

Online Appendix for

Internet Adoption and Usage Patterns are Different: Implications for the Digital Divide

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Abstract

There is a well-documented a “digital divide” in internet connection. We ask whether a similar divide exists for internet usage. Using a survey of 18,439 Americans, we find that high-income, educated people were more likely to have adopted the internet by December 2001. However, conditional on adoption, low-income, less-educated people spend more time online. We examine four possible reasons for this pattern: 1) differences in the opportunity cost of leisure time, 2) differences in the usefulness of online activities, 3) differences in the amount of leisure time, and 4) selection. Our evidence suggests this pattern is best explained by differences in the opportunity cost of leisure time. Our results also help to determine the potential effects of internet-access subsidies.

JEL Classification: L86, L96

Keywords: internet adoption, digital divide

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ONLINE APPENDIX

Exact Questions Used

Dependent Variables

We convert the following question into a binary adopt/do not adopt variable:

- How often do you go online? This includes access from home, work, or elsewhere to an online service, the internet, or the World Wide Web. (X ONE Box)
 - Don't have online access at all Have access but never use
 - Less often than once a month About once a month Several times a month
 - About once a week Several times a week Daily (weekdays and weekend)
- What kind of internet connection do you usually use at home? (X ONE Box)
 - I don't connect from home Dial-up (56K or higher)
 - Dial-up (slower than 56K) Dial-up (don't know speed) ISDN
 - Cable modem DSL or ADSL Satellite
 - WebTV/MSNTV Fixed wireless Other Don't know
- How many hours in a typical week do you spend online from the following locations? (X ONE Box for EACH)

Home: None 1-4 Hours 5-9 Hours 10-14 Hours 15-19 Hours 20-24 Hours

25-29 Hours 30+ Hours Does Not Apply
- How many **hours each week** do you spend ACTIVELY ONLINE (from ALL locations) for personal reasons?
 - 0-4 hours 5-9 hours 10-14 hours 15-19 hours 20-24 hours 25-29 hours
 - 30 or more hours Don't know

We convert the following questions (5, 6, and 7) into BINARY adopt/do not adopt variables for the 11 applications:

- Indicate how often you do each of the following things online. (X ONE Box For Each Activity)

	Once A Week Or More	Less Than Once A Week	Never
Use email	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Use text-based chat	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Play games alone	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Play games with/against others	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Research products for purchase	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Research a specific medical condition	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Indicate how often you visit/use each of the following information and entertainment sites. (X ONE Box For Each Activity)

	Once A Week Or More	Less Than Once A Week	Never
Your health plan or HMO's website	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
General health or fitness sites (e.g., WebMD, drkoop.com)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Medical industry sites (e.g., tylenol.com, pfizer.com)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Daily newspapers	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
National news sites	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Government agency sites (e.g., IRS, Social Security Administration, Department of Motor Vehicles)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

7. Have you ever bought anything using the internet or an online service and actually paid for the product or service online?
 Yes No

Instruments

1. Which of the following describes you? (X ALL That Apply)
 You, or your spouse, operate a business from home.
 You, or your spouse, have a formal arrangement with an employer to work from home one or more days per week (i.e., telecommuter)
 You, or your spouse, bring work home to do outside normal work hours
2. Which of the following describes you (X ALL That Apply) (in 2000)
 You, or your spouse, bring work home to do outside normal work hours ...
3. How many **hours each week** do you spend ACTIVELY ONLINE (from ALL locations) for work-related reasons?
 0-4 hours 5-9 hours 10-14 hours 15-19 hours 20-24 hours 25-29 hours
 30 or more hours Don't know
4. Do you use a computer at or for work? (X ONE Box)
 Yes No
5. Do you currently have a cell phone? (X ONE Box)
 Yes, I have a cell phone that I own
 Yes, I have a cell phone that is provided to me by an employer
 Yes, I have BOTH a cell phone that I own and a cell phone that is provided to me by an employer
 No, I don't have a cell phone
6. Which of the following events have occurred to you, yourself, in the *last 12 months*? (X ALL That Apply)
 Moved ...

Other

1. In a typical WEEK, how many hours of free time (time which excludes work-related activities, chores, errands, and sleep) do you have, including weekend hours? (X ONE BOX)
 0 hours 1-6 hours 7-12 hours 13-18 hours 19-24 hours
 25-30 hours 31-36 hours 37 or more hours
2. How soon do you plan to get high-speed internet access (such as cable or DSL) for your home? (X ONE Box)
 Already have high-speed internet access at home Within the next 6 months
 6 months to less than 1 year 1 year to less than 2 years More than 2 years from now Never
3. How long have you been going online? (X ONE Box)
 Less than 6 months 6 months to less than 1 year 1 year to less than 2 years 2 years to less than 3 years 3 years to less than 4 years 4 years to less than 5 years 5 years or more

Table A1: Coefficients of internet adoption and Heckman-corrected usage with added instruments

	Heckman-All instruments		Heckman-All instruments except years since first used the internet	
	(1)	(2)	(3)	(4)
Covariates	Personal usage	Home adoption	Personal usage	Home adoption
Income (\$0,000)	-0.092 (0.017)**	0.012 (0.003)**	-0.083 (0.017)**	0.012 (0.003)**
High school graduate	-1.857 (0.396)**	0.589 (0.041)**	-1.743 (0.399)**	0.587 (0.041)**
University/college graduate	-1.199 (0.188)**	0.067 (0.031)*	-1.006 (0.190)**	0.063 (0.031)*
Married	-2.161 (0.190)**	0.302 (0.027)**	-2.197 (0.192)**	0.302 (0.027)**
White	-0.399 (0.302)	0.529 (0.038)**	-0.233 (0.305)	0.531 (0.038)**
Age	-0.039 (0.008)**	-0.011 (0.001)**	-0.048 (0.008)**	-0.011 (0.001)**
Female	-1.504 (0.161)**	0.103 (0.026)**	-1.657 (0.163)**	0.106 (0.026)**
English is primary language	-1.145 (0.498)*	-0.084 (0.076)	-1.116 (0.504)*	-0.087 (0.076)
In city with 100,000 to 499,999 people	0.310 (0.266)	0.112 (0.039)**	0.389 (0.270)	0.112 (0.039)**
In city with 500,000 to 1,999,999 people	-0.099 (0.245)	0.126 (0.036)**	-0.031 (0.248)	0.125 (0.036)**
In city with over 2 million people	-0.406 (0.215)+	0.111 (0.032)**	-0.323 (0.218)	0.110 (0.032)**
# of children in household	-0.495 (0.091)**	-0.008 (0.017)	-0.609 (0.092)**	-0.008 (0.017)
Leisure time	0.671 (0.040)**	0.032 (0.006)**	0.712 (0.040)**	0.033 (0.006)**
Teen in the home		0.508 (0.024)**		0.518 (0.024)**
Operates a business from home		0.231 (0.037)**		0.231 (0.037)**
Brings work home (in 2000)		-0.015 (0.038)		-0.016 (0.038)
Brings work home (in 2001)		0.060 (0.036)		0.061 (0.036)+
Telecommutes		0.146 (0.072)*		0.149 (0.072)*
Time online for work (in 2000)		0.313 (0.012)**		0.317 (0.012)**
Optimism toward technology		0.155 (0.040)**		0.155 (0.040)**
Has a cell phone		0.007 (0.023)		0.007 (0.023)
Uses a computer at work		0.328 (0.031)**		0.328 (0.031)**
Moved		-0.057 (0.051)		-0.054 (0.051)
Years since first used the internet	0.686 (0.044)**			
ρ		-0.271 (0.0231)**		-0.310 (0.0211)**
σ		8.478 (0.056)**		8.604 (0.0577)**
λ		-2.298 (0.202)**		-2.663 (0.190)**
# of observations		17,808		17,808
Log likelihood		-54,861		-54,983.7

All regressions include occupation dummies and a constant. Standard errors in parentheses.

+ significant at 10%; * significant at 5%; ** significant at 1%

Table A2: Coefficients of internet adoption and Heckman-corrected usage with different definitions

	Usage defined by hours online at home		Only new adopters	
	(1)	(2)	(3)	(4)
<u>Covariates</u>	<u>Home usage</u>	<u>Home adoption</u>	<u>Personal usage</u>	<u>Home adoption</u>
Income (\$0,000)	-0.066 (0.018)**	0.013 (0.003)**	-0.057 (0.060)	0.012 (0.006)*
High school graduate	-2.335 (0.403)**	0.672 (0.039)**	-1.856 (0.931)*	0.320 (0.066)**
University/college graduate	-1.089 (0.192)**	0.133 (0.029)**	-0.477 (0.634)	0.236 (0.059)**
Married	-2.209 (0.195)**	0.298 (0.026)**	-1.315 (0.612)*	0.125 (0.051)*
White	0.469 (0.309)	0.463 (0.036)**	0.397 (0.810)	0.214 (0.066)**
Age	-0.036 (0.008)**	-0.014 (0.001)**	-0.054 (0.027)*	-0.010 (0.002)**
Female	-1.441 (0.165)**	0.014 (0.024)	-0.779 (0.545)	0.019 (0.048)
English is primary language	-0.659 (0.510)	-0.040 (0.072)	-1.351 (1.454)	-0.128 (0.128)
In city with 100,000 to 499,999 people	0.352 (0.273)	0.125 (0.038)**	-1.216 (0.836)	0.091 (0.072)
In city with 500,000 to 1,999,999 people	-0.151 (0.251)	0.130 (0.035)**	-0.711 (0.785)	0.066 (0.067)
In city with over 2 million people	-0.352 (0.221)	0.113 (0.030)**	-0.984 (0.697)	0.064 (0.059)
# of children in household	-0.642 (0.094)**	-0.024 (0.017)	-0.460 (0.304)	0.090 (0.032)**
Leisure time	0.669 (0.041)**	0.037 (0.006)**	0.76 (0.126)**	-0.011 (0.011)
Teen in the home		0.163 (0.039)**		0.042 (0.073)
Operate a business from home		0.32 (0.035)**		0.306 (0.066)**
Brings work home (in 2000)		0.021 (0.037)		-0.055 (0.083)
Brings work home (in 2001)		0.125 (0.035)**		0.128 (0.078)
Telecommutes		0.21 (0.070)**		0.077 (0.143)
Work usage (in 2000)		0.356 (0.012)**		0.205 (0.021)**
ρ		-0.307 (0.022)**		-0.186 (0.105)+
σ		8.835 (0.059)**		7.655 (0.204)**
λ		-2.709 (0.200)**		-1.404 (0.822)+
# of observations		18,439		5,137
Log likelihood		-57,181.3		-5,720.9

All regressions include occupation dummies and a constant. Standard errors in parentheses.

+ significant at 10%; * significant at 5%; ** significant at 1%

Table A3: Coefficients of internet adoption and Heckman-corrected usage for households of size one and size one or two

	Household size of 1		Household size of 1 or 2	
	(1)	(2)	(3)	(4)
Covariates	Personal usage	Home adoption	Personal usage	Home adoption
Income (\$0,000)	-0.173 (0.0665)**	-0.00295 (0.00800)	-0.107 (0.023)**	0.008 (0.004)*
High school graduate	0.988 (1.244)	0.840 (0.0972)**	-0.938 (0.530)+	0.692 (0.049)**
University/college graduate	-1.315 (0.584)*	0.0667 (0.0705)	-1.027 (0.255)**	0.093 (0.037)*
Married	-1.769 (0.893)*	0.571 (0.130)**	-2.235 (0.238)**	0.309 (0.031)**
White	0.0354 (0.686)	0.579 (0.0676)**	0.303 (0.403)	0.521 (0.045)**
Age	-0.0912 (0.0211)**	-0.00944 (0.00244)**	-0.054 (0.010)**	-0.014 (0.001)**
Female	-2.384 (0.488)**	0.217 (0.0573)**	-1.925 (0.216)**	0.029 (0.030)
English is primary language	-2.935 (1.542)+	-0.0111 (0.173)	-0.958 (0.676)	-0.069 (0.091)
In city with 100,000 to 499,999 people	-0.0995 (0.930)	-0.00320 (0.110)	0.693 (0.371)+	0.070 (0.050)
In city with 500,000 to 1,999,999 people	-0.0813 (0.877)	-0.223 (0.0984)*	-0.431 (0.340)	0.072 (0.046)
In city with over 2 million people	-1.185 (0.755)	-0.156 (0.0855)+	-0.502 (0.299)+	0.065 (0.040)
# of children in household	N/A	N/A	-1.28 (0.766)+	0.149 (0.138)
Leisure time	0.938 (0.124)**	0.0568 (0.0136)**	0.672 (0.054)**	0.053 (0.007)**
Teen in the home	N/A	N/A		-0.131 (0.194)
Operates a business from home		0.544 (0.124)**		0.368 (0.049)**
Brings work home (in 2000)		-0.0391 (0.105)		0.035 (0.050)
Brings work home (in 2001)		-0.0204 (0.101)		0.040 (0.047)
Telecommutes		0.379 (0.221)+		0.284 (0.098)**
Work usage (in 2000)		0.367 (0.0278)**		0.376 (0.015)**
ρ		-0.395 (0.0580)**		-0.295 (0.0307)**
σ		9.729 (0.201)**		8.932 (0.0799)**
λ		-3.839 (0.613)**		-2.558 (0.285)**
# of observations		2,781		10,920
Log likelihood		-7,767.4		-33,037.7

All regressions include occupation dummies and a constant. Standard errors in parentheses.

+ significant at 10%; * significant at 5%; ** significant at 1%

Table A4: First stage of Table 3: Heckman-corrected probit of application adoption conditional on internet adoption

Covariate/Usage Type	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Email	Chat	Online games	Research purchases	E-commerce	Health information (telemedicine)	News	E-government
Income (\$0,000)	0.025	0.026	0.026	0.028	0.027	0.025	0.023	0.023
	(0.004)**	(0.004)**	(0.004)**	(0.004)**	(0.004)**	(0.004)**	(0.004)**	(0.004)**
High school graduate	0.597	0.593	0.589	0.570	0.577	0.593	0.597	0.598
	(0.041)**	(0.041)**	(0.042)**	(0.041)**	(0.041)**	(0.041)**	(0.041)**	(0.041)**
University/college graduate	0.179	0.174	0.169	0.155	0.162	0.157	0.180	0.174
	(0.037)**	(0.037)**	(0.037)**	(0.036)**	(0.036)**	(0.036)**	(0.036)**	(0.036)**
Married	0.217	0.241	0.244	0.220	0.213	0.235	0.243	0.255
	(0.031)**	(0.031)**	(0.032)**	(0.031)**	(0.030)**	(0.032)**	(0.031)**	(0.031)**
White	0.485	0.467	0.464	0.456	0.443	0.468	0.485	0.467
	(0.041)**	(0.042)**	(0.042)**	(0.041)**	(0.041)**	(0.041)**	(0.041)**	(0.041)**
Age	-0.015	-0.018	-0.018	-0.017	-0.014	-0.017	-0.016	-0.018
	(0.001)**	(0.001)**	(0.001)**	(0.001)**	(0.001)**	(0.001)**	(0.001)**	(0.001)**
Female	0.005	-0.005	-0.005	0.011	-0.0003	-0.006	0.021	0.014
	(0.029)	(0.030)	(0.030)	(0.029)	(0.029)	(0.031)	(0.029)	(0.029)
English is primary language	-0.077	-0.053	-0.053	-0.073	-0.049	-0.052	-0.053	-0.011
	(0.085)	(0.087)	(0.088)	(0.085)	(0.084)	(0.086)	(0.085)	(0.086)
In city with 100,000 to 499,999 people	0.103	0.118	0.115	0.104	0.096	0.094	0.112	0.103
	(0.044)*	(0.045)**	(0.045)*	(0.044)*	(0.044)*	(0.044)*	(0.044)*	(0.044)*
In city with 500,000 to 1,999,999 people	0.134	0.14	0.139	0.119	0.113	0.124	0.137	0.14
	(0.041)**	(0.042)**	(0.042)**	(0.041)**	(0.040)**	(0.042)**	(0.041)**	(0.041)**
In city with over 2 million people	0.128	0.145	0.144	0.118	0.116	0.124	0.131	0.132
	(0.036)**	(0.036)**	(0.036)**	(0.036)**	(0.035)**	(0.036)**	(0.036)**	(0.036)**
# of children in household	-0.037	-0.055	-0.057	-0.049	-0.033	-0.045	-0.049	-0.050
	(0.021)+	(0.021)**	(0.021)**	(0.021)*	(0.020)	(0.020)*	(0.021)*	(0.020)*
Leisure time	0.042	0.043	0.042	0.043	0.041	0.046	0.043	0.045
	(0.007)**	(0.007)**	(0.007)**	(0.007)**	(0.007)**	(0.007)**	(0.007)**	(0.007)**
Teen in the home	0.202	0.264	0.267	0.217	0.177	0.222	0.224	0.238
	(0.049)**	(0.045)**	(0.050)**	(0.048)**	(0.048)**	(0.048)**	(0.049)**	(0.048)**
Operates a business from home	0.253	0.261	0.260	0.270	0.287	0.249	0.202	0.269
	(0.045)**	(0.049)**	(0.046)**	(0.044)**	(0.043)**	(0.044)**	(0.045)**	(0.044)**
Brings work home (in 2000)	0.099	0.752	0.115	0.132	0.106	0.137	0.095	0.105
	(0.051)+	(0.021)**	(0.053)*	(0.051)*	(0.050)*	(0.052)**	(0.051)+	(0.051)*
Brings work home (in 2001)	0.272	0.129	0.255	0.301	0.276	0.274	0.269	0.258
	(0.049)**	(0.100)	(0.051)**	(0.049)**	(0.048)**	(0.049)**	(0.049)**	(0.049)**
Telecommutes	0.111	0.103	0.141	0.152	0.15	0.176	0.175	0.191
	(0.100)	(0.052)*	(0.102)	(0.097)	(0.097)	(0.097)+	(0.098)+	(0.096)*
Work usage (in 2000)	0.799	0.266	0.752	0.779	0.796	0.76	0.765	0.766
	(0.010)**	(0.049)**	(0.024)**	(0.020)**	(0.014)**	(0.047)**	(0.015)**	(0.020)**

All regressions include occupation dummies and a constant. Standard errors in parentheses.

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