer use may arise, so we examine differences in computer use at work as well as home and anywhere. Differences in the type of jobs held may lead to differences in computer usage across genders. For example, gender differences in the fraction of workers employed in nonstandard jobs may contribute to gender differences in IT use if workers in nonstandard jobs are less likely to use computers. Cross-country differences in the types of positions held may lead to differences between the U.S. and Japan in computer use at work across sexes. These differences may carry over to computer use at home as well.

Trends in Computer Use

Until recently, the proportion of households with computers was higher in the U.S. than in Japan. As Table 1 indicates, the fraction of households with a computer was about 17 percentage points greater in the U.S. than in Japan as recently as 1998. In fact, diffusion of computers in households in Japan remained lower than in most OECD countries throughout much of the 1990s (OECD 2000). Only after 2000 did computer penetration rates in Japan reach a level comparable to the U.S. Internet use in Japan also lagged behind the U.S. during the 1990s, reaching comparable rates only recently.

Differences in the skills required to use computers and the costs of acquiring them may contribute to these patterns. According to the Economic Planning Agency (EPA) of Japan, computer and Internet penetration rates in Japan were initially lower than in the U.S. in part because of higher costs of hardware, software and telecommunication fees (EPA 2000).

The fact that computers and the Internet predominantly rely on the English language also played a role in Japan’s slower adoption of IT. Over 90 percent of online content is in

English (OECD 2001), but relatively few Japanese speak English.[1] For example, a survey conducted by the Recruit Works Institute in 2000 found that 77 percent of workers in the Tokyo metropolitan area can barely speak English (Recruit Works Institute 2001). The fact that English is still a distant foreign language in Japan is a significant handicap in the adoption of computers and the Internet.[2] The same is true for the supply side of IT. Developers must make additional investments in hardware and software in order to make their products compatible with the non-Roman alphabet languages of Asia. This is believed to be one of the key reasons why Internet applications and e-commerce in Asia continue to lag the West (Teicher 2001).[3]

Furthermore, although the typewriter was a common fixture in offices and homes in the pre-computer era in the U.S., no comparable counterpart to the typewriter existed in Japan. And because Japanese is still the dominant language used on computers in Japan, all users must first master the craft of transforming the English alphabet into Japanese characters (or *kanji*) using their keyboards. Thus, the introduction of computers was (and continues to be) a major adjustment for users in Japan because the majority of the population does not speak English and does not know how to type.

Given that the cost of acquiring computer skills is not negligible in Japan, women in Japan may invest less in computer skills and subsequently have less access to computers than men. Differential investment in men's and women's human capital remains a salient feature of contemporary Japanese society. Although perceptions of traditional gender roles are declining in Japan, social norms and expectations governing the gender division of labor do

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[1] The Prime Minister's Commission on Japan's Goals in the 21st Century issued a report in 2000 warning of Japan's lack of global literacy. The report argues that English skills plus mastery of computers and the Internet are the key to survival on the global stage. The report also cites a 1998 study that found that Japan ranked the lowest among Asian nations in English proficiency. (*International Herald Tribune*, "Japan Advised to Open Up to the World." January 19, 2000).

[2] In the U.S., Lazarus and Mora (2000) argue that non-English speakers are often left out of the benefits offered by the Internet. Fairlie (2002) reports that Mexican-Americans in Spanish-speaking households are half as likely as non-Hispanic whites to own a computer or use the Internet.

[3] Hargittai (1999) shows that English language competency has little effect on Internet connectivity among 18 OECD countries, but her sample does not include any Asian countries.

remain and lead to greater gender differences in human capital accumulation than in the U.S. (Brinton 1988). Women are less likely than men to be enrolled in higher education in Japan, the opposite of the U.S. pattern in recent years. As Brinton (1989) explains, having too much education may actually hurt a Japanese woman's chance of getting a job as she may threaten the status quo of the patriarchy. For reasons such as this, parents choose to invest more in sons' education than their daughters' (Ono forthcoming).

Differential investment in human capital by gender is also a prominent feature of the Japanese labor market. Employers invest more in male employees' training, partly because of concerns that such investments will not be recouped if women quit when they marry or have children (Brinton 1993). Such gender differences in human capital investment in Japan may carry over to IT skills. The aforementioned study by the Recruit Works Institute found that computer literacy was significantly lower among working women than working men in the Tokyo metropolitan area (Recruit Works Institute 2001). Women were less likely than men to use computer applications such as email, Internet, word processing and databases, and more likely to respond that they can barely use computers. Moreover, the survey also finds that 42 percent of women are in positions that do not require computers (versus 26 percent of men) but does not discuss what these positions are.[4] We further investigate these differences and their causes below.

Computers, work and gender

The fraction of workers in the U.S. using a computer has increased dramatically in recent decades, and a majority of workers in the U.S. now use a computer (NTIA 2002). Women are considerably more likely to use computers at work than men; in 2001, almost 63 percent of women used a computer at work compared with about 51 percent of men (NTIA

[4] The survey also finds that 73 percent of women are in positions that do not require English versus 56 percent for men (Recruit Works Institute 2001).

2002). The higher proportion of female workers using computers is in large part due to changes in job skill requirements that have favored women. Weinberg (2000) explains that the number of physically demanding jobs—positions in which men have a comparative advantage—has been falling since the 1970s. At the same time, computer usage, which does not require physical strength, has risen. These trends have increased the relative demand for female workers; gender-biased technological change can explain over half of the growth in the demand for female workers during the period 1975 to 1993. Interestingly, women without college degrees are more likely than similarly-educated men to use computers at work whereas the opposite holds among college graduates (Losh 2003).

Women's higher overall rate of usage of computers at work in the U.S. does not carry over to all aspects of IT access and use. Women are slightly less likely to live in a household with a computer (Census 2001, Losh 2003), and men dominate household decisions about computer purchases (Papdakis 2001). Some studies conclude that women are less likely to use the Internet at all (e.g., UCLA 2001; Bimber 2000) and use the Internet less frequently, given Internet use at all (Ono and Zavodny 2003). However, many of these conclusions are based on either cross-tabulations or regressions that do not control for employment and therefore may reflect gender differences in employment status, the focus of this analysis. No official estimates of the proportion of computer users at work or at home by gender are available for Japan. Proprietary data from the Nomura Research Institute indicate that 33 percent of female workers used computers at work in 2001, compared with 46 percent of male workers. About 32 percent of all women aged 15-57 reported using a computer at home versus 52 percent of men.

Institutional features that have persisted over time in Japan are a potential explanation for these gender differences in computer use. Men are significantly more likely to be employed in the internal labor market characterized by intensive training and internal promotion. Women, on the other hand, are more likely to be employed in the secondary labor market, which involves little training and few prospects for promotion.[5] Moreover, prevailing social norms presume that women exit the labor market upon marriage or childbearing (Brinton 1993). When they re-enter the labor market at later stages, many do so into nonstandard employment such as part-time or temporary work, or into unskilled blue-collar positions because there are very few mid-career ports of entry back into white-collar positions

Standard versus nonstandard jobs

A critical dimension in the study of labor markets and social organizations is the distinction between standard versus nonstandard employment. Kalleberg et al. (2000) label this distinction as "good" versus "bad" jobs and explain that good jobs (or standard work arrangements) are characterized by "the exchange of a worker's labor for monetary compensation from an employer, with work done on a fixed schedule – usually full-time – at the employer's place of business, under the employer's control, and with the mutual expectation of continued employment" (p.258). Bad jobs (or nonstandard employment arrangements), on the other hand, are identified on the basis of three dimensions – low earnings, lack of health insurance, and lack of pension benefits.

Previous research indicates that women disproportionately occupy nonstandard jobs in both the U.S. and Japan (Kalleberg et al. 2000; Osawa and Houseman 2003). In addition, Osawa and Houseman report that Japanese women are more likely to be employed in nonstandard jobs than their U.S. counterparts. Moreover, while the proportion of women in nonstandard employment remained stable in the U.S. throughout the 1990s, it rose in Japan. This is an outcome of the high costs of maintaining the Japanese system of "lifetime

[5] Edwards (1994), citing a 1987 survey of large employers in Japan, explains that a majority of female white-collar workers are not in jobs that can lead to high-level management positions.

employment."[6] The economic downturn of the 1990s resulted in a decrease in the number of core employees (or regular full-time workers) and an increase in the number of part-time workers (Ministry of Health, Labour and Welfare 2001). Because it is generally more difficult to dismiss full-time, regular workers in Japan than in the U.S., Japanese employers are more likely to maintain a secondary workforce, or "buffers," in part-time or temporary positions who can be more easily dismissed and allow firms to respond to business cycle fluctuations.[7] This buffer workforce is comprised mainly of women. This results in women bearing a disproportionate amount of the adjustment to changes in labor demand (Houseman and Abraham 1993).

Differences in the use of IT in the workplace between workers in standard versus nonstandard jobs have received little attention from researchers. Because workers in nonstandard positions typically have shorter employment durations with a firm, employers should be less inclined to invest in training such workers because it is less likely that firms will recoup such investments. This may extend to IT training, causing nonstandard employees to have lower rates of computer use at work because their employers are less likely to provide them with training in IT skills.

The differences between the U.S. and Japan in women's and men's labor market outcomes and human capital accumulation may give rise to differences between the two countries in women's and men's IT access and use both at work and at home. We next investigate whether the patterns in IT usage discussed above hold in the data.

[6] For further discussion about the impact of Japanese employment systems on female workers, see Brinton (1993) and Ono and Rebick (2003).

[7] Empirically, Houseman and Abraham (1993) show that female employment elasticity is significantly greater than the male elasticity throughout the 1970s and 1980s in Japan.

Data and Methods

We use two data sets to examine the role of work in gender differences in IT use during the period 1997 to 2001. Although this is a relatively short time period, it is the only period for which data for Japan are available, as discussed below. This period covers the time when the number of Internet users increased dramatically in both countries, so we examine patterns in Internet use as well as in computer usage. The surveys we use are the Current Population Survey and the Nomura Research Institute Cyber Life Observations Survey. Our sample from each survey includes all adult respondents with complete answers to the IT and demographic questions analyzed here.

Current Population Survey (CPS)

The CPS is a monthly survey of labor force behavior conducted in over 50,000 U.S. households. In October 1997, December 1998, August 2000, and September 2001, the CPS had a supplement on computer ownership and usage that included questions about Internet usage. This analysis focuses on the CPS when discussing IT use in the U.S. for several reasons. The CPS is the largest U.S. survey that includes questions on computer usage and therefore yields the most precise estimates of the determinants of Internet usage. The questions about IT use included in the CPS change across some of the surveys, so not all years are included in all regressions that use CPS data. All results using the CPS data are weighted using the final CPS weights.

Nomura Research Institute Cyber Life Observations Survey (CLO)

The Nomura Research Institute conducted its CLO surveys of technology usage in Japan during the years 1997-2001 and in the U.S. in 1997 and 2000. All surveys were conducted in October. The CLO surveys were designed to monitor the activity of various information and communication technologies and are proprietary data. The surveys asked respondents about ownership and use of a personal computer, Internet usage, and mobile phone usage as well as about their demographic characteristics. As in the CPS, some of the questions are not included all years in the Japanese surveys, so not all regressions using the CLO data for Japan include all years. Results using the CLO are not weighted because the data do not include sampling weights.

The CLO is the only source of individual-level data on IT use in Japan of which we are aware. We use the CLO data here for all questions regarding Japan and for some questions regarding the U.S. In particular, we use the U.S. CLO data on the length of time individuals have been using computers and on typing speed, questions not covered in the CPS.

Methods

We use logit and ordered logit regressions to estimate the determinants of a wide variety of aspects of IT usage. We examine personal computer (PC) use at home and at work, Internet usage, computer skills and experience with using computers. The outcome variables are detailed below as we discuss our findings. We focus on the role of gender, examining whether there are differences between the sexes in IT use, whether any such differences have changed over time and whether employment plays a role in any gender differences. We compare results for the U.S. and Japan throughout, but separate regressions are estimated for each country because all coefficients are likely to differ between the two nations.

For most outcomes, we estimate four sets of regressions. The first includes an indicator variable for whether an individual is female (as well as other control variables discussed below). In the second set of regressions, the female dummy variable is interacted with indicator variables for survey year to measure changes in gender differences over time. Some specifications include an indicator variable equal to one for respondents who were employed at the time of the survey; these regressions examine how the estimated coefficient of the female indicator variable changes when controlling for employment status. We also include a full set of interactions between gender and employment status in some regressions in order to further investigate the role of work in any gender differential in IT use. In these regressions, working men are the omitted group, so the coefficients for other groups are relative to employed men.

All regressions control for age, marital status, household income, education level and survey year. The impact of these variables on IT use is undoubtedly crucial in understanding the sources of digital inequality. However, because our primary focus concerns gender differences, we do not report the estimated coefficients for these socioeconomic and demographic variables here.[8] The age variable is linear, with the midpoint of the survey interval used for the CLO data and the exact age used for the CPS data. Indicator variables are used to measure marital status (married or single), income and education. Household income includes 14 dummy variables in the CPS and 4 dummy variables in the CLO, with missing income as the omitted category for both data sets. Education includes dummy variables for 3 of 4 categories (less than high school, high school, some college and college graduates). Regressions using CPS data also control for race and ethnicity (black, Asian, other and Hispanic, with whites as the omitted group)

[8] Results not shown here are available from the authors on request. In general, our results for the socioeconomic and demographic variables confirm previous findings, mainly that IT ownership and use the U.S. and Japan has increased over time, rises with education and household income, and declines with age. We find mixed results for marital status. In the U.S., married persons have a higher probability of IT ownership and use than non-married persons, but we find few differences by marital status in Japan. Results for the variables of interest reported in the tables are robust to different specifications of the other variables, such as using dummy variables for age categories instead of a linear measure or including age squared as well as linear age.

Results

We begin by discussing gender differentials in computer use and then examine differences in Internet use. We then turn to experience with computers and the role of nonstandard work.

Computer use

We examine four binary measures of PC use: computer ownership at home; computer use at home among computer owners only; computer use at work among workers only; and computer use anywhere, including home, work and school. All regressions are logits. Table 2 reports the results.

In the U.S., women are more likely than men to live in a household that owns a computer and also more likely to use a computer given ownership (columns 1 and 2). These differentials have changed over the 1997-2001 period, with women and men initially equally likely to own computers but women less likely to use them (panel B). For the period as a whole, women are more likely than men to live in a household that owns a computer and to use a computer, given ownership, differences that increase slightly (albeit insignificantly) when controlling for employment status. Nonemployed women are less likely than either working women or working men to live in a household that owns a computer or, given ownership, to use a computer at home (panel D).

In Japan, women and men are equally likely to live in a household that owns a computer, but women are significantly less likely to use computers at home (columns 5 and 6). This gender gap in usage has remained constant over time. Working increases the likelihood of computer use at home for both men and women, as in the U.S., but a sizable gender gap in home computer use remains in Japan after controlling for employment status (panel C). Women who do not work are the least likely to use a computer at home given ownership, but working women are less likely to use a computer at home than are employed men (panel D). These results highlight the importance of asking the right question: Women in Japan may have equal access to computers in the home, but they are not using them. In the U.S., in contrast, women have greater access to computers at home and are more likely to use them.

There are large gender differences between the U.S. and Japan in computer use at work and computer use anywhere. In the U.S., women are more likely than men to use a computer at work or anywhere, a difference that holds in both 1997 and 2001, whereas women in Japan are less likely to use a computer than men in 1998 and 1999 (panel B). In the U.S., nonworking women are the least likely group to use a computer anywhere, whereas nonworking men are the least likely group in Japan (panel D). These results highlight the fact that gender differences in computer use in Japan are not simply due to lower labor force participation among women but also because women in Japan are less likely than men to use computers both at home and at work.

Internet use

We examine Internet use at different locations, including use anywhere, use at home (both unconditional and conditional on computer ownership) and use at work among workers. All of these Internet use measures are indicator variables, so we estimate logit regressions. The results are reported in Table 3.

In the U.S., Internet use at various locations increased among women relative to men during the period 1997-2001. In 1997 and 1998, women were less likely than men to use the Internet anywhere or at home, but they were more likely to do so by 2001 (panel B, columns 1-3). Among those who work, women remained less likely than men to use the Internet at work through 2001, but the gender gap did narrow over time (column 4). People who are employed are more likely than the nonemployed to use the Internet at home or anywhere, with nonworking women the least likely to use the Internet (panel C). This is consistent with our finding that nonworking women are the least likely to use a computer at home or anywhere.

Women in Japan are much less likely to use the Internet than men regardless of location, and this difference has not narrowed significantly over time. This is similar to our finding that women are less likely than men to use computers at home or at work, gender gaps that also did not narrow between 1997 and 2001. Workers are more likely than nonworkers to use the Internet use at any location or at home, but working women are less likely to use the Internet at home or at work than are working men (panels C and D). These differences across employment/gender groups in Internet use are also consistent with the differences in computer use shown in Table 2 —working women in Japan are less likely than working men to use computers or the Internet, and nonworking women even less so compared with working men. The similarity between the computer and Internet results suggest that computer use translates into Internet use or that the same factors underlie differences in both computer use and Internet use.

Computer skills

We next examine gender differences in several measures of computer skills, including experience with computers and ability to type, a crucial skill when using a computer. We focus on four specific outcome variables: the number of years of experience with computers (in categories); an indicator variable for whether an individual has no experience at all with computers; self-reported typing speed (in categories); and an indicator variable for whether an individual can barely type or cannot type at all. The categorical measures of computer experience and typing speed are increasing in experience or speed. We use logit regressions to estimate the binary outcomes and ordered logit regressions to estimate the categorical outcomes.

Women and men in the U.S. have similar experience with computers, and women have an advantage in typing. As the results in Table 4 report, there are no significant gender differences in computer experience, measured either categorically (column 1) or as a binary variable for no experience (column 2). Workers have more experience with computers than nonworkers, and, in particular, working women have been using computers for more years than have working men (panel C, column 1). Nonworking women have less experience with computers than working men, a difference that does not occur between nonworking and working men (panel D, column 1). Women, including those not currently working, report being significantly faster typists than men (columns 3 and 4).

In contrast to the U.S., our results for Japan show that women have less experience with computers. Women have been using computers for significantly less time (column 5) and are less likely to have ever used a computer (column 6). These differences have not changed over the period 1997-2001 and hold even after controlling for employment status (panels B and C). Working is positively associated with computer experience, but the effect is stronger for men than for women (panel D, column 5). Further, gender differences in experience among workers are greater than among nonworkers.[9]

Unlike in the U.S., Japanese women's self-reported typing skills fall short of men's, and they are more likely to report that they can barely type (column 8). The difference in typing speed is largely due to the fact that women in Japan are less likely to work; there is no difference in typing speed between men and women who work (panel D, column 7).

[9] In other words, the results in panel D, column 5 indicate that the difference in experience with computers is smaller between working and nonworking women than between working and nonworking men. In addition, the difference between working women and working men is larger than the difference between nonworking men and nonworking men.

However, working women are more likely than working men to report that they can barely type (panel D, column 8).

These results are not surprising in light of our previous findings for Japan, mainly that women are less likely to use computers and the Internet at home or at work. Because of less exposure to computers, women have lower computer skills than men. Our finding that working is more positively associated with computer skills for men than for women also suggests that men and women occupy different positions in the labor force.

Standard versus nonstandard employment

For our final analysis, we examine the role of nonstandard employment in gender differences in IT use. The estimation samples consist of workers only, and the regressions include interactions of gender with standard or nonstandard employment status, with men working in standard jobs as the omitted group. Following Kalleberg et al. (2001), we define standard employment as regular full-time workers and nonstandard employment as part-time workers and the self-employed.[10] Table 5 shows the regression results; we do not present results for the logit models of no experience with computers and poor typing skills because they are similar to the results using the ordinal measures of computer experience and typing speed.

In the U.S., the effect of working in a nonstandard job on IT access and use differs somewhat across the sexes. Women in standard jobs are the most likely to use a computer at work, and men in nonstandard jobs the least likely to do so (panel A, column 1). For Internet use at work, in contrast, women in nonstandard jobs have the lowest usage rate, followed by

[10] Kalleberg et al. (2001) also include temporary and contingent workers as being in nonstandard jobs. Neither the CPS (during the survey months with questions about computer use) nor the CLO asks about temporary or contingent jobs, so we do not categorize workers based on this dimension. In addition, the 2000 U.S. CLO survey did not ask about part-time versus full-time status, so we only use self-employment status to categorize workers for that survey; the results are not sensitive to categorizing the 1997 U.S. CLO data using only self-employment status.

men in nonstandard jobs (panel B). Women in standard jobs have been using computers the longest, with men in standard jobs and both men and women in nonstandard positions having less but similar experience with computers (panel C). These results do not clearly indicate that working in nonstandard jobs disadvantages women relative to men; for some measures of IT use, women in nonstandard jobs are more likely to use IT than men in nonstandard jobs.

In the U.S., workers in nonstandard jobs are significantly less likely to use a computer or the Internet at work and have not been using computers as long as workers in standard positions. In results not shown here, workers in nonstandard jobs are about 16 percent less likely than workers in standard jobs to use a computer at work, for example, controlling for other factors. Given that female workers are more likely than male workers to occupy nonstandard jobs (30 percent versus 21 percent in the CPS data), this suggests that gender differentials in nonstandard employment may contribute to gender differences in computer use. We further investigate this possibility after discussing gender differentials in the impact of nonstandard employment in Japan.

In Japan, workers in nonstandard jobs are considerably less likely to use IT and have lower computer skills than workers in standard jobs. However, the results in Table 5 suggest that women in such jobs are more disadvantaged than men. Women in nonstandard jobs not only are less likely to use a computer or the Internet at work and have less experience with PCs than men in standard jobs but *also* relative to men in nonstandard jobs. Women in standard jobs, in contrast, are not significantly different from comparable men in standard jobs in terms of IT use and skills. These results are in striking contrast to the results when pooling all workers, which indicated that women had lower IT use and skills—the gender difference is driven by women in nonstandard jobs.

The substantial gender difference in the fraction of workers in nonstandard employment suggests that part of the gender inequality in IT use and skills in Japan may be due to women's higher propensity to occupy nonstandard jobs. About 61 percent of female workers in Japan are in nonstandard jobs, compared with 22 percent of male workers. This is about double the fraction of women in the U.S. but a comparable number for men.

This suggests that there are two ways that nonstandard employment can contribute to the gender gap in IT use: more women may be in nonstandard jobs, and the effect of being in a nonstandard job may be more adverse for women. To illustrate these two effects, we report three sets of predicted probabilities of computer and Internet use at work in Table 6. The first set is simply the fraction of women who use computers and the Internet at work predicted using the coefficients in Table 5. The second set is the predicted fraction of women using IT at work if the proportion of women in nonstandard jobs was the same as among men. The third set is the predicted fraction of women using IT at work if the effect of nonstandard employment on IT use was the same for women as it is for men.[11]

The results indicate that both factors act to lower women's IT use in both countries, but the magnitude of the two effects differs across countries. In the U.S., the greater fraction of women in nonstandard employment and the more adverse effect of nonstandard employment each result in lower rates of computer and Internet use at work (i.e., the counterfactuals are larger than predictions using the actual fraction of women in nonstandard employment and women's return to nonstandard employment), but the effects are small in magnitude. The impacts are considerably larger in Japan. In particular, the disproportionate employment of Japanese women in nonstandard jobs lowers the fraction of women who use computers by about 13 percentage points and the Internet at work by over 4 percentage points. These results indicate that the prevalence of women in nonstandard employment in Japan plays a large role in the gender gaps in IT use and access in that country.

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[11] These predictions are similar to a Blinder-Oaxaca decomposition, where the gender difference is decomposed into a component due to differences in observed characteristics and a component due to differences in returns (regression coefficients) and unobservable factors. Here, we focus on only one factor—nonstandard employment—and its coefficient.

Discussion and Conclusions

Information technology skills are becoming increasingly vital to individuals' economic success, political participation, and social networks. Gender differences in computer use, Internet access, and computer skills are important because groups that have less access risk being excluded from job and educational opportunities as well as losing political influence as the computers and the Internet becomes increasingly important to how people live and work (Norris, 2001). Such consequences make it important to investigate the extent and causes of differences in computer access and use across groups. This study does so along the dimension of gender.

Our results indicate that there are few gender differences in IT use and skills in the U.S., and any such gaps have diminished in recent years. In addition, female workers are not at a disadvantage relative to men with regard to computer use or skills; the same is true of nonworking women relative to nonworking men, although both groups of women are generally less likely to use the Internet than comparable men. Further, women in nonstandard jobs—part time positions or self-employment—do not have systematically lower levels of IT use and skills than comparable men.

The results for Japan are considerably different than those for the U.S. Women in Japan are less likely to use computers or the Internet and have lower computer-related skills than men. These differences have not narrowed significantly in recent years. Working women in Japan have lower levels of IT use and skills than working men, whereas comparisons between female and male nonworkers yield mixed results. Our results suggest that the disproportionate employment of women in nonstandard employment in Japan accounts for much of the gender gap in IT use and skills in that country. This suggests that larger social and economic factors—those that have resulted in the prevalence of women in nonstandard employment—have led to a gender gap in IT use there.

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Table 1 Computer ownership and Internet use in the U.S. and Japan

Year	U.S.		Japan	
	Computer ownership	Internet use	Computer ownership	Internet use
1997	36.6	22.2	-	9.2
1998	42.1	32.7	25.2	13.4
1999	-	-	-	21.4
2000	-	44.4	38.6	37.1
2001	51.0	53.9	50.1	44.0
2002	56.5	59.1	57.2	54.5

Note: Computer ownership is the fraction of households that own a computer. Internet use is the fraction of individuals that use the Internet (from any location).
Source: U.S.: National Telecommunications and Information Administration (NTIA), Japan: Economic and Social Research Institute (ESRI)

Table 2 Computer ownership and use in the U.S. and Japan

	U.S.				Japan			
	PC at home	Use PC at home cond'l on PC at home	Use PC at work (workers only)	PC use anywhere	PC at home	Use PC at home cond'l on PC at home	Use PC at work (workers only)	PC use anywhere
A. All Years								
Female	0.035**	0.049**	0.602**	0.259**	0.006	-1.033**	-0.308**	-0.659**
	(0.009)	(0.019)	(0.015)	(0.013)	(0.055)	(0.086)	(0.118)	(0.095)
B. Female * Year Interactions								
Female * Year 1997	0.020	-0.090**	0.609**	0.242**	-0.062	-0.996**		
	(0.018)	(0.028)	(0.021)	(0.019)	(0.124)	(0.213)		
Female * Year 1998	0.017				-0.056	-1.158**	-0.378*	-0.642**
	(0.018)				(0.118)	(0.195)	(0.156)	(0.128)
Female * Year 1999					0.144	-1.358**	-0.294	-0.674**
					(0.119)	(0.196)	(0.163)	(0.130)
Female * Year 2000	0.044*				0.135	-0.738**		
	(0.018)				(0.115)	(0.163)		
Female * Year 2001	0.059**	0.166**	0.595**	0.278**	-0.137	-1.034**		
	(0.017)	(0.025)	(0.020)	(0.018)	(0.117)	(0.163)		
C. Gender and Work								
Female	0.053**	0.061**		0.392**	-0.017	-0.883**		-0.442**
	(0.009)	(0.019)		(0.014)	(0.058)	(0.090)		(0.098)
Working	0.158**	0.092**		1.006**	-0.081	0.589**		0.983**
	(0.010)	(0.022)		(0.015)	(0.064)	(0.101)		(0.117)
D. Gender * Work Interactions								
Female working	0.067**	0.124**		0.624**	0.078	-1.004**		-0.450**
	(0.011)	(0.022)		(0.017)	(0.066)	(0.103)		(0.112)
Female not working	-0.110**	-0.063*		-0.704**	0.036	-1.453**		-1.006**
	(0.013)	(0.027)		(0.019)	(0.073)	(0.116)		(0.194)
Male not working	-0.132**	0.046		-0.567**	0.367**	-0.938**		-1.420**
	(0.015)	(0.035)		(0.023)	(0.113)	(0.181)		(0.135)
N	368,545	99,995	125,396	191,887	6,800	3,116	1,785	2,704

* p<0.05; ** p<0.01
Note: Standard errors are reported in parentheses and are White-corrected for individual-specific heteroscedasticity. The regressions also include socioeconomic and demographic controls (see text for details).

Table 3 Internet use in the U.S. and Japan

	U.S.				Japan			
	Anywhere	At home	At home (PC at home)	At work (workers only)	Anywhere	At home	At home (PC at home)	At work (workers only)
A. Gender Coefficients in Base Specification								
Female	0.004	-0.064**	-0.104**	-0.199**	-0.799**	-0.530**	-0.698**	-0.598**
	(0.009)	(0.010)	(0.012)	(0.018)	(0.078)	(0.077)	(0.089)	(0.105)
B. Female * Year Interactions Coefficients								
Female * Year 1997	-0.252**	-0.313**	-0.369**	-0.383**	-0.759**	-0.943**	-0.977**	-0.319
	(0.021)	(0.023)	(0.026)	(0.030)	(0.188)	(0.265)	(0.286)	(0.239)
Female * Year 1998	-0.074**	-0.148**	-0.188**	-0.119*	-1.058**	-1.100**	-1.197**	-0.879**
	(0.019)	(0.020)	(0.023)	(0.048)	(0.162)	(0.236)	(0.253)	(0.222)
Female * Year 1999					-0.585**	-0.494**	-0.753**	-0.420*
					(0.140)	(0.172)	(0.195)	(0.197)
Female * Year 2000	0.109**	0.014	0.002	0.077		-0.132	-0.297	
	(0.018)	(0.018)	(0.022)	(0.048)		(0.140)	(0.159)	
Female * Year 2001	0.169**	0.066**	0.068**	-0.149**	-0.833**	-0.601**	-0.770**	-0.681**
	(0.017)	(0.017)	(0.021)	(0.029)	(0.124)	(0.126)	(0.153)	(0.166)
C. Gender and Work Coefficients								
Female	0.056**	-0.051**	-0.099**		-0.656**	-0.449**	-0.575**	
	(0.010)	(0.010)	(0.012)		(0.081)	(0.081)	(0.092)	
Working	0.441**	0.112**	0.042**		0.604**	0.320**	0.516**	
	(0.012)	(0.012)	(0.014)		(0.090)	(0.090)	(0.106)	
D. Gender * Work Interactions Coefficients								
Female working	0.120**	-0.037**	-0.091**		-0.682**	-0.464**	-0.706**	
	(0.011)	(0.011)	(0.013)		(0.093)	(0.093)	(0.107)	
Female not working	-0.426**	-0.171**	-0.147**		-1.245**	-0.762**	-0.823**	
	(0.014)	(0.014)	(0.017)		(0.107)	(0.105)	(0.169)	
Male not working	-0.289**	-0.080**	-0.019		-0.668**	-0.356*	-1.044**	
	(0.017)	(0.018)	(0.022)		(0.143)	(0.143)	(0.121)	
N	368,545	368,545	191,396	96,987	5,409	6,800	3,108	3,549

* p<0.05; ** p<0.01

Note: For each panel, each column represents a separate regression with the dependend variable as indicated. Standard errors are reported in parentheses and are White-corrected for individual-specific heteroscedasticity. The regressions also include socioeconomic and demographic controls (see text for details).

Table 4 Computer skills in the U.S. and Japan

	U.S.				Japan			
	PC experience	No prior PC experience	Typing speed	Can barely type	PC experience	No prior PC experience	Typing speed	Can barely type
A. Gender Coefficients in Base Specification								
Female	0.122	-0.089	1.139**	-1.137**	-0.564**	0.539**	-0.149**	0.317**
	(0.094)	(0.149)	(0.103)	(0.122)	(0.048)	(0.060)	(0.049)	(0.062)
B. Female * Year Interactions Coefficients								
Female * Year 1997	-0.042	0.084	0.556**	-0.622**	-0.520**	0.526**	-0.062	0.180
	(0.170)	(0.247)	(0.169)	(0.200)	(0.108)	(0.126)	(0.105)	(0.127)
Female * Year 1998					-0.508**	0.410**	-0.242*	0.418**
					(0.109)	(0.123)	(0.104)	(0.126)
Female * Year 1999					-0.556**	0.550**	-0.062	0.236
					(0.107)	(0.125)	(0.105)	(0.130)
Female * Year 2000	0.200	-0.186	1.440**	-1.398**	-0.565**	0.603**	-0.153	0.456**
	(0.113)	(0.186)	(0.129)	(0.151)	(0.098)	(0.129)	(0.106)	(0.141)
Female * Year 2001					-0.654**	0.627**	-0.220*	0.300*
					(0.094)	(0.137)	(0.104)	(0.144)
C. Gender and Work Coefficients								
Female	0.181	-0.150	1.176**	-1.148**	-0.396**	0.390**	0.032	0.207**
	(0.095)	(0.152)	(0.105)	(0.123)	(0.049)	(0.063)	(0.052)	(0.066)
Working	0.478**	-0.377*	0.280*	-0.091	0.704**	-0.516**	0.655**	-0.365**
	(0.119)	(0.179)	(0.136)	(0.155)	(0.053)	(0.071)	(0.059)	(0.074)
D. Gender * Work Interactions Coefficients								
Female working	0.333**	-0.315	1.423**	-1.386**	-0.507**	0.413**	-0.051	0.257**
	(0.111)	(0.181)	(0.119)	(0.140)	(0.060)	(0.071)	(0.061)	(0.073)
Female not working	-0.405**	0.305	0.701**	-0.873**	-1.065**	0.900**	-0.597**	0.558**
	(0.144)	(0.204)	(0.164)	(0.185)	(0.065)	(0.079)	(0.065)	(0.081)
Male not working	-0.020	-0.067	0.456*	-0.649**	-0.977**	0.600**	-0.892**	0.568**
	(0.176)	(0.296)	(0.198)	(0.233)	(0.081)	(0.140)	(0.098)	(0.152)
N	1,445	1,445	1,445	1,445	6,800	6,800	6,800	6,800

* $p<0.05$; ** $p<0.01$

Note: For each panel, each column represents a separate regression with the dependend variable as indicated. Standard errors are reported in parentheses and are White-corrected for individual-specific heteroscedasticity. The regressions also include socioeconomic and demographic controls (see text for details)..

Table 5 Coefficients of Gender and Type of Employment Interactions for Computer Use, Internet Use and Computer Skills in the U.S. and Japan

	U.S.	Japan
A. PC use at work		
Female * Standard	0.819**	0.547**
	(0.018)	(0.165)
Female * Nonstandard	-0.246**	-1.497**
	(0.023)	(0.170)
Male * Nonstandard	-0.548**	-1.252**
	(0.025)	(0.195)
N	125,396	1,785
B. Internet use at work		
Female * Standard	-0.123**	-0.080
	(0.020)	(0.137)
Female * Nonstandard	-0.685**	-1.452**
	(0.032)	(0.152)
Male * Nonstandard	-0.212**	-0.947**
	(0.037)	(0.156)
N	96,987	3,549
C. Computer skills		
PC experience		
Female * Standard	0.313**	0.032
	(0.118)	(0.083)
Female * Nonstandard	0.037	-1.052**
	(0.238)	(0.076)
Male * Nonstandard	-0.226	-0.629**
	(0.183)	(0.090)
N	1,122	4,566
Typing speed		
Female * Standard	1.462**	0.488**
	(0.133)	(0.093)
Female * Nonstandard	1.450**	-0.670**
	(0.244)	(0.078)
Male * Nonstandard	0.025	-0.761**
	(0.175)	(0.088)
N	1,122	4,566

* p<0.05; ** p<0.01
Note: For each panel, each column represents a separate regression with the dependend variable as indicated. Standard errors are reported in parentheses and are White-corrected for individual-specific heteroscedasticity. The regressions also include socioeconomic and demographic controls (see text for details).

Table 6 Impact of Nonstandard Work on Women's Predicted Likelihood of IT Use

	U.S.	Japan
Predicted % use computer at work	58.6	30.2
Predicted % if same % in nonstandard employment as men	60.5	43.2
Predicted % if effect of nonstandard employment same as for men	61.6	37.1
Predicted % use Internet at work	59.2	14.2
Predicted % if same % in nonstandard employment as men	59.6	18.5
Predicted % if effect of nonstandard employment same as for men	60.4	16.2