October 17, 2015

CPS & ACS Geographic Estimates of Internet Use, 1997-2014
Technical Documentation

I. Overview

The technical documentation covers the following data sets of geographic estimates of Internet use:

Time Series:
- Counties:
  - countyTimeSeries.xls
  - countyThreeYearAverage.xls
  - countyTimeSeriesChangeRate.xls
  - countyThreeYearAverageChangeRate.xls
  - countyYearlySummaryStatistics.xlsx
- Principal Cities:
  - principalCityTimeSeries.xls
  - principalCityThreeYearAverage.xls
  - principalCityTimeSeriesChangeRate.xls
  - principalCityThreeYearAverageChangeRate.xls
  - principalCityYearlySummaryStatistics.xlsx
- MSA:
  - msaTimeSeries.xls
  - msaThreeYearAverage.xls
  - msaTimeSeriesChangeRate.xls
  - msaThreeYearAverageChangeRate.xls
  - msaYearlySummaryStatistics.xlsx
- States:
  - stateTimeSeries.xls
  - stateThreeYearAverage.xls
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2013 ACS:
- Counties:
  - county2013ACSFactFinder.xlsx
  - county2013ACSMicroData.xlsx
- Principal Cities:
  - principalCity 2013ACSFactFinder.xlsx
  - principalCity 2013ACSMicroData.xlsx
- MSA:

msa2013ACSFactFinder.xlsx
msa2013ACSMicroData.xlsx

States:

state2013ACSFactFinder.xlsx
state2013ACSMicroData.xlsx

2014 ACS:

Counties:

county2014ACSFactFinder.xlsx

Principal Cities:

principalCity2014ACSFactFinder.xlsx

MSA:

msa2014ACSFactFinder.xlsx

States:

state2014ACSFactFinder.xlsx

The geographic estimates are based on the following data sources from the U.S. government:

Current Population Survey, October 1997: School Enrollment Supplement File (N=135,599)
Current Population Survey, December 1998: Computer and Internet Use Supplement File (N=135,977)
Current Population Survey, August 2000: Internet and Computer Use Supplement File (N=134,986)
Current Population Survey, September 2001: Computer and Internet Use Supplement File (N=158,866)
Current Population Survey, October 2003: School Enrollment and Computer Use Supplement File (N=156,941)
Current Population Survey, October 2007: School Enrollment and Internet Use Supplement File (N=151,370)
Current Population Survey, October 2009: School Enrollment and Internet Use Supplement File (N=152,246)
Current Population Survey, October 2010: School Enrollment and Internet Use Supplement File (N=152,665)
Current Population Survey, July 2011: Computer and Internet Use Supplement File (N=152,260)
Current Population Survey, October 2012: School Enrollment and Internet Use Supplement File (N=150,871)
2013 American Community Survey 1-Year Public Use Microdata Sample (PUMS) File (N=2,459,182)
2013 American Community Survey 1-Year Summary File (American FactFinder)
2014 American Community Survey 1-Year Summary File (American FactFinder)

Note: the Census Bureau plans to release the 2014 American Community Survey 1-Year Public Use Microdata Sample on October 27th, 2015.

II. Data Description

1. Time Series: Counties

- countyTimeSeries.xls

This data set contains the yearly estimates of the percentage of Internet use in about 330 U.S. counties along with their populations in 2014. The percentage of home Internet access goes back to 1997 from 2014, home broadband to 2000 from 2014, and mobile Internet and fully connected household to 2011 from 2014.

The CPS data are adjusted by multilevel models and used to create the Internet estimates for 1997, 1998, 2000, 2001, 2003, 2007, 2009, 2010, 2011, and 2012. The ACS summary tables of counties from American FactFinder provide the Internet estimates for 2013 and 2014. And the estimates for the missing years are imputed via linear interpolation. The counties that are identified in no CPS data between 1997 and 2012 are dropped.

- countyThreeYearAverage.xls

This data set takes the three-year moving average of the Internet estimates in countyTimeSeries.xls, following the formula $Y_{i,t}^{*} = (Y_{i,t-1} + Y_{i,t} + Y_{i,t+1}) / 3$ where $Y_{i,t}^{*}$ is three-year moving average and $Y_{i,t}$ is single-year estimate. The data set contains the yearly estimates of the percentage of Internet use in about 330 U.S. counties. The percentage of home Internet access is estimated between 1998 and 2013, and home broadband between 2001 and 2013. Because of the very short time series, three-year moving averages are not estimated for mobile Internet and fully connected household.

- countyTimeSeriesChangeRate.xls

This data set is based on countyTimeSeries.xls, and it estimates the yearly rate of change in the percentage of home Internet access, home broadband, mobile Internet, and fully connected households in about 330 U.S counties.

- countyThreeYearAverageChangeRate.xls

This data set is based on countyThreeYearAverage.xls, and it estimates the yearly rate of change in the percentage of home Internet access and home broadband in about 330 U.S. counties.

- countyYearlySummaryStatistics.xlsx

This file contains the summary statistics of the percentage of Internet use in U.S. counties across years. It summarizes home Internet access, home broadband, mobile Internet, fully connected household for single-year county estimates (countyTimeSeries.xls), and home Internet access and home broadband for three-year moving averages (countyThreeYearAverage.xls).

2. Time Series: Principal Cities

- principalCityTimeSeries.xls

This data set contains the yearly estimates of the percentage of Internet use in the principal cities of the 50 metropolitan areas that have the largest populations. It also contains the population in 2014 of each principal city. The percentage of home Internet access goes back to 1997 from 2014, home broadband to 2000 from 2014, and mobile Internet and fully connected household to 2011 from 2014.

The CPS data are adjusted by multilevel models and used to create the Internet estimates for 1997, 1998, 2000, 2001, 2003, 2007, 2009, 2010, 2011, and 2012. The ACS summary tables of principal cities from American FactFinder provide the Internet estimates for 2013 and 2014. And the estimates for the missing years are imputed via linear interpolation.

- principalCityThreeYearAverage.xls

This data set takes the three-year moving average of the Internet estimates in principalCityTimeSeries.xls, following the formula $Y^*_{i,t} = (Y_{i,t-1} + Y_{i,t} + Y_{i,t+1})/3$ where $Y^*_{i,t}$ is three-year moving average and $Y_{i,t}$ is single-year estimate. The data set contains the yearly estimates of the percentage of Internet use in the principal cities of the 50 largest metropolitan areas. The percentage of home Internet access is estimated between 1998 and 2013, and home broadband between 2001 and 2013. Because of the very short time series, three-year moving averages are not estimated for mobile Internet and fully connected household.

- principalCityTimeSeriesChangeRate.xls

This data set is based on principalCityTimeSeries.xls, and it estimates the yearly rate of change in the percentage of home Internet access, home broadband, mobile Internet, and fully connected households in the principal cities of the 50 largest metropolitan areas.

- principalCityThreeYearAverageChangeRate.xls

This data set is based on principalCityThreeYearAverage.xls, and it estimates the yearly rate of change in the percentage of home Internet access and home broadband in the principal cities of the 50 largest metropolitan areas.

- principalCityYearlySummaryStatistics.xlsx

This file contains the summary statistics of the percentage of Internet use in principal cities across years. It summarizes home Internet access, home broadband, mobile Internet, fully connected household for single-year principal-city estimates (principalCityTimeSeries.xls), and home Internet access and home broadband for three-year moving averages (principalCityThreeYearAverage.xls).

3. Time Series: Metropolitan Statistical Area (MSA)

- msaTimeSeries.xls

This data set contains the yearly estimates of the percentage of Internet use in the 50 metropolitan areas in the United States that have the largest populations. It also contains the population in 2014 of each metropolitan area. The percentage of home Internet access goes back to 1997 from 2014, home broadband to 2000 from 2014, and mobile Internet and fully connected household to 2011 from 2014.

The CPS data are adjusted by multilevel models and used to create the Internet estimates for 1997, 1998, 2000, 2001, 2003, 2007, 2009, 2010, 2011, and 2012. The ACS summary tables of metropolitan areas from American FactFinder provide the Internet estimates for 2013 and 2014. And the estimates for the missing years are imputed via linear interpolation.

- msaThreeYearAverage.xls

This data set takes the three-year moving average of the Internet estimates in msaTimeSeries.xls, following the formula $Y^*_{i,t} = (Y_{i,t-1} + Y_{i,t} + Y_{i,t+1}) / 3$ where $Y^*_{i,t}$ is three-year moving average and $Y_{i,t}$ is single-year estimate. The data set contains the yearly estimates of the percentage of Internet use in the 50 largest metropolitan areas. The percentage of home Internet access is estimated between 1998 and 2013, and home broadband between 2001 and 2013. Because of the very short time series, three-year moving averages are not estimated for mobile Internet and fully connected household.

- msaTimeSeriesChangeRate.xls

This data set is based on msaTimeSeries.xls, and it estimates the yearly rate of change in the percentage of home Internet access, home broadband, mobile Internet, and fully connected households in the 50 largest metropolitan areas.

- msaThreeYearAverageChangeRate.xls

This data set is based on msaThreeYearAverage.xls, and it estimates the yearly rate of change in the percentage of home Internet access and home broadband in the 50 largest metropolitan areas.

- msaYearlySummaryStatistics.xlsx

This file contains the summary statistics of the percentage of Internet use in metropolitan areas across years. It summarizes home Internet access, home broadband, mobile Internet, fully connected household for single-year MSA estimates (msaTimeSeries.xls), and home Internet access and home broadband for three-year moving averages (msaThreeYearAverage.xls).

4. Time Series: States

- stateTimeSeries.xls

This data set contains the yearly estimates of the percentage of Internet use in the 50 U.S. states along with their populations in 2014. The percentage of home Internet access goes back to 1997 from 2014, home broadband to 2000 from 2014, and mobile Internet and fully connected household to 2011 from 2014.

The CPS data are disaggregated with household weights to create the Internet estimates for 1997, 1998, 2000, 2001, 2003, 2007, 2009, 2010, 2011, and 2012. The ACS summary tables of metropolitan areas from American FactFinder provide the Internet estimates for 2013 and 2014. And the estimates for the missing years are imputed via linear interpolation.

- stateThreeYearAverage.xls

This data set takes the three-year moving average of the Internet estimates in stateTimeSeries.xls, following the formula $Y^*_{i,t} = (Y_{i,t-1} + Y_{i,t} + Y_{i,t+1})/3$ where $Y^*_{i,t}$ is three-year moving average and $Y_{i,t}$ is single-year estimate. The data set contains the yearly estimates of the percentage of Internet use in the 50 U.S. states. The percentage of home Internet access is estimated between 1998 and 2013, and home broadband between 2001 and 2013. Because of the very short time series, three-year moving averages are not estimated for mobile Internet and fully connected household.

- stateTimeSeriesChangeRate.xls

This data set is based on stateTimeSeries.xls, and it estimates the yearly rate of change in the percentage of home Internet access, home broadband, mobile Internet, and fully connected households in the 50 U.S. states.

- stateThreeYearAverageChangeRate.xls

This data set is based on stateThreeYearAverage.xls, and it estimates the yearly rate of change in the percentage of home Internet access and home broadband in the 50 U.S. states.

- msaYearlySummaryStatistics.xlsx

This file contains the summary statistics of the percentage of Internet use in states across years. It summarizes home Internet access, home broadband, mobile Internet, fully connected household for single-year state estimates (stateTimeSeries.xls), and home Internet access and home broadband for three-year moving averages (stateThreeYearAverage.xls).

5. 2013 ACS

- county2013ACSFactFinder.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in 817 U.S. counties along with their 2013 populations. It is based on the summary tables of 2013 American Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

- county2013ACSMicroData.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in 417 U.S. counties. The estimates are generated by disaggregating the 2013 American Community Survey 1-Year Public Use Microdata Sample which was obtained through Minnesota Population Center. For home Internet access, home broadband, mobile Internet, and fully connected household, the estimates are broken down by race, ethnicity, education, age, family income, and language skill.

- principalCity 2013ACSFactFinder.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in 383 principal cities along with their 2013 populations. It is based on the summary tables of 2013 American Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

- principalCity 2013ACSMicroData.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in 102 principal cities. The estimates are generated by disaggregating the 2013 American Community Survey 1-Year Public Use Microdata Sample which was obtained through Minnesota Population Center. The variable CITY which is consistent with the census definition of place is used as a proxy for principal city. For home Internet access, home broadband, mobile Internet, and fully connected household, the estimates are broken down by race, ethnicity, education, age, family income, and language skill.

- msa2013ACSFactFinder.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in 381 metropolitan areas along with their 2013 populations. It is based on the summary tables of 2013 American Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

- msa2013ACSMicroData.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in 260 metropolitan areas. The estimates are generated by disaggregating the 2013 American Community Survey 1-Year Public Use Microdata Sample which was obtained through Minnesota Population Center. For home Internet access, home broadband, mobile Internet, and fully connected household, the estimates are broken down by race, ethnicity, education, age, family income, and language skill.

- state2013ACSFactFinder.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in the 50 U.S. states along with their 2013 populations. It is based on the summary tables of 2013 American

Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

- state2013ACSMicroData.xlsx

This data set contains the 2013 estimates of the percentage of Internet use in the 50 U.S. states. The estimates are generated by disaggregating the 2013 American Community Survey 1-Year Public Use Microdata Sample which was obtained through Minnesota Population Center. For home Internet access, home broadband, mobile Internet, and fully connected household, the estimates are broken down by race, ethnicity, education, age, family income, and language skill.

6. 2014 ACS

- county2014ACSFactFinder.xlsx

This data set contains the 2014 estimates of the percentage of Internet use in 817 U.S. counties along with their 2014 populations. It is based on the summary tables of 2014 American Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

- principalCity2014ACSFactFinder.xlsx

This data set contains the 2014 estimates of the percentage of Internet use in 387 principal cities along with their 2014 populations. It is based on the summary tables of 2014 American Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

- msa2014ACSFactFinder.xlsx

This data set contains the 2014 estimates of the percentage of Internet use in 381 metropolitan along with their 2014 populations. It is based on the summary tables of 2014 American Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

- state2014ACSFactFinder.xlsx

This data set contains the 2014 estimates of the percentage of Internet use in the 50 U.S. states along with their 2014 populations. It is based on the summary tables of 2014 American Community Survey from American FactFinder. For home Internet access and home broadband, the estimates are broken down by race, ethnicity, education, age, and employment status.

III. Variable Description and Coding

1. Internet Variables

1) Variable description at the aggregate level

- access: percentage of having Internet access at home
- broadband: percentage of having high-speed Internet access at home
- mobile: percentage of having mobile Internet
- fully connected: percentage of having both mobile Internet and home high-speed Internet

2) Variable coding (ACS FactFinder data files)

Access is the percentage of the population who satisfy one of the following descriptions:
- With dial-up Internet subscription alone
- With a fixed broadband Internet subscription
- Mobile broadband subscription alone or with dial-up

Broadband is the percentage of the population who satisfy one of the following descriptions:
- With a fixed broadband Internet subscription
- Mobile broadband subscription alone or with dial-up

Mobile is the percentage of the population who satisfy one of the following descriptions:
- With a fixed broadband Internet subscription and mobile broadband subscription
- Mobile broadband subscription alone or with dial-up

Fully connected is the percentage of the population who satisfy the two descriptions below:
- With a fixed broadband Internet subscription
- With mobile broadband subscription

3) Variable coding at the individual level (CPS and ACS PUMS data files)

Variable	Survey/Coding	Source Variable/Question Wording
Access Access to Internet access at home 1 = true 0 = other	1997 CPS Coded to 1 if *pesu1* = 1 and *pescu12a* = 1; 0, otherwise.	*pesu1*: Is there a computer in this household? *pescu12a*: Does … use the Internet (or another on-line service) at home? 1 Yes 2 No
	1998 CPS, 2000 CPS Coded to 1 if *prs11* = 1 and either *hescu1a* or *hescu2* = 1; 0, otherwise.	*hescu1a*: Is there a personal computer or laptop in this household? *hescu2*: Is there a Web TV in this household? *prs11*: Internet use at home recode – for any purpose 1 Yes 2 No
	2001 CPS, 2003 CPS	*prnet2*: Internet use at home recode

	Coded to 1 if *prnet2* = 1; 0, otherwise.	1 Yes 2 No
	2007 CPS, 2009 CPS Coded to 1 if *henet1* = 1 and *henet2* = 1; 0, otherwise.	*henet1*: (Do you/Does anyone) in this household use the Internet at any location? *henet2*: (Do you/Does anyone in this household) connect to the Internet from home? 1 Yes 2 No
	2010 CPS Coded to 1 if *henet2a* = 1; 0, otherwise.	*henet2a*: At home (do you/do you or any member of this household) access the Internet? 1 Yes 2 No
	2011 CPS Coded to 1 if *hesci5* = 1; 0, otherwise.	*hesci5*: Does anyone in this household use the Internet from home? (Include using the Internet on mobile devises such as smartphones and laptops as well as on desktop computers.) 1 Yes 2 No
	2012 CPS Coded to 1 if *henet3* = 1; 0, otherwise.	*henet3*: Does anyone in this household use the Internet from home? 1 Yes 2 No
	2013 ACS PUMS Coded to 1 if *cinethh* = 1; 0, otherwise.	*cinethh*: At this house, apartment, or mobile home – do you or any member of this household access the Internet? 0 N/A; 1 Yes, with a subscription to an Internet Service; 2 Yes, without a subscription to an Internet Service; 3 No Internet access at this house, apartment, or mobile home.
Broadband Access to high-speed Internet at home 1 = true 0 = other	2000 CPS Coded to 1 if *hescu8* = 2 and **access** = 1; 0, otherwise.	*hescu8*: Type of home Internet access 1 Regular, or "dial-up", telephone service 2 Higher speed Internet access service
	2001 CPS, 2003 CPS Coded to 1 if *hesint2a* ≠ 1 and **access** = 1; 0, otherwise.	*hesint2a*: Do you currently access the Internet using – 1 A regular "dial-up" telephone line 2 A DSL line (Digital Subscriber Line) 3 A cable modem

		4 Something else
	2007 CPS, 2009 CPS Coded to 1 if *henet4* ≠ 1 and **access** = 1; 0, otherwise.	*henet4*: Do you currently access the Internet using – 1 A regular "dial-up" telephone 2 DSL, cable modem, satellite, wireless (such Wi-Fi), mobile phone or PDA, fiber-optics, or some other broadband Internet connection 3 Something else
	2010 CPS Coded to 1 if at least one variable from *heserv32-heserv37* is equal to 1 and **access** = 1; 0, otherwise.	*heserv32*: At home, (do you/does anyone in this household) access the Internet using DSL service? *heserv33*: At home, (do you/does anyone in this household) access the Internet using cable modem service? *heserv34*: At home, (do you/does anyone in this household) access the Internet using fiber-optic service? *heserv35*: At home, (do you/does anyone in this household) access the Internet using a mobile broadband plan for a computer or a cell phone? *heserv36*: At home, (do you/does anyone in this household) access the Internet using satellite service? *heserv37*: At home, (do you/does anyone in this household) access the Internet using some other service? 1 Yes 2 No
	2011 CPS Coded to 1 if at least one variable from *hesci32-hesci37* is equal to 1 and **access** = 1; 0, otherwise.	*hesci72*: At home, does anyone in this household access the Internet using DSL service? *hesci73*: At home, does anyone in this household access the Internet using cable modem service? *hesci74*: At home, does anyone in this household access the Internet using fiber-optic service? *hesci75*: At home, does anyone in this household access the Internet using a mobile broadband plan (for a computer or a cell phone)? *hesci76*: At home, does anyone in this household access the Internet using satellite service? *hesci77*: At home, does anyone in this household access the Internet using some other service? 1 Yes 2 No
	2012 CPS Coded to 1 if at least one variable from *henet42-henet47* is	*henet42*: At home, does anyone in this household access the Internet using a DSL service? *henet43*: At home, does anyone in this household access the Internet using a cable modem service?

	equal to 1 and **access** = 1; 0, otherwise.	*henet44*: At home, does anyone in this household access the Internet using a fiber-optic service? *henet45*: At home, does anyone in this household access the Internet using a mobile broadband plan (for a computer, cell phone, smart phone, or tablet)? *henet46*: At home, does anyone in this household access the Internet using a satellite service? *henet47*: At home, does anyone in this household access the Internet using some other service? 1 Yes 2 No
	2013 ACS PUMS Coded to 1 if at least one variable from *cimodem*, *cisat*, *cidsl*, *cifiber*, *cibrdbnd*, and *ciothsvc* is equal to 1; 0, otherwise.	*cimodem*: cable Internet service *cisat*: satellite Internet service *cids1*: DSL service *cifiber*: fiber-optic Internet service *cibrdbnd*: mobile broadband plan *ciothsvc*: other internet service 0 N/A; 1 Yes; 2 No.
Mobile Access to mobile Internet 1 = true 0 = other	2011 CPS Coded to 1 if at least on source variable is equal to 1 and **access** = 1.	*hesci75*: At home, does anyone in this household access the Internet using a mobile broadband plan (for a computer or a cell phone)? *pesc2a4*: When you use your cellular phone or smartphone, do you E-mail? *pesc2a5*: When you use your cellular phone or smartphone, do you use maps or use GPS navigation? *pesc2a7*: When you use your cellular phone or smartphone, do you access social network sites (such as Facebook or Twitter)? *pesc2a8*: When you use your cellular phone or smartphone, do you download "apps" or applications? 1 Yes 0 No
	2012 CPS Coded to 1 if at least on source variable is equal to 1 and **access** = 1.	*henet45*: At home, does anyone in this household access the Internet using a mobile broadband plan (for a computer, cell phone, smart phone, or tablet)? *penet1a4*: When you use your cellular phone or smartphone, do you browse the web? *penet1a5*: When you use your cellular phone or smartphone, do you Email? *penet1a6*: When you use your cellular phone or smartphone, do you use maps or use GPS navigation?

		penet1a8: When you use your cellular phone or smartphone, do you access social network sites? *penet1a9*: When you use your cellular phone or smartphone, do you download "apps" or applications? 1 Yes 2 No
	2013 ACS PUMS Coded to 1 if *cibrdbnd* = 1; 0, otherwise.	*cibrdbnd*: mobile broadband plan 0 N/A; 1 Yes; 2 No.
Fully Connected Access to both mobile Internet and high-speed Internet 1 = true 0 = other	2011 CPS Coded to 1 if **broadband** = 1 and **mobile** = 1; 0, otherwise.	
	2012 CPS Coded to 1 if **broadband** = 1 and **mobile** = 1; 0, otherwise.	
	2013 ACS PUMS Coded to 1 if **broadband** = 1 and **mobile** = 1; 0, otherwise.	

2. Demographic Characteristics

Variable description and coding at the individual level

Variable	Survey/Coding	Source Variable/Question Wording
White White race 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS Coded to 1 if *perace* = 1 and **hispanic** = 0; 0, otherwise.	*perace*: race 1 = White 2 = Black 3 = American Indian, Aleut, Eskimo 4 = Asian or Pacific islander 5 = Other - Specify

	2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *ptdtrace* = 1 and **hispanic** = 0; 0, otherwise.	*ptdtrace*: race 1 = White Only 2 = Black Only 3 = American Indian, Alaskan Native Only 4 = Asian Only 5 = Hawaiian/Pacific Islander Only 6 = White-Black 7 = White-AI 8 = White-Asian 9 = White-Hawaiian 10 = Black-AI 11 = Black-Asian 12 = Black-HP 13 = AI-Asian 14 = Asian-HP 15 = W-B-AI 16 = W-B-A 17 = W-AI-A 18 = W-A-HP 19 = W-B-AI-A 20 = 2 or 3 Races 21 = 4 or 5 Races
	2013 ACS PUMS Coded to 1 if *racwht* = 2; 0, otherwise.	*racwht*: race: white 1 = No 2 = Yes
Black African-American race 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS Coded to 1 if *perace* = 2 and **hispanic** = 0; 0, otherwise.	*perace*: race
	2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *ptdtrace* = 2 and **hispanic** = 0; 0, otherwise.	*ptdtrace*: race
	2013 ACS PUMS Coded to 1 if *racblk* = 2; 0, otherwise.	*racblk*: race: race: black or African American 1 = No 2 = Yes

Asian Asian race 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS Coded to 1 if *perace* = 4 and **hispanic** = 0; 0, otherwise.	*perace*: race
	2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *ptdtrace* = 4 and **hispanic** = 0; 0, otherwise.	*ptdtrace*: race
	2013 ACS PUMS Coded to 1 if *racasian* = 2; 0, otherwise.	*racasian*: race: race: Asian 1 = No 2 = Yes
Hispanic Hispanic ethnicity 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS Coded to 1 if *prhspnon* = 1; 0, otherwise.	*prhspnon*: Hispanic or non-Hispanic 1 = Hispanic 2 = Non-Hispanic
	2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *prhspnon* = 1; 0, otherwise.	*pehspnon*: Hispanic or non-Hispanic 1 = Hispanic 2 = Non-Hispanic
	2013 ACS PUMS Coded to 1 if *hispan* is equal to 1, 2, 3, or 4; 0, otherwise.	*hispan*: Hispanic origin [general version] 0 = Not Hispanic 1 = Mexican 2 = Puerto Rican 3 = Cuban 4 = Other 9 = Reported
Male Male gender 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009, CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *pesex* = 0; coded to 0 if *pesex* = 2.	*pesex*: sex 0 = Male 2 = Female

Age Age in years **age** = age in years	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2007 CPS, 2009, CPS, 2010 CPS, 2011 CPS **age =** *peage*	*peage*: person's age as of the end of survey week 0 = min value 90 = max value
	2003 CPS, 2012 CPS **age =** *prtage*	*prtage*: person's age 0-79 = Age in years 80 = 80-84 years old 85 = 85+ years old
	2013 ACS PUMS **age =** *age*	*age*: age in years
Age4 Age (4 categories) 1 = 18-29 2 = 30-49 3 = 50-64 4 = 60+	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009, CPS, 2010 CPS, 2011 CPS, 2012 CPS, 2013 ACS PUMS Coded to 1 if **age** $\in$ [18, 29]; 2 if **age** $\in$ [30, 49]; 3 if **age** $\in$ [50, 64]; 4 if **age** $\geq$ 60.	
Education Education attainment (5 categories) 1 = less than a high school diploma 2 = high school graduates, no college 3 = some college, no degree 4 = associate degree 5 = bachelor's degree or higher	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *educd* $\in$ [31, 38]; 2 if *educd* = 39; 3 if *educd* = 40; 4 if *educd* $\in$ [41,42]; 5 if *educd* $\in$ [43,46].	*peeduca*: Highest level of school completed or degree received 31 = Less Than 1st Grade 32 = 1st, 2nd, 3rd Or 4th Grade 33 = 5th Or 6th Grade 34 = 7th Or 8th Grade 35 = 9th Grade 36 = 10th Grade 37 = 11th Grade 38 = 12th Grade No Diploma 39 = High School Grad-Diploma Or Equiv (GED) 40 = Some College But No Degree 41 = Associate Degree-Occupational/Vocational 42 = Associate Degree-Academic Program 43 = Bachelor's Degree (Ex: BA, AB, BS) 44 = Master's Degree (Ex: MA, MS, MENG, MED, MSW)

		45 = Professional School Deg (Ex: MD, DDS, DVM) 46 = Doctorate Degree (Ex: PHD, EDD)
Education4 Education attainment (4 categories) 1 = less than a high school diploma 2 = high school graduates, no college 3 = some college, associate degree 4 = bachelor's degree or higher	2013 ACS PUMS Coded to 1 if *educd* $\in$ [0, 61]; 2 if *educd* $\in$ [62, 64]; 3 if *educd* $\in$ [65, 100]; 4 if *educd* $\in$ [101, 116].	*educd*: Educational attainment [detailed version] 0 = N/A or no schooling 1 = N/A 2 = No schooling completed 10 = Nursery school to grade 4 11 = Nursery school, preschool 12 = Kindergarten 13 = Grade 1, 2, 3, or 4 14 = Grade 1 15 = Grade 2 16 = Grade 3 17 = Grade 4 20 = Grade 5, 6, 7, or 8 21 = Grade 5 or 6 22 = Grade 5 23 = Grade 6 24 = Grade 7 or 8 25 = Grade 7 26 = Grade 8 30 = Grade 9 40 = Grade 10 50 = Grade 11 60 = Grade 12 61 = 12th grade, no diploma 62 = High school graduate or GED 63 = Regular high school diploma 64 = GED or alternative credential 65 = Some college, but less than 1 year 70 = 1 year of college 71 = 1 or more years of college credit, no degree 80 = 2 years of college 81 = Associate's degree, type not specified 82 = Associate's degree, occupational program 83 = Associate's degree, academic program 90 = 3 years of college

		100 = 4 years of college 101 = Bachelor's degree 110 = 5+ years of college 111 = 6 years of college (6+ in 1960-1970) 112 = 7 years of college 113 = 8+ years of college 114 = Master's degree 115 = Professional degree beyond a bachelor's degree 116 = Doctoral degree 999 = Missing
Income Family income	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009 CPS **income** = *hufaminc* Missing values are imputed via ordered logistic regressions where the predictors are **male**, **age**, **Hispanic**, **black**, **Asian**, **education**, **unmarried**, and occupation types.	*hufaminc*: Family income (combined income of all family members during the last 12 months. Includes money from jobs, net income from business, farm or rent, pensions, dividends, interest, social security payments and any other money income received by family members who are 15 years of age or older.) 1 = Less Than $5,000 2 = 5,00, 0 to 7,499 3 = 7,500 to 9,999 4 = 10,000 to 12,499 5 = 12,500 to 14,999 6 = 15,000 to 19,999 7 = 20,000 to 24,999 8 = 25,000 to 29,999 9 = 30,000 to 34,999 10 = 35,000 to 39,999 11 = 40,000 to 49,999 12 = 50,000 to 59,999 13 = 60,000 to 74,999 14 = 75,000 or more
	2010 CPS, 2011 CPS, 2012 CPS **income** = *hefaminc* Missing values are imputed via ordered logistic regressions where the predictors are **male**, **age**, **Hispanic**, **black**, **Asian**,	*hefaminc*: Family income (combined income of all family members during the last 12 months. Includes money from jobs, net income from business, farm or rent, pensions, dividends, interest, social security payments and any other money income received by family

	education, **unmarried**, and occupation types.	members who are 15 years of age or older.) 1 = less than $5,000 2 = 5,000 to 7,499 3 = 7,500 to 9,999 4 = 10,000 to 12,499 5 = 12,500 to 14,999 6 = 15,000 to 19,999 7 = 20,000 to 24,999 8 = 25,000 to 29,999 9 = 30,000 to 34,999 10 = 35,000 to 39,999 11 = 40,000 to 49,999 12 = 50,000 to 59,999 13 = 60,000 to 74,999 14 = 75,000 to 99,999 15 = 100,000 to 149,999 16 = 150,000 or more
Income5 Family income (5 categories) 1 = less than 20,000 2 = 20,000 to 39,999 3 = 40,000 to 59,999 4 = 60,000 to 99,999 5 = 100,000 or more	2013 ACS PUMS Coded to 1 if *ftotinc* $\leq$ 19999; 2 if *ftotinc* $\in$ [20,000, 39,999]; 3 if *ftotinc* $\in$ [40,000, 59,999]; 4 if *ftotinc* $\in$ [60,000, 99,999]; 5 if *ftotinc* $\geq$ 100,000.	*ftotinc*: total family income
Business Owner Owns a business or farm 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *hubus* = 1; 0, otherwise.	*hubus:* Does anyone in this household have a business or a farm? 1 = Yes 2 = No
Unmarried Not currently married 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *pemaritl* $\in$ [3,6]; 0, otherwise.	*pemaritl*: marital status 1 = Married - Spouse Present 2 = Married - Spouse Absent 3 = Widowed 4 = Divorced 5 = Separated 6 = Never Married
English Well	2013 ACS PUMS	*speakeng*: speaks English 0 = N/A or blank

English is spoken well. 1 = true 0 = other	Coded to 1 if *speaking* is equal to 3, 4, or 5; 0, otherwise.	1 = Does not speak English 2 = Yes, speaks English... 3 = Yes, speaks only English 4 = Yes, speaks very well 5 = Yes, speaks well 6 = Yes, but not well 7 = Unknown 8 = Illegible
Spanish Only Spanish is only language spoken. 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *huspnish* = 1; 0, otherwise.	*huspnish*: Is Spanish the only language spoken by all members of this household who are 15 years of ae or older? 1 = Spanish only language spoken
Occupation Primary job 0 = Met no conditions to assign 1 = Management, business, and financial 2 = Professional and related 3 = Service 4 = Sales and related 5 = Office and administrative support 6 = Farming, fishing, and forestry 7 = Construction and extraction 8 = Installation, maintenance, and repair 9 = Production 10 = Transportation and material moving	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS **occupation =** *prmjocc1* if *prmjocc1* $\neq$ 14; **occupation** = 0 if *prmjocc1* = 14.	*prmjocc1*: major occupation recode 1 = Executive, Administrative, & Managerial Occupations 2 = Professional Specialty Occupations 3 = Technicians And Related Support Occupations 4 = Sales Occupations 5 = Administrative Support Occupations, Including Clerical 6 = Private Household Occupations 7 = Protective Service Occupations 8 = Service Occupations, Except Protective & Hhld 9 = Precision Production, Craft & Repair Occupations 10 = Machine Operators, Assemblers & Inspectors 11 = Transportation And Material Moving Occupations 12 = Handlers, Equip Cleaners, Helpers, Laborers 13 = Farming, Forestry And Fishing Occupations 14 = Armed Forces
	2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS	*prmjocc1*: major occupation recode 1 = Management, business, and financial occupations

	occupation = *prmjocc1* if *prmjocc1* ≠ 14; **occupation** = 0 if *prmjocc1* = 14.	2 = Professional and related occupations 3 = Service occupations 4 = Sales and related occupations 5 = Office and administrative support occupations 6 = Farming, fishing, and forestry occupations 7 = Construction and extraction occupations 8 = Installation, maintenance, and repair occupations 9 = Production occupations 10 = Transportation and material moving occupations 11 = Armed Forces

3. Geographic identifiers

Variable description and coding at the individual level (CPS and ACS PUMS data files)

Variable	Survey/Coding	Source Variable/Question Wording
County County code	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS	*geco*: FIPS county code 000 = Not identified 001-810 = Specific county code
	2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS	*gtco*: FIPS county code 000 = Not identified 001-810 = Specific county code
	2013 ACS PUMS **county** = 10000***state** + *county*	*county*: A 4-digit numeric variable that identifies the county where the household was enumerated using the Inter-University Consortium for Political and Social Research (ICPSR) coding scheme. It is a state-dependent variable. 0000 = Not identifiable from public-use data
Principal City Principal city code	2013 ACS PUMS **principal city** = *city*	*city*: It identifies the city of residence for households located in identifiable cities. The cities identified by *city* are generally

		consistent with U.S. Census "place" definitions. 0000 = Not in identifiable city 0001-7650 = Specific city code
Principal City Status In a principal city 1 = true 0 = other	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS Coded to 1 if *gemsast* = 1; 0, otherwise.	*gemsast*: Central city/balance status 1 = Central city 2 = Balance 3 = Non-metropolitan 4 = Not identified
	2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS Coded to 1 if *gtcbsast* = 1; 0, otherwise.	*gtcbsast*: Principal city/balance status 1 = Principal city 2 = Balance 3 = Non-metropolitan 4 = Not identified
Metropolitan Area Metropolitan area code	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS **metropolitan** = *gemsa*	*gemsa*: MSA/PMSA FIPS code 0000 = Not identified or non-metropolitan 0080 = Min value 9360 = Max value
	2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS **metropolitan** = *gtcbsa*	*gtcbsa*: Metropolitan CBSA FIPS code 00000 = Not identified or non-metropolitan 00460 = Min value 79600 = Max value
	2013 ACS PUMS **metropolitan area** = *met2013*	*met2013*: A metropolitan area, or metro area, is a region consisting of a large urban core together with surrounding communities that have a high degree of economic and social integration with the urban core. For residents of metro areas, *met2013* identifies the metro area of residence using the official 2013 delineations for metropolitan statistical areas (MSAs) from the U.S. Office of

		Management and Budget (OMB). 00000 = Not in identifiable area 10420-49740 = Specific metropolitan area
State State code	1997 CPS, 1998 CPS, 2000 CPS, 2001 CPS, 2003 CPS, 2007 CPS, 2009 CPS, 2010 CPS, 2011 CPS, 2012 CPS **state** = *gestfips*	*gestfips*: Federal Information Processing Standards (FIPS) state code 01-56
	2013 ACS PUMS **state** = *statefip*	*statefip*: It reports the state in which the household was located, using the Federal Information Processing Standards (FIPS) coding scheme, which orders the states alphabetically. 01-56

IV. Procedures of Multilevel Models

Multilevel models are used to estimate the percentage of Internet use across counties, principal cities, and metropolitan areas with the CPS data.

A groups of random intercept logistic regressions (a type of multilevel model) are constructed for each Internet-related variables, namely, home Internet access, home broadband, mobile Internet, and fully connected household, respectively. In each regression, the dependent variable is an Internet-related variable, and the independent variables are Hispanic, black, Asian, Spanish only, income education5, age, male, unmarried, occupation dummies, percent black, and percent in poverty where percent black and percent in poverty are at the county, city, or MSA level and the other independent variables are all at the individual level.

For each Internet-relevant variable, a set of multilevel models are built, corresponding to the years when Internet use is a focus to the Current Population Survey. Home Internet access is estimated for ten years—1997, 1998, 2000, 2001, 2003, 2007, 2009, 2010, 2011, and 2012. Home broadband is estimated for eight years—2000, 2001, 2003, 2007, 2009, 2010, 2011, and 2012. And mobile Internet and fully connected household are estimated for two years—2011 and 2012.

The time-series data sets on Internet use are based on 66 multilevel models, with 22 for counties, principal cities, and MSAs, respectively. When county is the second level, only the observations for which counties are identifiable are kept. When MSA is the second level, all the observations

except those in the largest 50 MSAs are dropped. And when principal city is the second level, the observations examined are those in the principal cities of the largest 50 MSAs.

With multilevel models, respondents' answers to the Internet-related questions are adjusted, and disaggregated by counties, principal cities, or MSAs. The household weight (*hwhhwgt*) is not used in estimating the multilevel models, but it is used at the stage of disaggregation.