



FEDERAL
RESERVE
BANK
of ATLANTA

Gender and the Internet

Hiroshi Ono and Madeline Zavodny

Working Paper 2002-10
June 2002

Working Paper Series

Gender and the Internet

Hiroshi Ono, European Institute of Japanese Studies, Stockholm School of Economics
Madeline Zavodny, Federal Reserve Bank of Atlanta

Abstract: This article examines whether there are differences in men's and women's use of the Internet and whether any such gender gaps have changed in recent years. The authors use data from several surveys during the period 1997 to 2001 to show trends in Internet usage and to estimate regression models of Internet usage that control for individuals' socioeconomic characteristics. They find that women were significantly less likely than men to use the Internet at all in the mid-1990s, but the gender gap in usage disappeared by 2000. However, women continue to be less frequent and less intense users of the Internet. The results suggest that there is little reason for concern about sex inequalities in Internet access and usage now, but gender differences in frequency and intensity of Internet usage remain.

JEL classification: J16, O3

Key words: Internet, computers, sex, gender

The authors thank Robert L. Lineberry for helpful comments; Junichiro Miyabe, Juro Toda, and Wayne Parsons for assistance with the Nomura data set; and the Nomura Research Institute for access to their data. The views expressed here are those of the authors' and not necessarily those of the Federal Reserve Bank of Atlanta or the Federal Reserve System. Any remaining errors are the authors' responsibility.

Please address questions regarding content to Hiroshi Ono, European Institute of Japanese Studies, Stockholm School of Economics, P.O. Box 6501, S-113 83 Stockholm, Sweden, 46-8-736-9367, Hiroshi.Ono@hhs.se, or Madeline Zavodny, Research Department, Federal Reserve Bank of Atlanta, 1000 Peachtree Street, N.E., Atlanta, Georgia 30309-4470, 404-498-8977, madeline.zavodny@atl.frb.org.

The full text of Federal Reserve Bank of Atlanta working papers, including revised versions, is available on the Atlanta Fed's Web site at <http://www.frbatlanta.org>. Click on the "Publications" tab and then "Working Papers" in the navigation bar. To receive notification about new papers, please use the on-line publications order form, or contact the Public Affairs Department, Federal Reserve Bank of Atlanta, 1000 Peachtree Street, N.E., Atlanta, Georgia 30309-4470, 404-498-8020.

Gender and the Internet

When a new technology emerges, there are typically differences between initial users and those who wait until the technology is well established before using it. Initial adopters of a wide variety of new technologies are more likely to be young, male, better educated, more affluent, urban, and not members of a racial or ethnic minority group than the population as a whole (Rogers, 1995; Norris, 2001). Socioeconomic and demographic differences in the use of computers and the Internet are important because ability to use these technologies has become increasingly critical to economic success (National Telecommunications and Information Administration [NTIA], 1999). In response to such concerns, the U.S. government has crafted several policy initiatives in an effort to reduce the “digital divide,” such as direct subsidies and tax incentives.

One frequently noted dimension of inequality in Internet access and usage is gender. A number of studies have noted that women are less likely than men to use the Internet, particularly when the technology first became accessible to the general public in the mid-1990s.¹ Gender differences in adoption rates may exist because men and women differ, on average, in socioeconomic status, which influences computer and Internet access and use (Bimber, 2000). Alternatively, men tend to be more interested in computers than women, on average, contributing to gender differences in Internet use (Shashaani, 1997). Others speculate that technology itself is a product of social relations, so diffusion of new innovations favors particular social groups, such as men (Edwards, 1995; Wajcman, 1995). Such intergroup differences tend to eventually

¹ The Internet traces its origin to 1968 and the World Wide Web to 1991, but the Internet remained relatively unknown until graphical browsers made the Web user friendly and accessible to the general public in 1994 (Compaine, 2001a). Studies therefore did not begin to examine gender differences in Internet use until the mid-1990s.

diminish, although not necessarily disappear altogether, as a technology diffuses over time (Compaine, 2001b). Gender differences in Internet access and usage are important because groups that have lower usage rates risk being excluded from job and educational opportunities as well as losing political influence as the Internet becomes increasingly important to how people live and work (Norris, 2001). Gender differences in computer use in classrooms and at home noted by many studies may carry over to Internet usage (e.g., Shashaani, 1997).

This paper examines the extent of gender differences in several measures of Internet usage during the period 1997-2001. We use several data sets to estimate the determinants of whether an individual uses the Internet at all, how frequently, and how many different uses. In addition to reporting differences in means, we use multivariate regression techniques to control for a large set of socioeconomic and demographic characteristics. The results indicate that women were significantly less likely than men to use the Internet during the late 1990s but that this difference disappeared by 2000 and perhaps reversed in 2001. However, the results also indicate that women remained less frequent and less intense users of the Internet.

Previous Research on Gender Gaps in Computer and Internet Usage

Previous studies on computer and Internet usage patterns have examined differences in access and use across a wide range of socioeconomic and demographic groups, including gender. Most of these studies use cross-sectional data and report descriptive statistics and cross-tabulations and, because of data limitations, do not examine how intergroup differences have changed over time. We first briefly survey the literature on changes in sex differences in computer use over time and then discuss previous research on trends in gender differences in

Internet usage. This paper does not focus on the underlying reasons for gender differences in computer and Internet usage but instead seeks to identify recent trends.²

Previous studies conclude that women were less likely than men to use personal computers during the 1980s but that the gender gap in computer usage has since disappeared (Kominski, 1992; Kominski and Newburger, 1999). Men and women have had similar overall rates of computer usage since at least 1993 (Bikson and Panis, 1995; NTIA, 2002). Indeed, women are more likely than men to use computers and the Internet at work, in part because of occupational differences (Bikson and Panis, 1995; Kominski and Newburger, 1999).

Findings on trends in the gender gap in Internet usage are mixed. Pitkow and Kehoe (1997) and Clemente (1998) report that Internet users were predominantly male in 1994, but the proportion of users who are female increased between 1994 and 1997. Katz, Rice, and Aspden (2001) similarly report that the fraction of new Internet users who are female increased steadily over 1992-2000 and that women constituted the majority of new Internet users during 1997-2000. These studies focus on gender differences among new users, not the fraction of all users at a given point in time who are female. Bimber (2000) finds that men were about 5 percentage points more likely than women to have access to the Internet in 1996 and 1998—a statistically insignificant gap—but the gap increased to 10 percentage in 1999 and was significant. Hoffman, Novak, and Schlosser (2001), in contrast, report that the gender gap in Internet access and use narrowed between the spring and fall of 1997 but then remained flat through the spring of 1998. The NTIA (2002) similarly notes that the sex difference in Internet usage rates declined from about 4 percentage points in 1997 to nearly zero in 2000 and remained near zero in 2001. Of these studies, only Bimber (2000) controls for socioeconomic and demographic characteristics

² For detailed discussions of theoretical underpinnings for gender differences in computer and Internet usage, we refer readers to, among others, Edwards (1995), Wajcman (1995), and Shashaani (1997).

when examining gender differences. Bimber's study is also the only one that examines a measure of Internet behavior besides simple usage; the paper concludes that women are less frequent users of the Internet than men and that this gender gap in intensity of use did not narrow between 1996 and 1999.

Our study makes several contributions to this literature on gender differences in Internet usage. Previous studies reach differing conclusions on whether there is a gender gap in Internet usage, in part because of differences in survey time frames and in the specific questions asked in various surveys. Our empirical analysis uses several different datasets, including the largest available survey that includes questions on Internet usage, the Current Population Survey. We use questions about Internet usage in order to determine whether there are significant gender differences and whether any such differences have changed over time. We use data through 2001, thereby bringing the literature up to date with the most recently available data. We also examine several other dimensions of Internet usage—frequency and number of uses—in order to give a more complete picture of gender differences in Internet usage.

Data

We use several data sets to examine determinants of Internet usage, frequency, and intensity at different points in time during the period 1997 to 2001. We also examine how sex differences in Internet usage have changed over time. We use multiple data sets to give a more complete picture of Internet usage patterns; each survey asks slightly different questions about Internet activities. The surveys we use in addition to the Current Population Survey are the Pew Biennial Media Consumption Survey and the Nomura Research Institute Cyber Life

Observations Survey. Our sample from each survey includes all adult respondents with complete answers to the Internet usage 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. This analysis focuses on the CPS 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. 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 allows us to examine changes in patterns of Internet usage over a 4-year period, longer than any other available data source.

We use these four CPSs to examine several dimensions of Internet usage: Internet usage at home among individuals with access to a computer at home; Internet usage anywhere among all individuals; and the reported number of uses of the Internet among individuals who report using the Internet at home. Our measure of number of Internet uses ranges from one to five, with a value of five indicating five or more uses, such as e-mail, games, shopping, etc.

As Table 1 shows, a higher proportion of men than women use the Internet at home, given that their household has a computer, and use the Internet anywhere in the 1997 and 1998 surveys; the differences in these means are significant at the 1 percent level. In 1997, for example, men are 8 percentage points more likely than women to use the Internet at home and 5 percentage points more likely to use the Internet anywhere. The gender gap in Internet usage rates is negligible in 2000 and has completely disappeared by the 2001 survey, both conditional on computer ownership and unconditionally. However, the sample means indicate that the

gender gap in the average number of uses of the Internet among individuals who use the Internet at home remains sizable (and significant), although it declines between 1997 and 2001.

Pew Biennial Media Consumption Survey (Pew)

The Pew Research Center for the People and the Press conducted telephone surveys in April and May of 1998 and 2000 that included questions about computer and Internet usage as well as about demographic characteristics. We use the Pew data to examine determinants of whether individuals use the Internet anywhere, given that they use a computer anywhere. In other words, the Pew sample conditions on computer usage, an option not available in the other surveys used here. This allows us to examine to what extent any sex differences in Internet usage are due to sex differences in computer usage.

Men are more likely than women to use the Internet anywhere, given that they use a computer anywhere, on average. As Table 1 indicates, the gender gap in Internet usage among computer users in the Pew data fell from 12 percentage points in 1998 to 4 percentage points in 2000; in addition, the difference in means is significant at the 1 percent level in 1998 but only at the 5 percent level in 2000.

Nomura Research Institute Cyber Life Observations Survey (CLO)

The Nomura Research Institute conducted its CLO surveys of technology usage in the U.S. in October 1997 and October 2000. Previous studies have not used the CLO surveys, which are proprietary data, to examine the determinants of Internet usage. The surveys asked respondents about ownership and use of a personal computer at home and their Internet usage at home and at other locations as well as about their demographic characteristics. We use the CLO

data to examine the determinants of frequency of Internet usage at home, an aspect of Internet behavior not available in all of the CPSs or in the Pew surveys. From the CLO data, we created a variable that ranges from one to six indicating self-assessed frequency of Internet use among individuals who report using the Internet at home. A higher value indicates more frequent use of the Internet.

Among individuals who use the Internet at home, women are less frequent users than men, and the difference in means is significant in both years. The sample means in Table 1 suggest that the gender gap in frequency of use may have declined over time, however.

Methods

The gender differences in Internet usage suggested by the sample means in Table 1 may reflect average differences in socioeconomic status or other demographic factors instead of underlying differences across the sexes. We therefore use multivariate analysis to estimate the relationship between gender and Internet usage, controlling for observable characteristics. We use logit regressions to examine the determinants of our three measures of whether an individual uses the Internet at home and ordered logit regressions to examine the determinants of the number of uses of the Internet and the frequency of Internet usage.

All regressions include categorical variables for sex, age, education, marital status, and household income.³ We constructed the measures of socioeconomic and demographic characteristics as similarly as possible across the data sets, but the surveys differ somewhat in the

³ The regressions using CPS and Pew data include controls for 10 of 11 age groups while the CLO regression includes controls for 8 of 9 age groups. The CPS regressions include controls for 14 of 15 household income groups; the Pew, 8 of 9; the CLO, 4 of 5. All regressions include controls for 3 of 4 education groups (high school dropouts, high school graduates, some college, college graduates) and 2 of 3 marital status groups (married, separated/divorced/widowed, never married). All results not shown in the tables are available from the authors on request.

control variables available. The CPS and Pew samples are restricted to individuals aged 18 and older while the CLO samples include individuals aged 15-59. Regressions using the CPS and Pew data also control for race and ethnicity, which are not available in the 1997 CLO survey and therefore not included in the model that uses the CLO data.⁴ The regressions using the CPS and CLO data include a linear variable measuring household size, and the regressions using the Pew and CLO data include a dummy variable indicating whether there are any children present in the household. For each outcome variable, the regressions pool all of the data from the surveys that include that outcome. The regressions include an indicator variable for each survey year to control for average changes in the outcome variable over time, such as a secular increase in Internet usage.⁵

Each regression contains interactions of all of the covariates with the survey year dummy variables. This allows us to examine how the relationships between the outcomes and the covariates have changed over time. The reported coefficients on the female dummy variable interacted with a year dummy variable therefore measure the average of the outcome variable among women relative to men in that survey year, controlling for other factors. In the regression examining the likelihood of Internet usage at home in the CPS data, for example, the coefficient of the female dummy variable interacted with the dummy variable for the 1997 survey measures the likelihood of a woman using the Internet at home relative to an otherwise-comparable man in 1997. A value below zero indicates that women are less likely than men to use the Internet at home that year, on average. The pattern of the estimated coefficients of the interaction variables over time indicates the trend in the gender gap, if any.

⁴ The CPS and Pew regressions include controls for 4 of 5 race/ethnicity groups (non-Hispanic whites, non-Hispanic blacks, non-Hispanic Asians, non-Hispanic other, and Hispanics).

⁵ The first survey year is the omitted category for the set of survey year dummy variables.

Results

Much like the sample means, the results after controlling for socioeconomic and demographic characteristics indicate that a gender gap in Internet usage existed during the 1990s but has since disappeared. Indeed, women were more likely than men to use the Internet by 2001. As columns 1 and 2 of Table 2 show, women were significantly less likely than men to use the Internet in 1997 and 1998 both at home, conditional on computer ownership, and anywhere, not conditional on computer ownership or use. Transforming the results for 1997 into odds ratios, women were 68 percent as likely as men to use the Internet at home and 78 percent as likely to use the Internet anywhere. In 2000 and 2001, in contrast, women were significantly more likely to use the Internet anywhere, according to the CPS data. Women were also more likely than men to use the Internet at home in 2001.⁶ In the 2001 CPS data, the relative odds ratios are 1.07 for Internet use at home and 1.2 for Internet use anywhere. In results not shown in the table, data from the CLO also suggest that gender differences in Internet usage have fallen over time, although the differences are not significant in the smaller CLO sample.

The results in the first two columns of Table 2 and the relative odds ratios suggest that, among people who do not use the Internet at home, women may be more likely than men to use the Internet outside the home. This difference may result from women being more likely to use computers and the Internet at work, as previous studies report. We therefore use the Pew surveys to examine whether there is a gender gap in Internet use after conditioning on computer use. The results, which are reported in Table 3, indicate that there was a significant sex difference in

⁶ Unlike the estimated coefficients, the gender difference in sample means for the Internet usage at home or anywhere variables for 2001 are not significant, indicating that women's socioeconomic and demographic characteristics act to reduce Internet usage relative to men.

Internet use anywhere in 1998 but not in 2000. This confirms the finding in the CPS that the gender gap in Internet usage has disappeared over time, and the result appears to hold among both computer users and the general population. In results not reported in the table, the Pew data indicate that women are significantly more likely than men to use a computer anywhere in both 1998 and 2000.

In contrast to the trends in Internet usage, gender gaps in the number of uses of the Internet and in the frequency of Internet use persisted over time. As the ordered logit results reported in column 4 of Table 2 indicate, women have significantly fewer uses of the Internet than men. However, the estimated coefficients suggest that this gender gap diminished between 1997 and 2001; the coefficients of the female interaction terms for 1997 and 1998 are significantly different from those for 2000 and 2001. In results not shown in the table, data from the CLO surveys on the number of uses also indicate that women have significantly fewer uses of the Internet than men but that the gap declined between 1997 and 2000. According to the CLO data, the gender gap in frequency of Internet use remained significant but may have fallen over time (although the interactions shown in column 5 are not significantly different at conventional levels).

Discussion

As discussed by Bikson and Panis (1995), access to computers and the Internet confers considerable economic benefits. For example, individuals who have computer skills earn about 15 percent more, on average, than other workers with same education and experience but without computer skills (Krueger, 1993), and the majority of new jobs require computer skills (Holzer, 1996). Babb (1998) notes that individuals unfamiliar with computers and the Internet have fewer

employment opportunities as the Internet becomes an increasingly important means of job search. In addition, the Internet may foster civil and political involvement (Katz, Rice, and Aspden, 2001).

Identifying gaps in Internet access and usage and monitoring how any such gaps change over time enables policymakers to assess the success of government initiatives and to target subsidies designed to reduce the “digital divide” to the appropriate socioeconomic and demographic groups. Our results indicate that there is no longer a gender gap in Internet usage. However, there continues to be a gender gap in frequency and intensity of use, although this gap appears to have diminished over time.

This study does not examine sex differences in specific uses of the Internet, such as e-mail, distance learning, or job search.⁷ Investigating the extent of any such differences is obviously an area for future research, as is learning the consequences of gender differences in Internet activities.

⁷ E-commerce, which includes online shopping, is one area where women are at least as likely as men to use the Internet (Ono and Zavodny, 2002). Howard, Rainie, and Jones (2001) and Weiser (2000) note several other gender differences in Internet uses.

REFERENCES

- Babb, Stephanie F. 1998. "The Internet as a Tool for Creating Economic Opportunity for Individuals and Families." Ph.D. dissertation, University of California, Los Angeles.
- Bikson, Tora K., and Constantijn W.A. Panis. 1995. "Computers and Connectivity: Current Trends." Pp. 13-40 in Robert H. Anderson et al., eds., *Universal Access to E-Mail: Feasibility and Societal Implications*, Santa Monica, CA: RAND.
- Bimber, Bruce. 2000. "Measuring the Gender Gap on the Internet." *Social Science Quarterly* 81: 868-876.
- Clemente, Peter. 1998. *The State of the Net: The New Frontier*, New York: McGraw Hill.
- Compaine, Benjamin M. 2001a. "The Set-Up: Documenters of the Digital Divide." Pp. 1-5 in Benjamin M. Compaine, ed., *The Digital Divide*, Cambridge: MIT Press.
- Compaine, Benjamin M. 2001b. "Information Gaps: Myth or Reality?" Pp. 105-118 in Benjamin M. Compaine, ed., *The Digital Divide*, Cambridge: MIT Press.
- Edwards, Paul N. 1995. "From 'Impact' to Social Process." Pp. 257-285 in Shela Jasanoff, et al., eds., *Handbook of Science and Technology Studies*, London: Sage Publications.
- Hoffman, Donna L., Thomas P. Novak, and Ann E. Schlosser. 2001. "The Evolution of the Digital Divide." Pp. 47-97 in Benjamin M. Compaine, ed., *The Digital Divide*, Cambridge: MIT Press.
- Holzer, Harry. 1996. *What Employers Want*. New York: Russell Sage Foundation.
- Howard, Philip E.N., Less Rainie, and Steve Jones. 2001. "Days and Nights on the Internet." *American Behavioral Scientist* 45: 383-404.
- Katz, James E., Ronald E. Rice, and Philip Aspden. 2001. "The Internet, 1995-2000." *American Behavioral Scientist* 45: 405-419.

- Kominski, Robert. 1992. "Computer Use in the United States: The Bureau of the Census Surveys." Paper presented at the Annual Meeting of the American Society for Information Science, Pittsburgh.
- Kominski, Robert and Eric Newburger. 1999. "Access Denied: Changes in Computer Ownership and Use: 1984-1997." Paper presented at the Annual Meeting of the American Sociological Association, Chicago.
- Krueger, Alan. 1993. "How Computers Have Changed the Wage Structure: Evidence Microdata, 1984-1989." *Quarterly Journal of Economics* 108: 33-61.
- National Telecommunications and Information Administration (NTIA). 1999. *Falling through the Net: Defining the Digital Divide*. Washington, D.C.: U.S. Department of Commerce.
- National Telecommunications and Information Administration (NTIA). 2002. *A Nation Online: How Americans are Expanding their Use of the Internet*. Washington, D.C.: U.S. Department of Commerce.
- Norris, Pippa. 2001. *Digital Divide: Civic Engagement, Information Poverty and the Internet in Democratic Societies*. New York: Cambridge University Press.
- Ono, Hiroshi and Madeline Zavodny. 2002. "Race, Internet Usage and E-commerce." Federal Reserve Bank of Atlanta, Working Paper 2002-01.
- Pitkow, Jim and Colleen Kehoe. 1997. "Special Presentation of Selected Results for the WWW History Data." Available online at http://www.cc.gatech.edu/gvu/user_surveys/www6.
- Rogers, Everett M. 1995. *Diffusion of Innovations*, 4th edition. New York: Free Press.
- Shashaani, Lily. 1997. "Gender Differences in Computer Attitudes and Use among College Students." *Journal of Educational Computing Research* 16: 37-51.

Spooner, Tom, and Lee Rainie. 2000. "African-Americans and the Internet." *Pew Online Life Report*. Washington, D.C.: Pew Internet & American Life Project.

Wajcman, Judy. 1995. "Feminist Theories of Technology." Pp. 189-204 in Shela Jasanoff, et al., eds., *Handbook of Science and Technology Studies*, London: Sage Publications.

Weiser, Eric B. 2000. "Gender Differences in Inter Use Patterns and Internet Application Preferences." *CyberPsychology & Behavior* 3: 167-178.

TABLE 1
Sample Means for Measures of Internet Usage, by Sex

Survey and Variable	1997	1998	2000	2001
CPS: Use Internet at Home, Conditional on Computer in Household				
Men	0.39	0.52	0.67	0.72
Women	0.31	0.47	0.66	0.73
CPS: Use Internet Anywhere				
Men	0.25	0.35	0.47	0.54
Women	0.20	0.32	0.46	0.54
Pew: Use Internet Anywhere, Conditional on Use Computer Anywhere				
Men	--	0.65	0.81	--
Women		0.53	0.77	
CPS: Number of Internet Uses, Conditional on Use Internet at Home				
Men	3.03	3.33	3.30	4.19
Women	2.72	2.98	3.14	4.08
CLO: Frequency of Internet Use, Conditional on Use Internet At Home				
Men	4.69	--	4.28	--
Women	4.16		3.83	

NOTE: The CPS and Pew data are weighted using the survey final weights. The number of Internet uses variable ranges from 1 to 5 and the frequency of Internet use variable ranges from 1 to 6, with higher values indicating more usage.

TABLE 2
Regression Estimates of Gender Gap in Internet Usage

	Use Internet at Home (conditional) CPS	Use Internet Anywhere (unconditional) CPS	Use Internet Anywhere (conditional) Pew	Number of Internet Uses (conditional) CPS	Frequency of Internet Use (conditional) CLO
Female * Year 1997	-0.380** (0.026)	-0.253** (0.021)	--	-0.379** (0.032)	-0.637* (0.321)
Female * Year 1998	-0.189** (0.023)	-0.075** (0.019)	-0.349** (0.109)	-0.436** (0.028)	--
Female * Year 2000	-0.008 (0.023)	0.108** (0.019)	-0.141 (0.128)	-0.203** (0.022)	-0.494** (0.177)
Female * Year 2001	0.067** (0.022)	0.184** (0.018)	--	-0.182** (0.023)	--
Year 1998	0.511** (0.122)	0.637** (0.092)	--	0.468** (0.155)	--
Year 2000	1.346** (0.117)	1.222** (0.088)	2.003** (0.499)	0.124 (0.142)	-1.099 (1.070)
Year 2001	1.867** (0.114)	1.583** (0.087)	--	1.294** (0.142)	--
Log likelihood	-110,343	-173,698	-2070	-163,344	-1016
N	191,396	368,545	4,036	115,287	610

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

NOTE: Shown are estimated coefficients from logit regressions (columns 1-3) and ordered logit regressions (columns 4-5). Standard errors are in parentheses and are White-corrected for individual-specific heteroscedasticity. The regressions also include other demographic controls interacted with the year variables (see text for details). The dummy variable for the first survey year is omitted in each regression. The CPS and Pew data are weighted using the survey final weights.