Race and the Digital Divide

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Race and the Digital Divide

Abstract

In recent years, a plethora of public and private programs in the United States have been created to close the "Digital Divide." Interestingly, however, we know very little about the underlying causes of racial differences in rates of computer and Internet access. In this paper, I use data from the Computer and Internet Use Supplement to the August 2000 Current Population Survey (CPS) to explore this question. Estimates from the CPS indicate that Mexican-Americans are roughly one-half as likely to own a computer and one-third as likely to have Internet access at home than are whites. The black home computer rate is 59 percent of the white rate and the black home Internet access rate is 51 percent of the white rate. Using Blinder-Oaxaca decompositions, I find that racial differences in education, income and occupation contribute substantially to the black/white and Mexican-American/white gaps in home computer and Internet access rates. The digital divide between races, however, is not simply an "income divide" as income differences explain only 10 to 30 percent of the gaps in access to technology. I do not find evidence that price or school differences are responsible for the remaining gaps. I find some evidence, however, that language barriers may be important in explaining low rates of computer and Internet access among Mexican-Americans.

1. Introduction

Although computer and Internet use is expanding rapidly in the United States, large disparities exist between ethnic and racial groups. For example, only 29.3 percent of African-Americans and 23.7 percent of Latinos use the Internet. In contrast, 50.3 percent of white, non-Latinos use the Internet (U.S. Department of Commerce 2000). Racial differences in computer ownership are not as large, but remain substantial.[1] Interestingly, however, policy makers cannot agree on the importance of and solutions to these differences in access to information technology or the so-called "Digital Divide." The Department of Agriculture, Commerce, Education, Health and Human Services, Housing and Urban Development, Justice and Labor, each have programs addressing the digital inclusion of various groups, and spending on the E-rate program, which provides discounts to schools and libraries for the costs of telecommunications services and equipment, totaled $5.8 billion as of February 2001 (Puma, Chaplin, and Pape 2000). More recently, however, the current Chairman of the Federal Communications Commission, Michael Powell, referred to the digital divide as "a Mercedes divide. I'd like to have one; I can't afford one," and the funding for several technology-related programs affecting disadvantaged groups is in jeopardy (Servon 2002).

Underlying the policy debate is the question of how we should view the digital divide, especially as it pertains to access to home computers and the Internet. Should the digital divide be viewed simply as a disparity in utilization of goods and services arising from income differences just as we might view disparities in purchases of other electronic goods, such as cameras, stereos, or televisions? Or, should the digital divide be viewed as a disparity in a good that has important enough externalities, such as education, healthcare, or job training, that it warrants redistributive policies (see Noll, et al. 2000 and Crandall 2000 for example). Although a clear answer to this question may be unattainable, there are a few reasons to be concerned about potential consequences of the digital divide for disadvantaged minority groups.

First, information technology skills are becoming increasingly important in the labor market. The U.S. Department of Labor's 2002-03 Occupational Outlook Handbook projects Computer Software Engineers-Applications, Computer Support Specialists, Computer Software Engineers-Systems Software, Network and Computer Systems Administrators, and Network Systems and Data Communications Analysts to be the fastest growing occupations from 2000 to 2010. Freeman (2002) provides evidence that the share of employment in information technology industries and occupations and the share of employees using computers and the Internet at work have risen dramatically over the past decade, a large percentage of new hires are required to use computers (Holzer

[1] I henceforth use the term race to refer to ethnicity and race for brevity.

1996), and workers who use computers on the job earn more than their non-computer-using counterparts, although there is some debate over why (Krueger 1993, Autor, Katz and Krueger 1998, and DiNardo and Pischke 1997). Furthermore, online-job search is becoming increasingly popular. Monster.com posted 3.9 million resumes and 430,000 jobs in August 2000 (Autor 2001), and the percentage of unemployed workers searching for jobs online grew from 15 percent in 1998 to 25.5 percent in 2000 (Kuhn and Skuterud 2000, 2004).[2]

The Internet is also "expected to become a primary medium for communications, commerce, education, and entertainment in the 21st century" (U.S. General Accounting Office 2001). Access to the Internet may be increasingly important for consumers as it has lowered the price of many goods and services, provides extensive information on many products, and has made shopping more convenient. As a result online sales represent an increasing share of all retail sales (see Morton, Zettelmeyer and Risso 2000, Bakos 2001, Borenstein and Saloner 2001, and Ratchford, Talukdar and Lee 2001). It has also been argued that the Internet improves political engagement (Norris, 2001). Finally, recent evidence suggests that access to home computers may increase the returns to classroom use of computers and improve educational outcomes among children (see Attewell and Battle 1999, Selwyn 1998, Underwood, Billingham and Underwood 1994, and Fairlie 2004).

Although several previous studies using different data sources document large racial differences in rates of computer and Internet use, we know very little about the underlying causes of these differences. A recent report by the U.S. Department of Commerce (2000) finds that group differences in income and education account for approximately 50 percent of the gap in Internet use between African-Americans or Latinos and the national average. A simple "shift-share" analysis is used, however, to calculate this estimate, which does not control for other factors correlated with income and education. Additional factors that may be especially important are employment status, occupation and family structure. Exposure to computers at work or the perceived need to acquire computer skills for future employment opportunities may be the catalyst for many individuals to purchase computers and subscribe to Internet service.

Using data from the Computer and Internet Use Supplement to the August 2000 Current Population Survey (CPS), I document and explore the underlying causes of racial differences in computer and Internet access. In particular, I examine whether racial differences in the most likely "suspects" -- family income, education, occupation, employment status and family structure -- contribute to disparities in access to computers and the Internet at home. To date, we know

[2] Kuhn and Skuterud (2004), however, do not find evidence of shorter unemployment spells among Internet searchers than among non-Internet searchers after controlling for differences in observable characteristics.

very little about the importance of these potential causes. Using detailed information on computer and Internet access, I also explore whether telephone access, price differences and language barriers contribute to the digital divide.

2. Data

I use data from the Computer and Internet Usage Supplement to the August 2000 Current Population Survey (CPS). The survey, conducted by the U.S. Census Bureau and the Bureau of Labor Statistics, is representative of the entire U.S. population and interviews approximately 50,000 households. It contains a wealth of information on computer and Internet use by families and individuals.

In the August 2000 Computer and Internet Supplement, all of the questions pertaining to computers refer to home computers. Information on Internet use outside the home exists, however, I focus on access to the Internet at home. Rates of Internet use outside the home are substantially lower than inside the home as discussed below. Internet access at home is also of more interest because racial disparities in access to the Internet at any location, at least among urban residents, should be negligible. Most Americans have access to the Internet at a public library (U.S. General Accounting Office, 2001). Finally, home access most likely provides more frequent and longer access than other locations, and is the typical metric for measuring the digital divide (U.S. Department of Commerce 2000).

The samples include all working-age (25-55) civilian adults who do not live in group quarters. In some analyses, I include controls for labor force status and occupations. Thus, I do not include children in the analysis.[3] I do not include individuals older than 55 to avoid retirement issues and possible connections with computer use (see Friedberg 2001).

3. Computer and Internet Access

Blacks and Latinos are substantially less likely to have a computer at home than are white, non-Latinos. Table 1 reports the fraction of all working-age adults (ages 25-55) who have a computer at home.[4] Estimates from the 2000 CPS indicate that 70.4 percent of whites have access to a home computer. In contrast, only 41.3 percent of blacks and 38.8 percent of Latinos have access to a home computer. These large racial disparities are not simply due to differences in who

[3] Krueger (2003) finds evidence of large racial disparities in computer use at school using CPS data for selected years from 1984 to 1997. He finds that family income and region of residence explain a large percentage of the gap between black and white children in computer use at school.
[4] For all reported measures of access to technology in Table 1, white/minority differences are statistically significant.

owns the personal computers. Only a small percentage of home computers are owned by employers or home businesses.

Table 1
Home Computer and Internet Access Rates by Race/Ethnicity
CPS (2000)

	Black	Latinos	Mexican-Americans	Whites
Percent of adults who have a home computer	41.3%	38.8%	33.0%	70.4%
Sample size	5,433	5,339	3,362	40,208
Percent of computer owners who have access to the Internet at home (conditional)	72.1%	69.8%	67.1%	83.7%
Sample size	2,276	2,044	1,072	28,412
Percent of adults who have access to Internet at home (unconditional)	29.8%	27.1%	22.1%	58.9%
Sample size	5,433	5,339	3,362	40,208

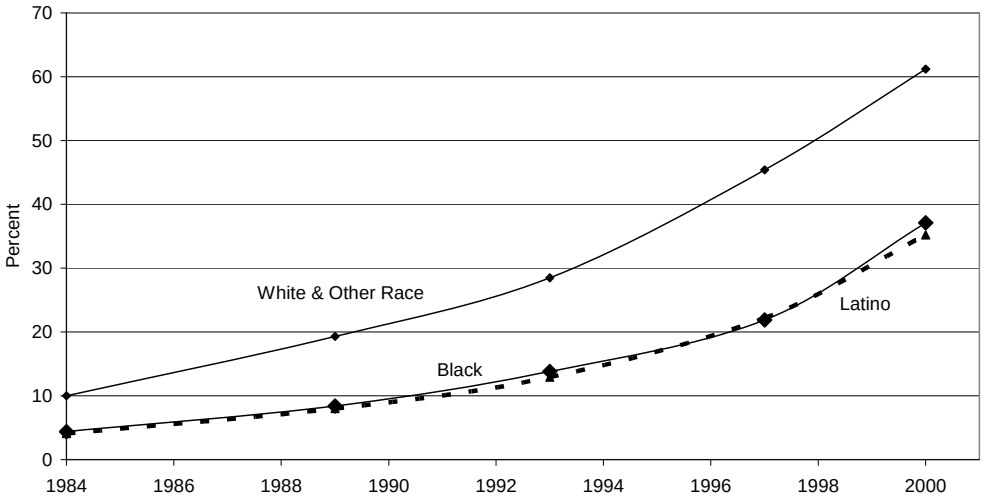
Notes: (1) The sample consists of adults ages 25-55. (2) All estimates are calculated using sample weights provided by the CPS.

Racial disparities in access to home computers have existed for at least as long as the government began collecting data on computer use. Figure 1 displays the percent of adults (18 and over) who have access to a home computer by race for selected years from 1984 to 2000. Estimates for years prior to 2000 are reported in U.S. Bureau of the Census (1984, 1989, 1993, 1997). In 1984, only 4.4 percent of blacks and 4.1 percent of Latinos had home computers, whereas 10.0 percent of whites and those of other race had home computers. Over the past 16 years, the racial gaps have declined in relative terms, but not in percentage point terms. The estimates clearly indicate, however, that blacks and Latinos have been and continue to be much less likely to have access to a home computer than whites.

Racial differences in access to the Internet at home are also a cause of concern among policymakers, partly due to arguments that economic advancement, educational advancement, and community participation are increasingly dependent on access to the Internet (see U.S. Department of Commerce 2000 for example). Table 1 reports the fraction of adult computer owners who have Internet access at home. Conditional on having a home computer, blacks and Latinos are less likely than whites to have access to the Internet at home. Their rates of home Internet access are 86 and 83 percent of the white rate, respectively. These differences are also not due to racial differences in

access to telephones as conditioning on telephone access I find very similar Internet access rates by race.

Figure 1
Percent of Persons (Ages 18+) with Access to a Home Computer by Race/Ethnicity
CPS (1984-2000)



From the computer ownership rate and conditional Internet access rate, the unconditional rate of Internet access at home can be calculated. It represents the fraction of *all* working-age adults who have access to the Internet at home. The racial disparities noted above become even larger for the unconditional Internet access rate. Only 29.8 percent of blacks and 27.1 percent of Latinos have access to the Internet at home, compared to 58.9 percent of whites.

Table 1 also reports estimates for Mexican-Americans. Of all Latino groups, Mexican-Americans have the lowest rates of access to home computers and the Internet (Fairlie 2002). They also represent the largest Latino group in the United States. The differences between Mexican-Americans and whites in access to technology are striking. Mexican-Americans are roughly half as likely as whites to own a computer, and they are roughly one third as likely to have Internet access at home. These differences have been masked somewhat in government publications, which only report estimates for all Latinos. I make comparisons between Mexican-Americans and whites below. I do not make comparisons to whites for other Latino groups because of small sample sizes.

LOCATIONS OF INTERNET USE

The CPS provides detailed information on locations of Internet use. Estimates are reported in Table 2. I first examine home Internet use conditional on having access to the Internet at home. Conditional on access to the Internet, blacks are somewhat less likely to use the Internet than are whites. Mexican-Americans, in contrast, are substantially less likely to use the Internet at home. Both of these estimates are statistically different from the white rate. Although these patterns are consistent with racial differences in preferences explaining disparities in Internet use, they may also be due to racial differences in the quality of Internet access, such as location in the house, competition from other household users, and connection speed.[5]

Table 2
Locations of Internet Use by Race/Ethnicity
CPS (2000)

	Blacks	Mexican-Americans	Whites
Percent of adults with Internet access at home who use the Internet at home	79.1%	66.9%	86.6%
Sample Size	1,644	717	23,671
Percent of adults who use the Internet at home	23.7%	14.8%	51.2%
Percent of adults who use the Internet at work	14.5%	7.7%	24.7%
Percent of adults who use the Internet outside the home other than at work	5.1%	2.4%	4.6%
Percent of adults who use the Internet anywhere	34.7%	21.0%	61.6%
Sample Size	5,433	3,362	40,208

Notes: (1) The sample consists of adults ages 25-55. (2) All estimates are calculated using sample weights provided by the CPS.

Table 2 also reports estimates of Internet use outside the home. Large racial differences exist for Internet use outside the home. For example, 24.7 percent of whites use the Internet at work, whereas only 14.5 percent of blacks and 7.7 of Mexicans use the Internet at work. Internet use at other locations of use, such as school, libraries, community centers and someone else's computer,

[5] For example, hi-speed Internet connections are more common for whites with home Internet access than for blacks or Mexican-Americans with home Internet access.

are relatively low for all racial groups.[6] Creating a measure of Internet use at any location, I find large racial differences. Sixty-two percent of whites use the Internet anywhere, compared to 34.7 percent of blacks and 26.2 percent of Latinos. Evidently, the low rates of home Internet use among blacks and Latinos relative to whites are not simply due to substitution of outside-the-home use for home use.[7] Furthermore, Internet use at home comprises a large fraction of all Internet users, and justifies the focus on home access below.

HOW DO MEXICAN-AMERICANS AND BLACKS USE THE INTERNET AT HOME

It is potentially useful to examine whether racial groups differ in how they use the Internet. Information is available in the 2000 CPS on types of Internet use, but unfortunately not on other types of computer use. Table 3 reports results. As expected, the most common use of the Internet is for email. Among black Internet users, 83.3 percent use email regularly. A slightly lower percentage of Mexican-Americans use the Internet for email, and a slightly higher percentage of whites use the Internet for email. The next two most common uses of the Internet are "searching for information, such as government, business or health," and "to check news, weather, or sports." The percentages are fairly similar across groups. In fact, the main conclusion that can be drawn from these results is that blacks, Mexican-Americans and whites do not differ substantially in how they use the Internet.

The use of online job search is of special interest. Kuhn and Skuterud (2000, 2004) find that 15 and 25.5 percent of unemployed jobseekers used the Internet for job search in 1998 and 2000, respectively. Conditioning on unemployment, I find that 31.0 percent of whites use the Internet at home to search for jobs. In contrast, only 9.1 percent of unemployed blacks and 10.9 percent of unemployed Mexican-Americans use the Internet at home for job search. These disparities are primarily due to differences in access to the Internet at home. I find that conditioning on using the Internet at home, 60.0, 52.1 and 58.4 percent of unemployed whites, blacks, and Mexican-Americans use the Internet at home to search for jobs, respectively.

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[6] The black/white difference in non-home, non-work Internet use is not statistically significant. All of the other estimates of Internet use reported in Table 2 are statistically different between minorities and whites.

[7] In addition, as reported in Table 9 only a small percentage of individuals who do not use the Internet at home report that they can use it somewhere else as the main reason for not subscribing to Internet service.

Table 3
Home Internet Activity Use by Race/Ethnicity
CPS (2000)

	Blacks	Mexican-Americans	Whites
Percent of home Internet users who use the Internet:			
For E-mail	83.3%	79.9%	88.2%
To take educational courses, or do research for school	27.8%	27.0%	19.6%
To check news, weather, or sports	52.5%	48.5%	55.3%
For making phone calls	8.8%	7.9%	5.9%
To search for information such as business, government, health or education	67.3%	63.2%	67.2%
To search for jobs	30.7%	23.3%	20.1%
To do job-related tasks	40.6%	33.1%	39.5%
To shop, pay bills or other commercial activities	38.4%	34.8%	44.6%
For any other purpose	8.6%	8.7%	9.1%
Sample Size	1,295	486	20,337

Notes: (1) The sample consists of adults ages 25-55 who are currently using the Internet at home. (2) All estimates are calculated using sample weights provided by the CPS.

4. An Empirical Model of Home Computer and Internet Access

A simple linear random utility model of the decision to purchase a computer is used. Assume that the utility associated with having a computer or not having a computer is a function of an individual's characteristics, x, and an additive error term, ε. Define U_{i0} and U_{i1} as the ith person's indirect utilities associated with not having a computer and having a computer, respectively. These indirect utilities can be expressed as:

(4.1) $U_{i0} = \alpha_0 + x_i'\beta_0 + \varepsilon_{i0}$, and

(4.2) $U_{i1} = \alpha_1 + x_i'\beta_1 + \varepsilon_{i1}$.

The ith person purchases a home computer if $U_{i1} > U_{i0}$. If $y_i=1$ if the ith person owns a computer then:

(4.3) $P(y_i=1) = P(U_{i1} > U_{i0}) = F[(\alpha_1-\alpha_0) + x_i'(\beta_1-\beta_0)]$,

where F is the cumulative distribution function of $\varepsilon_{i1}-\varepsilon_{i0}$. The model can be estimated with a logit regression by assuming that $\varepsilon_{i1}-\varepsilon_{i0}$ has a logistic distribution.

The indirect utilities are functions of several measurable individual characteristics. Income is likely to be a key determinant. It has an effect on the budget constraint underlying (4.1) and (4.2), and it may also affect preferences for owning a computer, especially in the sense of "keeping up with the Joneses." Income may be especially important in the presence of liquidity constraints. Although some consumers may view computers as a worthwhile investment they may not be able to finance the purchase of one.

Preferences for owning a computer are likely to vary across individuals and may depend on exposure to and the perceived usefulness of owning a computer. This may be related to a person's education level, marital status, presence of children, region of the country, employment status, and occupation. Prices of computers and software also affect the decision, however, I do not have a good measure of prices faced by individuals. Instead, I take an indirect approach to investigate whether minorities face different prices for computers than whites.

A similar model can be created for subscribing to Internet service conditional on having a home computer.[8] I focus on the determinants of home

[8] An alternative approach that combines the two decisions is to estimate the computer and conditional Internet decisions as a nested or "mixed" nested logit model. The model cannot be estimated, however, because of the lack of variation in measurable characteristics of the alternative choices.

access to the Internet conditional on computer ownership to provide evidence on the additional factors affecting home Internet access. Income has an effect on the budget constraint and may have an additional effect on preferences. In addition, preferences for Internet service may be influenced by the individual's education level, marital status, presence of children, region of the country, employment status and occupation. Finally, there may exist geographical variation in prices or access to high-speed services that may have an effect on choices. For example, the barriers facing low-income, inner-city residents to obtain high-speed services may include the poor quality of telecommunications plants and inside wiring of multiple-tenant buildings (Federal Communications Commission, 2000).

Table 4 reports estimates from a logit regression for the probability of having access to a home computer. Marginal effects and their standard errors are reported.[9] Specification 1 includes only dummy variables for all racial groups. The left out group is white, non-Latinos. The coefficient estimates capture the racial differences discussed above. Blacks, Mexican-Americans, and other Latinos are less likely to have access to a home computer than are whites. Asians have only a slightly lower probability, and Native Americans have a much lower probability of owning a home computer.

Specification 2 includes measures of sex, age, marital status, children, education, family income, region, and central city status in addition to the racial group dummy variables. The coefficients on the female and age variables are small and statistically insignificant. Being married has a positive effect on the probability of having a home computer, which may simply be due to having at least one additional adult in the household. Consistent with this hypothesis, and not the effect of an unobserved "married" characteristic, the coefficient on being previously married is small and statistically insignificant. The coefficient on the number of children is statistically insignificant, but the coefficient on the dummy variable indicating the presence of children between the ages of 6 and 17 (controlling for the number of children) is large and statistically significant.

As expected, education is an important determinant of owning a home computer. Each education level is associated with a substantially larger probability of owning a home computer. Individuals who have a college degree have a 0.278 higher probability of owning a computer than high school dropouts (the left-out category). Individuals who have a graduate degree have a 0.334 higher probability of having access to a home computer than do high school dropouts. Education may be a proxy for wealth or permanent income and have an effect on the budget constraint, or may have an effect on preferences for

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[9] The reported marginal effect provides an estimate of the effect of a 1-unit increase in the independent variable on the home computer probability. It equals the sample average of $e^{X_i\hat{\beta}}/(1+e^{X_i\hat{\beta}})$.

Table 4
Logit Regressions for Probability of Having a Home Computer

Explanatory Variables	Specification (1)	(2)	(3)	(4)
Black	-0.2652	-0.1303	-0.1305	-0.1253
	(0.0067)	(0.0064)	(0.0064)	(0.0070)
Mexican	-0.3523	-0.1799	-0.1806	-0.1703
	(0.0085)	(0.0082)	(0.0082)	(0.0090)
Other Latino	-0.2002	-0.0789	-0.0792	-0.0744
	(0.0103)	(0.0095)	(0.0095)	(0.0104)
Native American	-0.2593	-0.1175	-0.1165	-0.1073
	(0.0165)	(0.0148)	(0.0149)	(0.0167)
Asian	-0.0327	-0.0624	-0.0623	-0.0598
	(0.0103)	(0.0095)	(0.0095)	(0.0106)
Female		0.0011	0.0034	-0.0172
		(0.0038)	(0.0039)	(0.0047)
Age		-0.0003	-0.0002	0.0001
		(0.0002)	(0.0002)	(0.0003)
Married		0.0748	0.0735	0.0714
		(0.0055)	(0.0056)	(0.0060)
Previously married		0.0068	0.0052	0.0014
		(0.0064)	(0.0064)	(0.0069)
Number of children		0.0011	0.0015	0.0053
		(0.0027)	(0.0027)	(0.0030)
Children ages 6 to 17		0.1188	0.1183	0.1154
		(0.0061)	(0.0061)	(0.0067)
High school graduate		0.1152	0.1137	0.1001
		(0.0066)	(0.0066)	(0.0076)
Some college		0.2164	0.2144	0.1820
		(0.0068)	(0.0069)	(0.0080)
College graduate		0.2775	0.2760	0.2186
		(0.0078)	(0.0078)	(0.0093)
Graduate degree		0.3341	0.3318	0.2557
		(0.0103)	(0.0104)	(0.0123)

(continued)

Table 4 (continued)
Logit Regressions for Probability of Having a Home Computer

	Specification			
Explanatory Variables	(1)	(2)	(3)	(4)
Family Income: $10,000 to $15,000		0.0526	0.0503	0.0310
		(0.0114)	(0.0114)	(0.0142)
Family Income: $15,000 to $20,000		0.0772	0.0741	0.0566
		(0.0112)	(0.0113)	(0.0138)
Family Income: $20,000 to $25,000		0.0748	0.0712	0.0514
		(0.0106)	(0.0107)	(0.0130)
Family Income: $25,000 to $30,000		0.1198	0.1172	0.0978
		(0.0103)	(0.0104)	(0.0127)
Family Income: $30,000 to $35,000		0.1577	0.1546	0.1261
		(0.0102)	(0.0103)	(0.0126)
Family Income: $35,000 to $40,000		0.1741	0.1705	0.1429
		(0.0104)	(0.0106)	(0.0128)
Family Income: $40,000 to $50,000		0.2201	0.2162	0.1878
		(0.0098)	(0.0100)	(0.0122)
Family Income: $50,000 to $60,000		0.2410	0.2375	0.1995
		(0.0100)	(0.0102)	(0.0123)
Family Income: $60,000 to $75,000		0.2758	0.2722	0.2318
		(0.0102)	(0.0104)	(0.0125)
Family Income more than $75,000		0.3556	0.3524	0.3146
		(0.0098)	(0.0100)	(0.0122)
In MSA but not in central city		0.0053	0.0062	0.0063
		(0.0051)	(0.0051)	(0.0055)
Rural area		-0.0194	-0.0187	-0.0104
		(0.0059)	(0.0059)	(0.0065)
Central city status not identified		0.0076	0.0080	0.0092
		(0.0064)	(0.0064)	(0.0070)
Unemployed			-0.0175	-0.0130
			(0.0111)	(0.0111)
Not in the labor force			-0.0085	
			(0.0054)	
Uses the Internet at work				0.0182
				(0.0055)
Region Controls	No	Yes	Yes	Yes
Occupation Controls	No	No	No	Yes
Mean of Dependent Variable	0.6580	0.6580	0.6570	0.6786
Sample Size	46,626	46,626	46,397	39,039

Notes: (1) The sample consists of adults ages 25-55. (2) Marginal effects (sample average of individual marginal effects) and their standard errors are reported.

computers through pure tastes, exposure, perceived usefulness, or conspicuous consumption.

Family income also plays a major role in determining who owns a home computer. The relationship between the home computer probability and income is monotonically increasing across the listed categories. The effect on the probability of having a home computer when moving from the lowest income level (less than $10,000) to the highest income level (more than $75,000) is striking. The effect is 0.356, which represents more than half the sample mean for the dependent variable. Not surprisingly, income has a large effect on the probability of owning a home computer. It is likely to be primarily due to its effect on the budget constraint, however, it may also be due its effect on preferences.

Most regions of the country, with the exception of the Pacific region, have a lower probability of owning a computer than the New England region. There is no statistically significant difference between rates of computer ownership in the central city and suburbs. Residents of rural areas, however, have a lower probability of owning a home computer.

The inclusion of marital status, children, family income, education, and the other controls has a notable effect on the racial group coefficients. For all groups, except Asians, the coefficients have become substantially smaller in absolute value. The coefficient for blacks increased from -0.265 to -0.130, and the coefficient for Mexican-Americans increased from -0.352 to -0.180. Apparently, racial differences in individual characteristics, such as family income and education, account for a sizeable portion of the differences in home computer rates.

Employment status may also affect the probability of owning a home computer. It is not included, however, in the main specification because of concerns regarding endogeneity. The skills that individuals acquire in using their own personal computer may be valuable in the labor market, and thus increase their likelihood of being employed. With these potential problems in mind, nevertheless, it is useful to examine regression estimates that include dummy variables for being unemployed and not in the labor force (reported in Specification 3). The coefficient estimates are negative on both variables, however, neither is statistically significant. Furthermore, the point estimates imply only small effects and their inclusion has virtually no effect on the racial dummy variables.

The final specification reported in Table 4 includes dummy variables for 11 major occupation categories and whether the individual uses the Internet at work. The sample size is smaller because of the exclusion of individuals who are not in the labor force. The Professional and the Executive, Administrative and Managerial occupations have the highest probabilities of computer ownership.

The occupations with the lowest probabilities are Machine Operators and Transportation. Most of the coefficients on the occupation dummies are statistically significant and imply somewhat large effects. The coefficient estimate on whether the individual uses the Internet at work is positive and statistically significant. The point estimate, however, does not imply a large effect. Most importantly, the coefficients on the racial controls do not change substantially with the addition of the occupation and Internet use at work controls.

The determinants of home Internet access conditional on having a home computer are also of interest. Logit regressions for the probability of conditional Internet access at home are estimated with the results reported in Table 5. The sample only includes adults ages 25-55 who have access to a home computer. Table 5 reports the same specifications as those reported in Table 4. The relative patterns across racial groups in conditional Internet access are generally similar to those for computer access. All minority groups except Asians are less likely to have Internet access conditional on having a home computer than are whites.

Interestingly, the addition of controls for individual characteristics in Specification 2 has a large effect on the Mexican-American coefficient, but a relatively small effect on the black coefficient. This is surprising given the strong effects of education and income on the probability of Internet access among computer owners. Each step to a higher level of education results in a large increase in the probability of Internet access. The Internet probability generally increases with each level of income, although the effects are not as large as they are on the probability of having a home computer. The effect on the probability of Internet access when moving from the lowest family income level (less than $10,000) to the highest (more than $75,000) is 0.159, which represents 19.4 percent of the sample mean for the dependent variable.

Several additional controls affect the probability of Internet access conditional on having a home computer. Age has a large negative effect on the probability of Internet access among computer owners. Being married and having children ages 6 to 17 increases the probability of access. Living in a rural area has a negative effect on conditional Internet access relative to living in the central city suggesting that price or accessibility differences may exist (see Federal Communications Commission 2000).

Specification 3 includes dummy variables for whether the individual was unemployed or not in the labor force. The coefficient on not in the labor force is positive and statistically significant, but the coefficient on unemployment is statistically insignificant. Similar to the results for the home computer rate, the inclusion of controls for labor force status has little effect on the racial coefficients. Specification 4 includes occupation controls and the dummy variable for whether the individual uses the Internet at work. Most of the coefficients on the occupational variables are statistically significant.

Table 5

Logit Regressions for Probability of Internet Access at Home
Conditional on Having a Home Computer

	Specification			
Explanatory Variables	(1)	(2)	(3)	(4)
Black	-0.1013	-0.0861	-0.0865	-0.0860
	(0.0077)	(0.0079)	(0.0080)	(0.0086)
Mexican	-0.1398	-0.0964	-0.0975	-0.0964
	(0.0101)	(0.0105)	(0.0105)	(0.0115)
Other Latino	-0.0883	-0.0639	-0.0634	-0.0629
	(0.0114)	(0.0115)	(0.0115)	(0.0125)
Native American	-0.1341	-0.0771	-0.0757	-0.0795
	(0.0183)	(0.0182)	(0.0183)	(0.0198)
Asian	0.0285	-0.0009	-0.0015	-0.0053
	(0.0115)	(0.0115)	(0.0116)	(0.0126)
Female		-0.0044	-0.0061	-0.0244
		(0.0043)	(0.0044)	(0.0052)
Age		-0.0014	-0.0014	-0.0010
		(0.0003)	(0.0003)	(0.0003)
Married		0.0217	0.0185	0.0114
		(0.0072)	(0.0072)	(0.0076)
Previously married		0.0068	0.0064	0.0022
		(0.0084)	(0.0084)	(0.0090)
Number of children		-0.0147	-0.0156	-0.0128
		(0.0028)	(0.0028)	(0.0031)
Children ages 6 to 17		0.0197	0.0220	0.0171
		(0.0065)	(0.0065)	(0.0070)
High school graduate		0.0462	0.0466	0.0397
		(0.0089)	(0.0090)	(0.0102)
Some college		0.0934	0.0938	0.0807
		(0.0090)	(0.0091)	(0.0104)
College graduate		0.1294	0.1309	0.1111
		(0.0097)	(0.0098)	(0.0115)
Graduate degree		0.1427	0.1434	0.1223
		(0.0113)	(0.0114)	(0.0136)

(continued)

Table 5 (continued)

Logit Regressions for Probability of Internet Access at Home
Conditional on Having a Home Computer

	Specification			
Explanatory Variables	(1)	(2)	(3)	(4)
Family Income: $10,000 to $15,000		-0.0136	-0.0128	-0.0321
		(0.0164)	(0.0165)	(0.0203)
Family Income: $15,000 to $20,000		0.0030	0.0056	-0.0086
		(0.0161)	(0.0162)	(0.0196)
Family Income: $20,000 to $25,000		0.0277	0.0319	0.0118
		(0.0154)	(0.0155)	(0.0187)
Family Income: $25,000 to $30,000		0.0285	0.0328	0.0200
		(0.0146)	(0.0148)	(0.0180)
Family Income: $30,000 to $35,000		0.0471	0.0518	0.0322
		(0.0143)	(0.0145)	(0.0177)
Family Income: $35,000 to $40,000		0.0545	0.0591	0.0420
		(0.0144)	(0.0146)	(0.0177)
Family Income: $40,000 to $50,000		0.0663	0.0723	0.0546
		(0.0136)	(0.0138)	(0.0169)
Family Income: $50,000 to $60,000		0.0742	0.0802	0.0603
		(0.0136)	(0.0138)	(0.0170)
Family Income: $60,000 to $75,000		0.1162	0.1235	0.1030
		(0.0138)	(0.0140)	(0.0171)
Family Income more than $75,000		0.1594	0.1666	0.1432
		(0.0134)	(0.0136)	(0.0168)
In MSA but not in central city		-0.0172	-0.0163	-0.0184
		(0.0060)	(0.0060)	(0.0065)
Rural area		-0.0332	-0.0319	-0.0314
		(0.0069)	(0.0069)	(0.0075)
Central city status not identified		-0.0039	-0.0037	-0.0026
		(0.0075)	(0.0076)	(0.0081)
Unemployed			0.0081	-0.0017
			(0.0142)	(0.0143)
Not in the labor force			0.0218	
			(0.0065)	
Uses the Internet at work				-0.0333
				(0.0056)
Region Controls	No	Yes	Yes	Yes
Occupation Controls	No	No	No	Yes
Mean of Dependent Variable	0.8216	0.8216	0.8209	0.8225
Sample Size	30,679	30,679	30,482	26,490

Notes: (1) The sample consists of adults ages 25-55 who have access to a home computer. (2) Marginal effects (sample average of individual marginal effects) and their standard errors are reported.

Surprisingly, the coefficient estimate on whether the individual uses the Internet at work is negative and statistically significant. Although the coefficient implies a relatively small effect, it may be due to individuals not needing Internet access at home if they have access at work. Overall, the racial coefficients are not sensitive to the inclusion of the occupation and Internet use at work controls.

5. Decomposition of Racial Gaps in Computer and Internet Access Rates

The estimates reported in Tables 4 and 5 indicate that the large racial differences in computer and Internet access rates can be explained in part by group differences in individual characteristics, such as marital status, children, education and income. Although some of these variables may proxy for similar underlying characteristics, such as income and education capturing permanent income or wealth, it may be informative to estimate separate contributions from group differences in each of these variables.

To estimate these contributions, I employ a slight variant of the familiar technique of decomposing inter-group differences in a dependent variable into those due to different observable characteristics across groups and those due to different "prices" of characteristics of groups (see Blinder 1973 and Oaxaca 1973). In particular, the white/minority gap in the home computer rate or home Internet access rate, Y, can be expressed as:

$$(5.1)\quad \overline{Y}^{W} - \overline{Y}^{M} = (\overline{X}^{W} - \overline{X}^{M})\hat{\beta}^{W} + \overline{X}^{M}(\hat{\beta}^{W} - \hat{\beta}^{M}),$$

where $\overline{X}^{j}$ is a row vector of average values of the independent variables and $\hat{\beta}^{j}$ is a vector of coefficient estimates for race j.[10] The first term represents the part of the racial gap that is due to group differences in average values of the independent variables, and the second term represents the part due to differences in the group processes determining levels of Y.

I further decompose the first term into separate contributions from group differences in specific variables, such as education and family income. The second term or "unexplained" portion relates to group differences in the coefficients for specific variables, and includes the race dummies. This unexplained portion cannot be similarly decomposed into separate contributions because of its sensitivity to the choice of the left-out category (Oaxaca and Ransom 1999).

[10] The coefficients are estimated using a linear probability model. The linear probability model coefficient estimates are similar to the marginal effects from the logit regressions reported in Tables 4 and 5.

An equally valid method of calculating the decomposition is to use the minority coefficient estimates, $\hat{\beta}^M$, as weights in estimating the contributions from group differences in the independent variables. This alternative method of calculating the decomposition often provides different estimates, which is the familiar index problem with the Blinder-Oaxaca decomposition technique. A third commonly-used alternative is to weight the first term of the decomposition expression using coefficient estimates from a pooled sample of the two groups or all groups (see Oaxaca and Ransom 1994 for example). I follow this approach to calculate the decompositions. In particular, I use coefficient estimates from a linear probability regression that includes a pooled sample of all racial groups.[11] Thus, the first term in the decomposition that captures the explained variation in home computer rates or home Internet access rates between whites and the minority group (blacks or Mexicans) is

$$(5.2) \quad (\overline{X}^W - \overline{X}^M)\hat{\beta}^*,$$

where $\hat{\beta}^*$ are the pooled coefficients. An advantage of this technique over the first two decomposition techniques is that the same coefficient estimates are used for weighting the explained part of the decomposition for both blacks and Mexicans making it easier compare results.

Table 6 reports estimates from this procedure for decomposing the black/white and Mexican/white gaps in home computer rates.[12] I first describe the results for blacks, which are reported in Specifications 1 and 2. Specification 1 does not include labor force status, occupation and Internet use at work, and thus uses the full sample.[13] The white/black gap in the home computer rate gap is large (0.301). Racial differences in sex and age explain virtually none of the gap. Marital status and children explain only a small part of the gap (7.4 percent). This contribution is primarily due to blacks having a substantially lower probability of currently being married than whites and the positive effect of marriage on having a home computer. Lower marriage rates among blacks may limit their opportunities to take advantage of increasing returns to scale in family members.

Blacks have lower levels of education, on average, than whites. Only 12.6 percent of blacks have a Bachelor's degree, and only 5.6 percent of blacks have a graduate-level degree. In contrast, 22.4 and 10.6 percent of whites have

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[11] Dummy variables are included for each racial group.

[12] Estimates are similar using the non-linear decomposition technique described in Fairlie (1999, 2002). The non-linear decomposition technique uses logit coefficients directly in the decomposition and racial differences in distributions of characteristics.

[13] The decomposition estimates do not differ substantially when using white or black coefficients instead of the pooled coefficients.

Table 6
Decomposition of Racial/Ethnic Gaps in Home Computer Rates

	Specification			
	Black		Mexican	
Explanatory Variables	(1)	(2)	(3)	(4)
White/minority gap in home computer rate	0.301	0.278	0.399	0.398
Contributions from racial differences in:				
Sex and age	-0.001	0.001	-0.002	-0.002
	-0.2%	0.2%	-0.5%	-0.4%
Marital status and children	0.022	0.018	-0.009	-0.008
	7.4%	6.6%	-2.2%	-1.9%
Education	0.038	0.024	0.118	0.097
	12.7%	8.6%	29.7%	24.3%
Income	0.082	0.063	0.098	0.089
	27.3%	22.6%	24.5%	22.3%
Region	0.008	0.007	-0.011	-0.008
	2.7%	2.6%	-2.7%	-2.0%
Central city status	-0.002	0.000	-0.002	-0.001
	-0.6%	-0.1%	-0.5%	-0.2%
Unemployment		0.000		0.000
		0.2%		0.0%
Occupation		0.015		0.030
		5.3%		7.4%
Internet use at work		0.002		0.003
		0.6%		0.8%
All included variables ("explained" part of the gap)	0.148	0.129	0.192	0.201
	49.3%	46.5%	48.2%	50.4%

Notes: (1) The sample consists of adults ages 25-55. (2) Contribution estimates are from linear decompositions. See text for more details

Bachelor's and graduate degrees, respectively. The combination of these patterns and the finding earlier that education is a major determinant of computer ownership suggests that racial differences in education account for a large part of the gap. Indeed, the decomposition estimate indicates that white/black differences in education distributions account for 12.7 percent of the home computer rate gap.

As expected, the largest factor explaining racial disparities in home computer ownership is income. Lower levels of income among blacks account for 27.3 percent of the white/black gap in the probability of having a home computer. As noted above, it is likely that this primarily captures racial differences in the ability to purchase computers, however, it may also partly capture racial differences in preferences for owning computers. Although income differences provide a large contribution, they do not explain the entire gap. Thus, low levels of computer ownership among blacks are not simply due to an inability to purchase computers. In fact, 80.0 percent of blacks with family incomes of $60,000 or more have a home computer, whereas 87.2 percent of whites with similar income levels have home computers.

The 27.3 percent contribution from income differs from earlier results reported in Novak and Hoffman (1998) using the 1997 Commerce Net/Nielsen Internet Demographic Study. The study finds that 44.2 percent of whites and 29.0 percent of blacks have a home computer in their household and that these observed differences are eliminated after statistically adjusting for household income. Their adjustment, however, does not simultaneously control for differences in education.[14] Interestingly, they find that for each reported income category under $40,000 whites had higher home computer ownership rates, but for each reported category above $40,000 blacks had higher computer ownership rates. Estimates from the 2000 CPS do not indicate these patterns. For all income categories reported in the CPS, blacks have lower probabilities of having a home computer than do whites.

The included geographical factors do not play a major role in explaining black/white differences in computer ownership. Racial differences in regional distributions explain less than 3 percent of the gap, and racial differences in central city status explain virtually none of the gap. Although blacks are much more likely to live in the central city than are whites, the contribution is essentially zero because central city status does not affect home computer ownership.

Specification 2 includes contributions from racial differences in labor force status, occupation, and Internet use at work. The logit regression estimates underlying these contributions are reported in Specification 4 of Table 4. Racial differences in unemployment and labor force participation do not explain the

[14] They find in a separate analysis that education cannot explain the white/black differences in computer ownership.

white/black gap in computer ownership. Although blacks have substantially higher unemployment and jobless rates than do whites, the contribution is small because labor force status has little effect on computer ownership. The contribution from occupation is larger, but still relatively small. Racial differences in occupational distributions explain 5.3 percent of the white/black gap. Blacks are less likely to be employed in executive, administrative, managerial and professional occupations than whites and more likely to be employed in machine operator and transportation occupations. Lower levels of Internet use at work, however, do not contribute to the gap. The different occupational distributions may be partly capturing disparities in exposure to computers at work, more generally, possibly translating into different preferences for home computers.

The decompositions reveal that low levels of education and, especially income, are responsible for a large part of the relative lack of computer ownership among blacks. Occupational, marital status, and regional differences also contribute to the gap. Controlling for these measurable differences, roughly half of the gap between blacks and whites in home computer ownership is explained.

The disparity between the rate of computer ownership among Mexican-Americans and whites is even larger than that for blacks. The white/Mexican gap in home computer rates is 0.399. Specifications 3 and 4 of Table 6 report the decomposition results for this gap. Similar to the results for blacks, racial differences in sex and age do not contribute to the gap. Marital status and children provide a small negative contribution to the home computer gap. This result suggests that the gap would be even larger if Mexican-Americans did not have a higher probability of having children ages 6 to 17, which increases the probability of home computer ownership.

Mexican-Americans have substantially lower levels of education than whites. Only 6.9 percent of Mexican-Americans have Bachelor's degrees and 1.9 percent have graduate degrees. The decomposition results indicate that these lower levels of education are a major cause of why so few Mexican-Americans own home computers. Racial differences in education explain nearly 30 percent of the white/Mexican gap in home computer rates.

Relatively low levels of income among Mexican-Americans also contribute greatly to the gap in computer ownership. The results indicate that 24.5 percent of the gap is due to white/Mexican differences in income. This contribution is comparable in magnitude to that for the white/black gap and is consistent with Mexican-Americans being less able to afford computers than whites, on average. Similar to blacks, however, it is somewhat surprising that income does not explain more of the gap. Even at income levels of $60,000 or more, only 74.2 percent of Mexican-Americans have a home computer compared

to 87.2 percent of whites. To be sure, income differences are important, but they cannot explain everything.

Racial differences in regions, central city status and labor force status do not contribute substantially to the gap. In contrast, however, occupational differences explain a large part of the gap. Mexican-American workers are more concentrated than whites in farming, handlers, and machine occupations (low computer rate occupations) and less concentrated in professional and technical occupations (high computer rate occupations). Lower levels of Internet use at work, however, do not explain part of the gap.

In sum, Mexican-Americans are less likely to own home computers than are whites primarily because they have substantially lower levels of education and income. Occupational differences also contribute to the gap. Similar to the results for blacks, roughly half of the computer ownership rate gap is explained by group differences in the included variables.

WHY ARE MINORITIES LESS LIKELY TO HAVE ACCESS TO THE INTERNET?

Racial differences in family structure, education, income, and occupation partly explain why blacks and Mexican-Americans are less likely to own computers than whites. Although there are many similarities between the home computer logit results and the conditional Internet logit results, minority/white differences in these characteristics change in nontrivial ways (see Appendices 1 and 2). For example, education and income differences conditional on home computer ownership are smaller. Therefore, the explanations for racial differences in conditional Internet access may differ from those for racial differences in computer ownership.

Table 7 reports estimates from decompositions of the racial gaps in conditional Internet access. I first discuss the results for blacks reported in Specification 1. The gap between blacks and whites in conditional Internet access rates is 0.119. The decomposition results indicate that group differences in education and income are the only two factors that explain a substantial portion of the white/black gap in conditional Internet access. Lower levels of education among blacks than whites account for 5.8 percent of the gap, which is similar to that for the gap in the home computer rate.

Racial differences in income also contribute to the white/black gap in conditional Internet access at home. They explain 15.4 percent of the gap. This contribution is much smaller than that reported in Table 6. Racial differences in income are mitigated by conditioning on home computer ownership, but also income has less of an effect on the probability of conditional Internet access than it does on home computer ownership. This is consistent with lower costs of obtaining Internet access than purchasing a personal computer.

Table 7
Decomposition of Racial/Ethnic Gaps in Conditional Internet Access Rates

	Specification			
	Black		Mexican	
Explanatory Variables	(1)	(2)	(3)	(4)
White/minority gap in Internet use rate	0.119	0.112	0.175	0.173
Contributions from racial differences in:				
Sex and age	-0.001	0.001	-0.003	-0.003
	-0.7%	0.6%	-1.9%	-1.7%
Marital status and children	0.002	0.001	0.004	0.003
	1.5%	0.9%	2.1%	1.7%
Education	0.007	0.005	0.033	0.027
	5.8%	4.0%	19.1%	15.8%
Income	0.018	0.014	0.027	0.026
	15.4%	12.8%	15.6%	14.9%
Region	-0.003	-0.003	-0.006	-0.006
	-2.7%	-2.6%	-3.2%	-3.3%
Central city status	-0.006	-0.006	-0.005	-0.004
	-5.4%	-5.4%	-2.8%	-2.6%
Unemployment		0.000		0.000
		0.0%		0.0%
Occupation		0.002		0.010
		1.8%		5.7%
Internet use at work		-0.2%		-0.4%
		-1.9%		-2.4%
All included variables ("explained" part of the gap)	0.017	0.012	0.051	0.049
	14.0%	10.4%	28.9%	28.3%

Notes: (1) The sample consists of adults ages 25-55 who have access to a home computer. (2) Contribution estimates are from linear decompositions. See text for more details.

Specification 2 reports decomposition results for the labor force sample. Racial differences in unemployment rates, occupations and Internet use at work do not contribute substantially to the gap. The combined effect of education, income and occupation to the white/black gap in conditional Internet access is smaller in both absolute and percentage terms than its effect on the gap in home computer rates. Group differences in all of the included variables explain roughly 16.8 to 21.2 percent of the white/black gap in conditional Internet access, whereas they explain 31.2 to 40.0 percent of the home computer rate gap. Clearly, the decomposition analysis has uncovered much less about why black computer owners are relatively unlikely to have access to the Internet at home than why blacks are relatively unlikely to own computers.

Specifications 3 and 4 of Table 7 report the results for Mexican-Americans. The gap between whites and Mexican-Americans is 0.175. Although the gap is much larger than the white/black gap, the only factors that make large contributions to the gap are income, education, and occupation. The results for education are the most striking. Differences in education explain 19.1 and 15.8 percent of the white/Mexican-American Internet access gaps in Specifications 3 and 4, respectively.

Conditioning on computer ownership reduces income disparities between Mexican-Americans and whites, which translates into a smaller contribution. Differences in income explain 14.9 to 15.6 percent of the white/Mexican-American gap in conditional Internet access rates. Many Mexican-Americans may not be able to afford Internet subscription services, but this is a relatively small expenditure compared to the computer as regular dial-up Internet service averages less than $20 per month (see below) and much of the software for using the Internet is free (e.g. Netscape and Eudora).

Finally, occupation contributes to the gap. Differences in occupation explain 5.7 percent of the white/Mexican-American gap in conditional Internet access. Combining the individual contributions, 28.3 to 28.9 percent of the gap in Internet use is explained by racial differences in observable characteristics. Again, the decompositions reveal less about why Mexican-Americans and whites differ in Internet access conditional on having a home computer than about why they are less likely to have access to a home computer.

6. Explanations for Remaining Differences

The decomposition results indicate that education, income, and occupation explain part of the racial gaps in home computer and Internet access rates. What are the causes of the remaining differences? I first examine responses to why computer owners did not use the Internet. A subsample of respondents who have access to a home computer, but do not use the Internet at home were asked the

question, "What is the MAIN reason that you don't have access to the Internet at home?" Table 8 reports the responses to this question by race.

Table 8
Main Reasons for Not Using the Internet at Home by Race/Ethnicity

Explanatory Variables	Blacks	Mexican/ Americans	Whites
Can use it somewhere else	7.0%	7.9%	12.1%
Cost, too expensive	19.2%	23.4%	16.5%
Not enough time to use it	12.1%	7.4%	9.2%
Not useful	3.5%	3.8%	4.7%
Not user friendly, too difficult	3.3%	2.6%	2.2%
Problems with service provider	1.5%	0.0%	1.1%
Concern about how children use it	6.0%	9.3%	7.7%
Don't want it	32.8%	23.7%	28.5%
Other	5.1%	8.9%	5.5%
Future access planned	3.1%	3.8%	3.3%
Computer not capable	5.8%	5.3%	8.0%
Lack of computer knowledge	0.5%	3.8%	1.0%
Sample Size	529	301	3,662

Notes: (1) The sample consists of adults ages 25-55 who have access to a home computer and live in households in which no one currently uses or has ever used the Internet from home. (2) All estimates are calculated using sample weights provided by the CPS.

As expected, price is an important factor for minorities. Almost one-fourth of Mexican-American and one-fifth of black computer owners report that cost is the main reason that they do not use the Internet at home. Among white computer owners, 16.5 percent report that cost is the main reason that they do not currently use the Internet. These percentages for minorities are consistent with the finding that differences in abilities to pay for Internet services contribute to differences in Internet access, but do not explain all of the differences.

Another interesting response is "not wanting it." Only 23.7 percent of Mexican-Americans and 32.8 percent of blacks report not wanting access to the Internet. The percent of whites not wanting access is 28.5 percent. Clearly, the low rate of use among minorities is not simply due to a lack of interest in having access to the Internet among this group.

It is also noteworthy that so few minorities report issues related to their ability to use the Internet. For example, only a small percentage of Mexican-Americans and blacks report the main reason as "not user friendly, too difficult," "problems with service provider," "computer not capable," or "lack of computer knowledge." Apparently, relatively low rates of Internet access among minorities are not simply due to a lack of their own ability or hardware/software capabilities.

DIFFERENCES IN PRICES

Do minorities face different prices for computer and Internet service than do whites? If blacks and Mexican-Americans are more likely to be located in geographic areas with higher prices then they will be less likely to purchase computers than whites who have comparable income levels. This explanation for racial differences, however, depends on the existence of at least some geographical variation in computer prices. Using data on computer purchases from a 1998 Forrester survey, Goolsbee (2000) finds evidence of cross-city variation in the prices paid by computer purchasers, and that this variation influences whether individuals purchase their computers online versus in stores. This finding, however, implies that the geographical differences in actual computer prices faced by all potential consumers are mitigated by the presence of online or mail-order computer manufacturers. In fact, Goolsbee (2000) reports that approximately 30 percent of computers were purchased from a catalog, direct from the manufacturer or over the Internet from 1996 to 1998 with Dell and Gateway comprising nearly half of these computers. More recent data from the second quarter of 2000 from the IDC indicate that Dell and Gateway alone comprise 28.5 percent of the market share of computers in the United States. Furthermore, it is likely that many consumers purchase computers from large retailers that set nation-wide prices.

Although these patterns suggest that the geographic variation in prices may not be large, nevertheless, it is useful to investigate the hypothesis more thoroughly with the CPS data. Unfortunately, the 2000 CPS Computer and Internet Use Supplement does not provide information on the cost of computers. I can examine this issue further, however, by including metropolitan area fixed effects in the logit regressions. These fixed effects will capture the effects of price differences across metropolitan areas. Specification 2 of Table 9 reports logit regression results for the probability of having a home computer after including fixed effects for the 18 identified CMSAs in the 2000 CPS. Specification 1 reports results using the same sample, but excluding the CMSA fixed effects. Conditioning on residence in an identified CMSA reduces the sample size by nearly 65 percent. For brevity, only the coefficients (marginal effects) for the race dummies are reported.

The inclusion of CMSA dummies has little effect on the racial dummies. The black coefficient estimate increases only slightly. It remains large, negative and statistically significant. The Mexican-American coefficient also increases only slightly and remains relatively large and negative. Apparently, cross-CMSA variation in computer prices and other unobservable characteristics cannot account for the large racial disparities in computer ownership reported above.

Table 9
Logit Regressions for Home Computer and Internet Access Probabilities

	Specification			
	(1)	(2)	(3)	(4)
Dependent Variables	Home Computer	Home Computer	Conditional Internet	Conditional Internet
Black	-0.1416	-0.1385	-0.0919	-0.0908
	(0.0092)	(0.0092)	(0.0105)	(0.0106)
Mexican	-0.1659	-0.1565	-0.0884	-0.0853
	(0.0118)	(0.0121)	(0.0137)	(0.0139)
Other Latino	-0.0963	-0.0907	-0.0694	-0.0767
	(0.0116)	(0.0121)	(0.0135)	(0.0140)
Native American	-0.1285	-0.1256	-0.0823	-0.0825
	(0.0377)	(0.0380)	(0.0441)	(0.0441)
Asian	-0.0518	-0.0492	0.0072	0.0059
	(0.0128)	(0.0129)	(0.0148)	(0.0149)
CMSA Controls	No	Yes	No	Yes
Mean of Dependent Variable	0.6768	0.6768	0.8406	0.8406
Sample Size	16,640	16,640	11,262	11,262

Notes: (1) The sample consists of adults ages 25-55 who live in one of the 18 CMSAs identified in the 2000 CPS. (2) Marginal effects (sample average of individual marginal effects) and their standard errors are reported. (3) All specifications include controls for sex, age, marital status, children, education, income, central city status, and region.

Geographical variation in prices for Internet services may contribute to racial differences in home Internet access. In particular, blacks and Mexican-Americans may be more likely to reside in areas in which prices are higher. Fortunately, the 2000 CPS Computer and Internet Use Supplement includes information on monthly costs of Internet service. Table 10 reports results by race. Average costs are separated by type of service. I focus on the results for regular or "dial-up" telephone service because it comprises roughly 90 percent of all Internet services. At least among Internet service purchasers, there do not appear to be any glaring racial inequalities. In fact, Mexican-Americans, on average, pay slightly less than whites for regular Internet service. The estimates indicate that

blacks pay slightly more, but the difference is negligible. In both cases, the differences are not statistically significant.

Table 10

Average Monthly Cost for Internet Service by Race/Ethnicity
CPS (2000)

	Blacks	Mexican/ Americans	Whites
Regular or "dial-up" telephone service	$17.22	$16.74	$17.04
Sample Size	1,486	653	21,118
High-speed service	$21.09	$22.61	$26.89
Sample Size	158	64	2,553

Notes: (1) The sample consists of adults ages 25-55 who have access to the Internet at home. (2) High-speed service includes DSL, cable modems, and ISDN. (3) All estimates are calculated using sample weights provided by the CPS.

I also calculate average Internet costs across my sample of 18 CMSAs. I do not find large differences. The average cost ranges from a low of $15 in Portland-Salem to $18.50 in New York-Northern New Jersey-Long Island - a maximum difference of only $3.50 per month. The lack of substantial variation across CMSAs may be due to the dominance of large Internet service providers that have national pricing plans and aggressive promotional offers (e.g. AOL).

In the comparisons, however, I am forced to condition on Internet subscription. A measure of local prices faced by all potential purchasers of Internet services would be preferred. Instead of including this type of measure, I include CMSA fixed effects in a logit regression for the probability of having Internet access conditional on having a home computer. Specification 3 of Table 9 reports the "baseline" results without the CMSA fixed effects and Specification 4 reports the results that include the CMSA fixed effects. The coefficient estimates on the black and Mexican-American dummy variables are not sensitive to the inclusion of these fixed effects. The change in coefficient estimates from including the CMSA fixed effects are negligible.

Although I admittedly do not provide direct evidence on the issue, it does not appear as though blacks and Mexican-Americans face higher prices for computers and Internet service than do whites. Surely, if price differentials exist they are small, and the CMSA fixed effect results suggest that they have little

effect on racial differences in computer and Internet access rates. Furthermore, racial discrimination in the pricing of computers and Internet services should be nonexistent or at least very small because their prices are typically non-negotiable and are often purchased from a catalog or online.

THE EFFECTS OF SCHOOL DIFFERENCES

Racial disparities in exposure to computers and the Internet in school may have an effect on differences in home computer and Internet access rates.[15] The logit regression results indicate that the presence of school-age children has a large positive effect on the probability of having a home computer. Interestingly, the National Center for Education Statistics (2001) recently reported that 98 percent of all public schools were connected in Fall 2000. The same report, however, indicates that large disparities in the percentage of instructional rooms connected to the Internet exist across schools by poverty level, metropolitan status, and minority enrollment. If computer and Internet access is less prevalent among minority students than white students in school then minority families may be less likely to see the need for purchasing home computers or Internet service. One method of addressing this issue is to examine whether racial differences in home computer rates and conditional Internet access are smaller among adults who do not have children. Specification 1 of Table 11 reports results for a logit regression for the probability of having a computer using a sample of adults who do not have children. The coefficient estimates are slightly larger in absolute value using the sample of adults without children than the original estimates. Specification 1 of Table 14 reports results for the probability of conditional Internet access. The disparity between blacks and whites is essentially the same, but the disparity between Mexican-Americans and whites is now smaller. The coefficient estimate, however, remains large, negative and statistically significant. These results indicate that racial differences in access to computers and the Internet at school are not driving the results for working-age adults.

LANGUAGE BARRIERS

Language may be an important factor limiting computer and Internet use among Mexican-Americans and other Latinos (Spooner and Rainie 2001). The 2000 CPS includes a question on whether Spanish is the only language spoken among adults in the household. I use this information to examine whether Mexican-Americans and other Latinos in Spanish-speaking households are less

[15] As noted in Goolsbee and Klenow (1999), schools in high-computer use neighborhoods may draft curricula to encourage residents to buy computers. This policy combined with residential sorting by race could lead to large disparities in computer ownership and Internet use.

likely to use computers and the Internet.[16] Specifications 3 and 4 of Table 11 reports results for Logit regressions that include interactions between the Spanish speaking variable and the Mexican-American and other Latino variables. Mexican-Americans in Spanish-speaking households are much less likely to have a home computer and have access to the Internet at home conditional on having a home computer than other Mexican-Americans, all else equal. Relative to whites, these Mexican-Americans have a computer ownership rate that is 0.323 less than whites and a conditional Internet access rate that is 0.167 less than whites. Thus, even after controlling for income and education, Mexican-Americans in Spanish-speaking households are substantially less likely than whites to own a computer or have access to the Internet at home. Clearly, language makes a large difference.

Table 11
Logit Regressions for Home Computer and Internet Access Probabilities

	Specification			
	(1)	(2)	(3)	(4)
Dependent Variables	Home Computer	Conditional Internet	Home Computer	Conditional Internet
Black	-0.1371	-0.0855	-0.1309	-0.0863
	(0.0095)	(0.0114)	(0.0063)	(0.0079)
Mexican	-0.1853	-0.0620	-0.1540	-0.0896
	(0.0139)	(0.0179)	(0.0087)	(0.0110)
Other Latino	-0.0796	-0.0635	-0.0482	-0.0621
	(0.0150)	(0.0176)	(0.0106)	(0.0120)
Native American	-0.0831	-0.0754	-0.1182	-0.0772
	(0.0234)	(0.0266)	(0.0147)	(0.0182)
Asian	-0.0674	-0.0074	-0.0644	-0.0013
	(0.0142)	(0.0168)	(0.0095)	(0.0115)
Mexican - Spanish speaking at home			-0.1690	-0.0771
			(0.0215)	(0.0332)
Other Latino - Spanish speaking at home			-0.1758	-0.0218
			(0.0247)	(0.0355)
Mean of Dependent Variable	0.5905	0.8262	0.6580	0.8216
Sample Size	23,827	14,071	46,626	30,679

Notes: (1) The sample consists of adults ages 25-55. Specifications 1 and 2 include only adults without children. (2) Marginal effects (sample average of individual marginal effects) and their standard errors are reported.

[16] In the sample, 24.9 percent of Mexican-Americans are in Spanish-speaking households and 21.6 percent of other Latinos are in Spanish-speaking households.

To return to issue of whether language barriers can explain part of the remaining gap between Mexican-Americans and whites, however, we need to compare the coefficient on the main Mexican dummy variable to the original Mexican dummy variable. For computer access, language appears to make a difference. The Mexican-American dummy variable decreases in absolute value from -0.1799 to -0.1540 (a decline of 14.4 percent). For conditional Internet access the decline is smaller, but still noteworthy (-0.0964 to -0.0896 or 7.1 percent). Language barriers appear to limit computer and Internet access among Mexican-Americans.

8. Conclusions

Using data from the Computer and Internet Use Supplements to the August 2000 Current Population Survey (CPS), I find that blacks and Latinos are substantially less likely to have a home computer and access to the Internet at home than are white, non-Latinos. Of all Latino groups, Mexican-Americans have the lowest rates of access to home computers and the Internet. Estimates from the CPS indicate that Mexican-Americans are roughly one-half as likely to own a computer and one-third as likely to have Internet access at home than are whites. Racial differences in Internet use at any location are similarly large because the most common location of use for all groups is at home.

To better understand the determinants of access to technology at home, I estimate logit regressions for the probability of having a home computer and the probability of having access to the Internet at home conditional on having a home computer. I find that education, income and occupation are important determinants of computer ownership and Internet access. Using linear decompositions, I find that racial differences in these factors contribute substantially to the black/white and Mexican/white gaps in home computer and Internet access rates. As expected, the most important overall factor is income. Low levels of income explain roughly a quarter of the black/white and Mexican/white gaps in home computer rates. Perhaps due to the relatively low additional price of Internet service, racial differences in income explain less of the gaps in Internet access conditional on having a home computer. Although income inequalities are important in contributing to the Digital Divide, they are clearly not the only factor.

Racial differences in education are also important, possibly capturing differences in preferences, permanent income or wealth. Low levels of education among blacks explain approximately 10 percent of their low rate of computer ownership and 5 percent of their low rate of home Internet access. For Mexican-Americans, group differences in education explain slightly more of the disparities in home computer and Internet access rates than group differences in income.

Related to education differences, occupational differences also explain part of the gap. They explain roughly 2-5 percent of black/white gaps in the two measures and 6-7 percent of the Mexican/white gaps. Surprisingly, however, relatively low rates of Internet use at work among blacks and Mexican-Americans do not contribute to disparities in access to technology. Overall, the decomposition results indicate that group differences in all measurable characteristics explain approximately 50 percent of the racial gaps in home computer rates and 10 to 30 percent of the racial gaps in conditional Internet access rates.

I also investigate a few explanations for the remaining differences. I do not find evidence that price or school differences are responsible for the remaining gaps. I do find some evidence, however, that language barriers may be important in explaining low rates of computer and Internet use among Mexican-Americans. Although the analysis has uncovered a few important factors, more research is needed to full understand the causes of disparities in access to computers and the Internet at home. In particular, the role that racial differences in networks, economic returns to computer and Internet use, and content play in contributing to the Digital Divide require further study. More research is also needed on the potential consequences of differential access to technology, particularly focusing on outcomes that will inform the debate over how we should view the Digital Divide.

Appendix 1
Sample Means of Analysis Variables for Home Computer Logit Regressions

Variable	Black	Mexican	White
Female	0.562	0.479	0.511
Age	39.511	36.898	40.389
Married	0.439	0.666	0.696
Previously married	0.217	0.127	0.150
Number of children	0.844	1.288	0.907
Children ages 6 to 17	0.369	0.481	0.380
High school graduate	0.364	0.274	0.307
Some college	0.307	0.171	0.300
College graduate	0.126	0.069	0.224
Graduate degree	0.056	0.019	0.106
Family income: $10,000 to $15,000	0.086	0.109	0.033
Family income: $15,000 to $20,000	0.075	0.094	0.035
Family income: $20,000 to $25,000	0.081	0.108	0.049
Family income: $25,000 to $30,000	0.088	0.100	0.057
Family income: $30,000 to $35,000	0.073	0.101	0.067
Family income: $35,000 to $40,000	0.064	0.074	0.065
Family income: $40,000 to $50,000	0.099	0.092	0.111
Family income: $50,000 to $60,000	0.087	0.079	0.115
Family income: $60,000 to $75,000	0.083	0.051	0.132
Family income: more than $75,000	0.129	0.092	0.298
Middle Atlantic	0.145	0.021	0.124
East North Central	0.164	0.080	0.155
West North Central	0.033	0.032	0.120
South Atlantic	0.315	0.045	0.149
East South Central	0.100	0.011	0.056
West South Central	0.109	0.235	0.078
Mountain	0.030	0.206	0.125
Pacific	0.075	0.366	0.105
In MSA but not in central city	0.289	0.358	0.411
Rural area	0.116	0.122	0.252
Central city status not identified	0.128	0.149	0.167
Sample size	4,555	2,985	34,690
Unemployed	0.058	0.038	0.027
Uses the Internet at work	0.187	0.105	0.298
Sample size	3,635	2,342	29,765

Note: The sample consists of adults ages 25-55.

Appendix 2
Sample Means of Analysis Variables for Conditional Internet Access Logit Regressions

Variable	Black	Mexican	White
Female	0.552	0.512	0.514
Age	39.808	38.128	40.497
Married	0.595	0.735	0.759
Previously married	0.162	0.106	0.116
Number of children	0.962	1.359	1.016
Children ages 6 to 17	0.447	0.540	0.430
High school graduate	0.265	0.309	0.259
Some college	0.362	0.277	0.315
College graduate	0.204	0.151	0.262
Graduate degree	0.106	0.046	0.131
Family income: $10,000 to $15,000	0.033	0.052	0.019
Family income: $15,000 to $20,000	0.040	0.044	0.022
Family income: $20,000 to $25,000	0.045	0.061	0.032
Family income: $25,000 to $30,000	0.068	0.062	0.043
Family income: $30,000 to $35,000	0.063	0.098	0.058
Family income: $35,000 to $40,000	0.069	0.072	0.058
Family income: $40,000 to $50,000	0.121	0.135	0.111
Family income: $50,000 to $60,000	0.114	0.147	0.123
Family income: $60,000 to $75,000	0.142	0.095	0.149
Family income: more than $75,000	0.258	0.202	0.369
Middle Atlantic	0.146	0.014	0.126
East North Central	0.144	0.095	0.153
West North Central	0.036	0.037	0.117
South Atlantic	0.341	0.027	0.145
East South Central	0.073	0.004	0.050
West South Central	0.086	0.233	0.074
Mountain	0.036	0.171	0.128
Pacific	0.097	0.414	0.115
In MSA but not in central city	0.362	0.396	0.437
Rural area	0.078	0.102	0.226
Central city status not identified	0.137	0.153	0.165
Sample Size	1,939	978	25,210
Unemployed	0.033	0.027	0.023
Uses the internet at work	0.270	0.207	0.338
Sample Size	1,666	801	21,887

Note: The sample consists of adults ages 25-55 who have access to a home computer.

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