

The Internet and the Economy – An Overview

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Using data from a variety of sources, this document provides a summary of the impact of the internet on the economy. Topics covered include internet access patterns, extent of use of the internet and internet devices in individuals' daily lives, the impact on certain industries, and privacy issues. Unless noted otherwise, all data are for the U.S.

The purpose of this document is twofold. First, it organizes and presents data along with some interpretation, with the hope that increasing knowledge of trends in the data may spark new research. Second, it informs researchers of available data and data sources.

The first section provides an overview of penetration of the internet and internet devices, as well as time spent on the internet. The second section covers the impact of internet use growth on certain sectors in the U.S. economy. In the third section, trends in awareness of privacy concerns are detailed. Lastly, in section 4, international data sources are briefly discussed.

Section 1: Individuals and the Internet

Nowadays, we frequently hear about how the internet is affecting the economy by sparking creative destruction in a variety of industries, impacting social dynamics/relationships, invading privacy, affecting

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public health for good (e.g. WebMD/Googleflu) or bad (e.g. texting while driving), etc. What underlies the frequent discussion of benefits and concerns is the increasingly widespread adoption of internet devices. Yet, in many cases individuals have vague or imprecise information about the adoption rates of different types of internet connections and internet devices. In this subsection, I address this absence of good information by presenting relevant data sources.

The number of internet users and internet device adopters has increased at a rapid pace over the last decade. As Table 1 shows, computer penetration has more than doubled between 1997 and 2010, reaching 77%. Internet penetration, only 19% in 1997, has grown to 71% in 2010. Moreover, nearly all internet connections ($68/71 \times 100 = 96\%$) now appear to be of the faster broadband variety.

Table 1

Computer and Internet Penetration								
	1997	1998	2000	2001	2003	2007	2009	2010
Computer	37%	42%	51%	56%	62%			77%
Internet	19%	26%	42%	50%	55%	62%	69%	71%
Broadband	0%	0%	4%	9%	20%	51%	64%	68%

Data are from the CPS supplement surveys. Extracted from U.S. Department of Congress (2011a), U.S. Department of Congress (2011b), and Greenstein and McDevitt (2010).

Tables 2 and 3 highlight another trend – consumers have moved more and more towards smaller, portable devices, and increasingly have access to the internet wherever they go. While desktop penetration has actually dropped, laptop penetration has grown dramatically, nearly doubling between 2006 and 2011. MP3 players, e-readers, and tablets show rapid rates of growth.

Table 2

Electronic Device Penetration							
	2006 - Apr	2007 - Dec	2008 - Apr	2009 - Apr	2010 - May	2011 - May	2012 - Jan
Cell phone	73%	75%	78%	85%	82%	83%	87%
Desktop	68%	65%	65%	64%	62%	57%	
Laptop	30%	37%	39%	47%	55%	56%	
mp3 player	20%	34%	37%	45%	46%	44%	
Game console				41%	42%		
e-reader				2%	4%	12%	19%
Tablet					3%	8%	19%

Pew (2012).

Of particular interest is the growth in penetration rates of smartphones and data plans. As Table 3 shows, smartphone penetration has nearly quadrupled between 2008 and 2011, reaching 42%. Not surprisingly, unlimited data plan penetration shows similar growth.

Table 3

Smartphone Penetration Among Mobile Subscribers		
December of year:	Smartphone Ownership	Unlimited Data plans*
2008	11%	16%
2009	16.8%	21.3%
2010	27.0%	29.0%
2011	42%	

Comscore (2010a,2011,2012).

* Unlimited data plans can be applied to "feature phones," in addition to smartphones. Generally, smartphones are defined by having "3rd party" operating systems on multiple phones. This includes IOS since it runs on multiple iPhone versions. Feature phones, by contrast, have operating systems specific to the phone, and typically have few available apps. For more, see Lee (2010).

Given the growth in adoption rates, it is not surprising that the internet now plays a more central role in peoples' lives. Table 4 shows that time spent on the internet continues to increase. While the definition of sample changed several times in the years included in Table 4, precluding direct comparisons over long time horizons, one can easily see steady year over year growth when considering short time frames where the sample definition remained constant.

Table 4

Time Spent on Internet		
	Hours Per Week	Sample
2000-2001	8.65	Households with home internet connections
2003	7.39	Households accessing internet more than 3 times
2004	7.79	Households accessing internet more than 3 times
2005	8.33	Households accessing internet more than 3 times
2006	9.16	Households accessing internet more than 3 times
2007	4.32	All 18+ households
2008	4.96	All 18+ households
2009	5.50	All 18+ households
2010	6.13	All 18+ households

Forrester Technographics. Obtained from Goldfarb and Prince (2008) and Brynjolfsson and Oh (2012).

*Note the criterion for the sample changed in 2003 and 2007, preventing direct comparisons at these junctures

Section 2: The E-economy and Old-economy

It is common knowledge that the internet is a driving force of change in the structure of our economy. This section gives specific information regarding its impact, and highlights differences in the impact across industries.

The End of a "Series of Tubes"

Before one can use all that the internet has to offer and before business can earn revenues from consumers via the internet, consumers must have access to the internet. Provision of internet access itself could be a big sector of the internet economy, given the aforementioned internet adoption rates.

Table 5 below shows growth in access revenues in the US from all sources, including individual consumers and businesses. Not surprisingly, growth has been dramatic. While dial-up revenue has declined, revenue from cable and DSL connections shows strong increases. The table shows that total access revenues alone, excluding wireless, were over \$50 billion in 2010. Wireless access revenues grew at a more rapid rate than cable and DSL. A rarely used form of access five years ago, revenues from wireless services reached nearly \$30 billion by 2010.

Table 5

Internet Service Provider Revenues (in Millions of Dollars) in the U.S.*				
	Dial Up	Cable	DSL	Wireless (Excl. Satellite)
1998	\$5,499	\$138		
1999	\$8,966	\$274		
2000	\$12,345	\$903		
2001	\$10,339	\$2,364	\$4,917	
2002	\$10,596	\$3,743	\$4,343	
2003	\$10,665	\$6,702	\$4,329	
2004	\$10,585	\$8,582	\$4,342	
2005**	\$10,281	\$11,568	\$14,315	
2006	\$8,399	\$13,736	\$15,272	\$7,650
2007	\$6,924	\$16,281	\$20,045	\$12,731
2008	\$5,966	\$18,070	\$22,468	\$20,069
2009	\$5,431	\$19,322	\$25,020	\$24,602***
2010	\$5,082	\$20,944	\$28,640	\$28,604

U.S. Department of Commerce (2000a, 2004a, 2010a).

*Dial-up revenue corresponds to NAICS code 514191 prior to 2005, and NAICS code 518111 thereafter. Cable modem corresponds to NAICS code 5175. DSL corresponds to NAICS code 5133 prior to 2005, and NAICS code 5171 from 2005 onwards. Wireless revenue corresponds to NAICS code 517212.

** The sample used to estimate total revenues changed in 2001 and 2005, potentially explaining large changes in those years. In 2004, the Dept. of Commerce surveyed both the new and old samples, allowing direct comparison. The revenues estimates for the new sample exceeded estimates from the old sample by roughly 33% for dial up, 15% for Cable, and 200% for DSL. The respective revenue estimates for 2004 using the new sample were \$14,174 million for dialup, \$9,924 million for Cable, and \$12,616 million for DSL. See U.S. Department of Commerce (2005a).

***Estimates for a given year change year to year based on cumulative available information. Occasionally, estimates for the same year varied wildly over time. For example, the original 2009 revenue estimate in the 2009 report for wireless access revenue data was \$10,101,000. In the 2010 report, the estimate for that same year, 2009, was revised upwards to \$24,604.

Data from the consumer expenditure survey provides a separate estimate on expenditures from consumers alone. Table 6, which contains this information, shows that access revenues from consumers are about \$35 billion, comprising over half of all non-wireless revenues.

Table 6

Average Annual Expenditures on Internet Access by Consumer Units			
	Consumer Unit Expenditure	Total Consumer Units in Thousands	Total Expenditures in Millions (Column 1 x Column 2)
1995	\$0.39	103,123	\$40.22
1996	\$13.63	104,212	\$1,420.41
1997	\$20.65	105,576	\$2,180.14
1998	\$35.25	107,182	\$3,778.17
1999	\$48.69	108,465	\$5,281.16
2000	\$61.36	109,367	\$6,710.76
2001	\$90.33	110,339	\$9,966.92
2002	\$107.29	112,108	\$12,028.07
2003	\$123.92	115,356	\$14,294.92
2004	\$139.46	116,282	\$16,216.69
2005	\$153.94	117,356	\$18,065.78
2006	\$176.44	118,843	\$20,968.66
2007	\$194.11	120,171	\$23,326.39
2008	\$219.27	120,770	\$26,481.24
2009	\$253.49	120,847	\$30,633.51
2010	\$285.14	121,107	\$34,532.45

Department of Labor (1994-2010).

Which of several possible reasons explains the increase in access revenues? The adoption data from Table 1 suggests that some combination of increased adoption and adoption of higher quality connections contribute to this revenue increase. But might prices also?

Table 7 shows the consumer price index for internet access. Ignoring 2006-2007, when a discrete jump occurred, no strong trend is apparent. Shane Greenstein has speculated that the discrete price jump was due to AOL's waiving access fees, and providing free service. A back of the envelope calculation would suggest that AOL's share of the market and price drop would nearly explain this change. However, the CPI has stated that other unnamed reasons are the cause.

The discrete jump highlights problems inherent to the CPI index for the internet. First, it does not provide separate price indexes for different connection types (broadband vs. dialup). Second, the CPI does not control for quality changes, such as connection speeds, data limits, and included software. It is well-known that omitted quality changes bias upwards price index estimates.

Greenstein and McDevitt (2010) and Wallsten and Riso (2010) attempt to control for quality changes via hedonic price regressions and "augmented matching." Greenstein and McDevitt's (2010) price indexes for standalone internet access, which do not include bundles with TV and/or phone, are shown in Table 8. They find a moderate decline in prices over time.

Table 7

Internet Consumer Price Index	
	Index
2001	98.1
2002	98.9
2003	99.8
2004	97.4
2005	95.7
2006	92.2
2007	73.2
2008	73.9
2009	76.5
2010	77.0
2011	76.3

U.S Department of Labor (2001b-2011b).

Table 8

Residential Standalone Internet Hedonic Price Index		
	Price Index For	
	Cable	DSL
2004	1.000	1.000
2005	0.937	1.035
2006	0.863	0.965
2007	0.760	0.908
2008	0.722	0.944
2009	0.864	0.940

Greenstein and McDevitt (2010).

Table 9

Residential Standalone Broadband Hedonic Price Index			
	Index Type:		
	Paasche	Laspeyres	Fisher
2007 (1st half)	1.00	1.00	1.00
2007 (2nd half)	0.88	0.94	0.91
2008 (1st half)	0.94	0.97	0.96
2008 (2nd half)	0.83	0.96	0.89
2009 (1st half)	0.88	1.02	0.95
2009 (2nd half)	0.77	1.00	0.89

Wallsten and Riso (2010).

Wallsten and Riso (2010) provide a second price index estimate. They leverage a more detailed dataset, compared with Greenstein and McDevitt (2010), that includes data on more types of quality changes,

but covers a shorter timeframe. Their results, in Table 9, show even greater price declines. Controlling for quality, it seems prices of internet access have declined noticeably.

Somewhat surprisingly, neither set of authors found evidence of price declines for broadband bundles, which include TV and/or phone in addition to internet.

For business internet access, Wallsten and Riso (2010) find similar, though less dramatic declines in prices of broadband connections. See Table 10.

Table 10

Business Standalone Broadband Hedonic Price Index						
	2007 (1st half)	2007 (2nd half)	2008 (1st half)	2008 (2nd half)	2009 (1st half)	2009 (2nd half)
Modified Laspeyres Index	1.00	0.94	0.89	0.89	0.9	0.85

Wallsten and Riso (2010).

Ecommerce

Access revenues alone are noteworthy. However, it is often believed that the main economic impact of the internet relates to businesses that connect with consumers through the internet, and the brick and mortar stores that are affected.

The first, most obvious fact is that consumers are buying more and more on the internet. Between 2004 and 2011, total e-spending more than doubled, reaching over a quarter of a trillion dollars.

Table 11

U.S. Ecommerce Expenditures (in Billions)		
	Total (Including travel- related purchases)	Non-travel
2004	\$117	-
2005	\$143	-
2006	-	\$102
2007	-	-
2008	\$214	\$130
2009	\$210	\$130
2010	\$228	\$143
2011	\$256	\$162

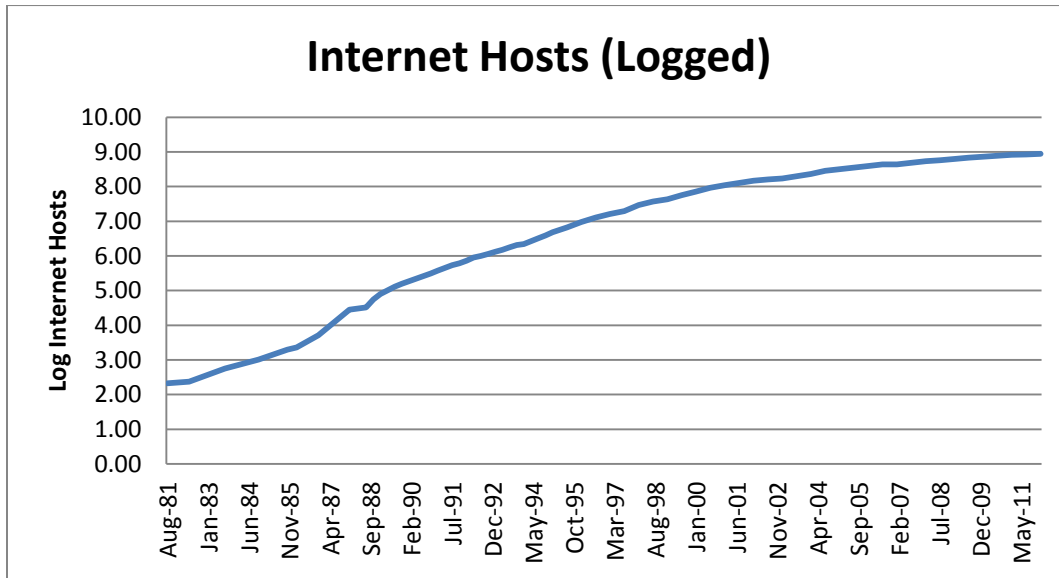
Comscore (2005a,2006a,2007a,2010a,2011).

“-“ Data not available.

Websites and Media

As more and more individuals spend more and more time online, the number and likely the quality of websites has increased. Figure 1 shows the increase in internet hosts, a proxy for number of websites worldwide, over the last 30 years. The number of hosts doubles every 3-6 years over this period, demonstrating very rapid growth.

Figure 1



Internet Systems Consortium.

The most popular websites see a greater and greater share of internet users, rather than seeing those individuals' attention being displaced by more specialized websites in the long tail. Table 12 shows the fraction of total internet users accessing selected top internet sites from the top 50 most accessed websites.

Note that several websites (Google, Microsoft, Yahoo, and Facebook) have over $\frac{1}{4}$ of internet users visiting their sites each month, as of December 2011. Facebook in particular is of interest, reaching such high penetration only 7 years after creation. Rome wasn't built in a day, but it seems a digital Rome might be.

Also of note is the growth in popularity of top new sites. The New York Times, for example, is accessed by over $\frac{1}{3}$ of internet users in December, 2011.

It is not surprising, nor news, that "old-fashioned" print newspapers have not fared well following strong competition from the internet. Both the total number and total circulation have fallen dramatically. See Figure 2.

Table 12

Unique Monthly Visitors to Selected Top Sites in December of Each Year, as % of Total Users								
Website*	2004	2005	2006	2007	2008	2009**	2010	2011
Facebook	< 7.7%	< 8.0%	11.0%	18.9%	28.6%		72.6%	73.5%
Google sites	44.5%	50.8%	64.8%	72.4%	78.2%		84.6%	84.9%
Microsoft sites	70.4%	68.5%	66.9%	65.4%	65.7%		83.5%	80.4%
Yahoo sites	74.1%	73.2%	75.5%	74.4%	76.4%		85.5%	80.1%
Amazon	29.9%	33.8%	32.6%	35.5%	37.5%		43.0%	52.0%
Wikimedia Foundation Sites	< 7.7%	10.2%	22.1%	28.2%	30.6%		36.7%	37.7%
Viacom Digital	20.8%	21.6%	23.0%	23.5%	24.3%		39.9%	35.7%
CBS digital	< 7.7%	< 8.0%	13.3%	13.7%	27.7%		40.6%	34.7%
Time Warner	71.3%	68.3%	69.4%	65.1%	17.3%		< 12.4%	< 11.9%
Ebay	41.3%	38.1%	48.4%	37.0%	40.9%		33.2%	33.8%
NYTimes	< 7.7%	20.2%	23.0%	24.2%	24.3%		32.9%	34.7%
Walmart	21.1%	22.4%	25.3%	24.1%	25.9%		24.2%	25.3%
Weather Channel	17.5%	17.9%	15.5%	22.1%	21.8%		20.9%	24.7%
Craigslist	< 7.7%	< 8.0%	8.8%	13.3%	19.4%		24.1%	19.7%
ESPN	9.2%	9.3%	9.3%	11.3%	10.7%		19.0%	19.7%
Netflix	< 7.7%	< 8.0%	< 8.4%	< 9.3%	< 15.8%		< 12.4%	15.8%
LinkedIn	< 7.7%	< 8.0%	< 8.4%	< 9.3%	< 15.8%		12.5%	15.2%
Myspace/Intermix Media	11.1%	18.9%	< 8.4%	< 9.3%	< 15.8%		< 12.4%	< 11.9%

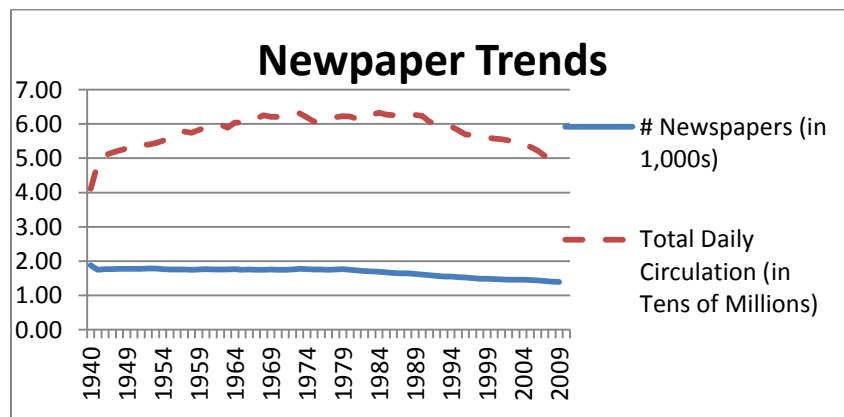
Comscore (2005b, 2006b, 2007b, 2007c, 2008, 2010b).

Observations for websites not in top 50 are censored. In the above table, such observations are replaced with a “<” sign before the percent unique visitors visiting the 50th most visited website.

*Websites may include subwebsites. Changes to classifications of subwebsites are not available.

** 2009 data not available

Figure 2

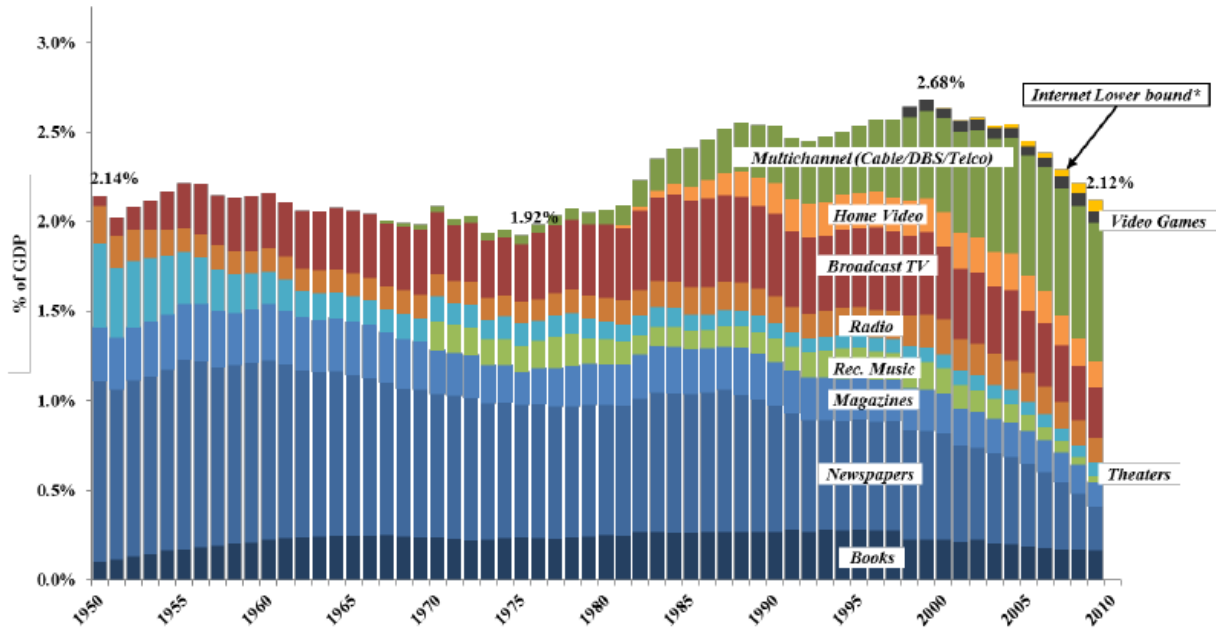


Newspaper Association of America - Editor and Publisher International Yearbook

While newspapers have been particularly hard hit, and their problems frequently covered in the news, the internet has had an impact on most forms of media. Figure 3 below, reproduced from Waterman and Ji (2011), nicely presents the trends in revenues from various media sources.

Figure 3

Revenues for Various Media Sources as Percent of GDP



* includes newspaper websites; digital music/movies; television station/network websites; Internet radio; e-books
 Preliminary data (Waterman/Ji, August, 2011)
 Sources: U.S. Census; trade associations; industry analysts; 10-K reports; author estimates; See Appendix A

One of the main impacts of the internet has been to steal advertising revenues. However, the above figure does not distinguish between advertising revenues and other sources of revenues. Data on advertising is available for some industries via the U.S. Service Annual Survey. It is summarized in Table 13.

It isn't surprising to anyone who has read the news the last few years that internet advertising revenues have grown dramatically. However, it may be surprising that advertising revenues in some industries were affected strongly by this, while others were not. For example, while newspapers have seen strong revenue declines, broadcast television has seemingly been unaffected. Radio falls somewhere in between.

Table 13

		Advertising Revenues (in Billions of Dollars)									
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Internet Advertising Bureau											
	Online Advertising	7.2	6.0	7.3	9.6	12.5	16.9	21.2	23.4	22.7	26.0
Census**											
	Web Search Portals	-	-	-	4.9*	5.5	8.0	11.4	13.7	-	15.9
	Companies Publishing Exclusively Online	-	-	-	1.5*	1.8	2.6	3.5	4.3	5.0	5.6
	Television Broadcasting										
	Local	-	-	-	9.7*	10.7	11.4	11.2	10.9	8.6	9.7
	National	-	-	-	16.3*	18.0	18.3	17.5	17.8	15.3	17.3
	Cable and Other Subscription Services	12.8	13.4	15.0	16.5	16.1	17.1	18.6	20.0	19.9	21.1
	Radio Stations										
	Local	-	-	-	12.3*	9.8	9.8	9.8	8.9	7.3	7.4
	National	-	-	-	3.8*	2.9	3.1	3.2	3.1	2.5	2.8
	Newspapers										
	Print	32.0	31.9	32.4	33.5	-	-	-	-	-	-
	Online	0.3	0.5	0.6	0.7	-	-	-	-	-	-
	Other	0.1	0.1	0.1	0.0	-	-	-	-	-	-
	Classifieds	-	-	-	12.8*	11.2	10.9	10.0	8.1	6.0	5.7
	All Other	-	-	-	23.1*	24.0	24.0	23.3	22.1	17.3	16.0
	Periodical Publishers										
	All Print	18.4	17.8	17.8	18.8	-	-	-	-	-	-
	General Interest	-	-	-	14.4*	14.1	15.1	15.1	14.0	10.9	9.7
	Display (e.g. Billboards)	4.5	4.6	4.9	5.4	5.7	6.2	7.1	7.2	6.2	6.4
	Direct Mail	10.7	10.5	10.6	11.6	12.4	12.5	12.4	11.5	10.0	10.7

U.S. Department of Commerce (2010a).

IAB (1999-2010).

"-" Data not available, not directly comparable with other years due to changes in NAICS code criteria or changes in the survey, or didn't meet publication standard for sampling variability.

* Available in 2005 SAS report.

** Substantial reclassification of companies in the web search and online publishing industries occurred between the NAICS 1997 codes (used until 2004), and the NAICS 2002 codes (used thereafter). The sample of firms used in estimation all changed in 2004, compounding errors in the difference between 2004 and 2005 numbers. Therefore Census statistics before 2005 should not be compared with statistics from 2005 or later.

The NAICS codes used to classify revenues by industry type are as follows. Web Search Portals - 519130 (2007 NAICS reclassification), 518112 (2002 NAICS reclassification). Online Publishers - 519130 (2007 NAICS reclassification) 516110 (2002 NAICS reclassification). Television Broadcasting - 51512 (2007, 2002 NAICS reclassifications), 51312 (1997 NAICS reclassification). Cable and Other Subscription Services - 5152 (2007, 2002 NAICS reclassifications), 5132 (1997 NAICS reclassification). Radio Stations - 515112 (2007, 2002 NAICS reclassifications), 513112 (1997 NAICS reclassification). Newspapers - 51111. Periodical Publishers - 51112. Display Advertising - 54185. Direct Mail - 54186.

Employment

Often, when new industries disrupt old ones, disrupting firms show strong employment growth. However, in the county business patterns data, industries likely to experience employment growth do not show a strong consistent pattern of growth. This is shown in Table 14.

Table 14

Employment Statistics for Selected Industries								
	2003	2004	2005	2006	2007	2008	2009	2010
Software Publishing								
Number Employed (in 1000s)	344.24	328.62	327.64	339.83	346.68	386.41	370.02	**
Gross Annual Payroll (in Billions of Dollars)	-	-	39.22	39.65	42.97	41.60	40.61	43.27
Internet Publishing and Broadcasting								
Number Employed (in 1000s)	35.61	37.05	36.15	41.59	46.63	88.66*	91.13	**
Gross Annual Payroll (in Billions of Dollars)	-	-	2.84	3.51	4.19	5.10	5.14	6.05
Data Processing, Hosting, and Related Services								
Number Employed (in 1000s)	403.00	365.92	379.41	385.11	375.47	391.96	387.17	**
Gross Annual Payroll (in Billions of Dollars)	-	-	20.86	22.68	24.05	27.16	27.28	27.91
Wired Telecommunications Carriers								
Number Employed (in 1000s)	855.20	781.41	693.72	634.54	621.71	844.01	840.52	**
Gross Annual Payroll (in Billions of Dollars)	-	-	69.68	73.83	70.18	73.11	70.58	69.13
Wireless Telecommunications Carriers (except Satellite)								
Number Employed (in 1000s)	266.28	262.06	249.97	241.41	277.62	286.32	277.59	**
Gross Annual Payroll (in Billions of Dollars)	-	-	15.26	15.89	16.01	17.95	16.42	15.48

U.S. Department of Commerce (1998b-2010b)

"-" Data Not Available, or not directly comparable with other years due to a change in NAICS code criteria or changes in the survey.

* Definition changed in 2009 to include employment in Web Search Portals. The NAICS code before then was 516110.

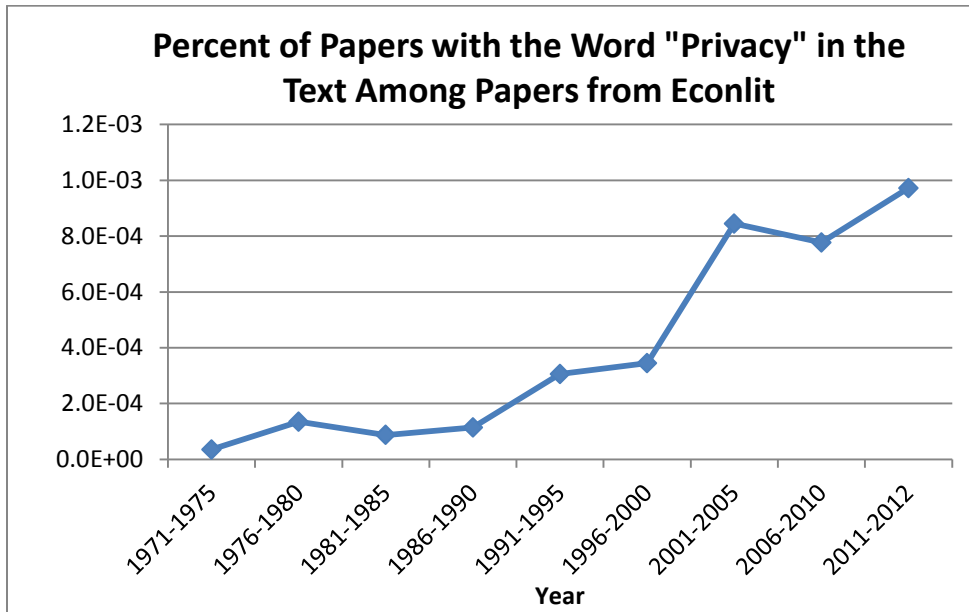
** Data unavailable at time of collection.

NAICS codes used to classify industries are as follows. Software Publishing – 5112. Internet Publishing and Broadcasting – 516110. Data Processing, Hosting, and Related Services – 518210. Wireless Telecommunications Carriers – 517110. Wireless Telecommunications Carriers (except Satellite) – 517210.

Section 3: Privacy

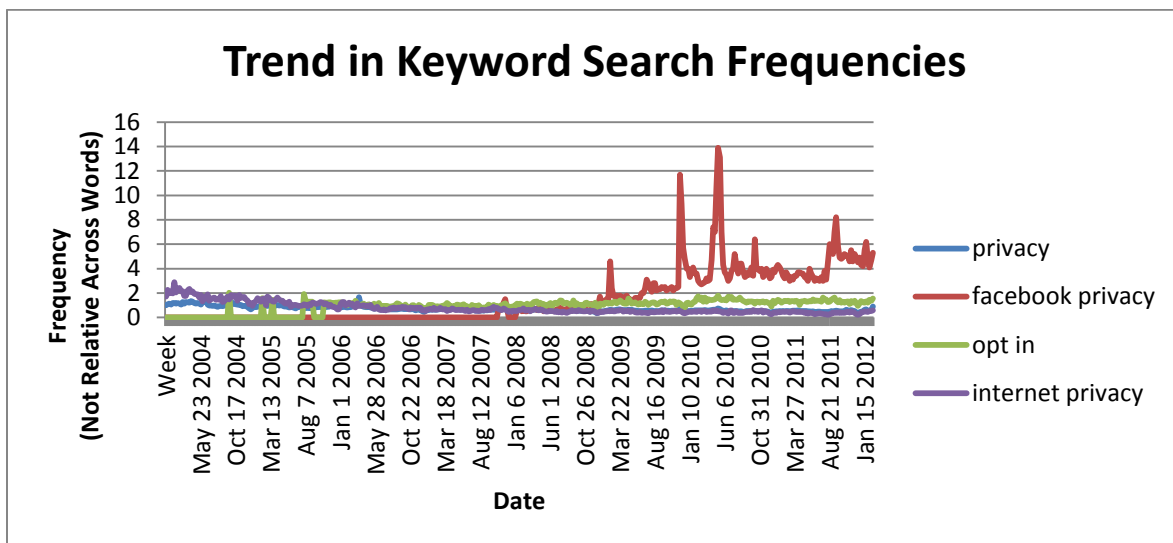
A frequently researched topic is privacy on the internet, or lack thereof. Figure 4 shows the increase in research in this area in the field of economics.

Figure 4



Despite being a concern among researchers, it does not appear to be a growing concern among the population generally. Figure 5 shows the trends in words related to privacy among search terms on Google.

Figure 5

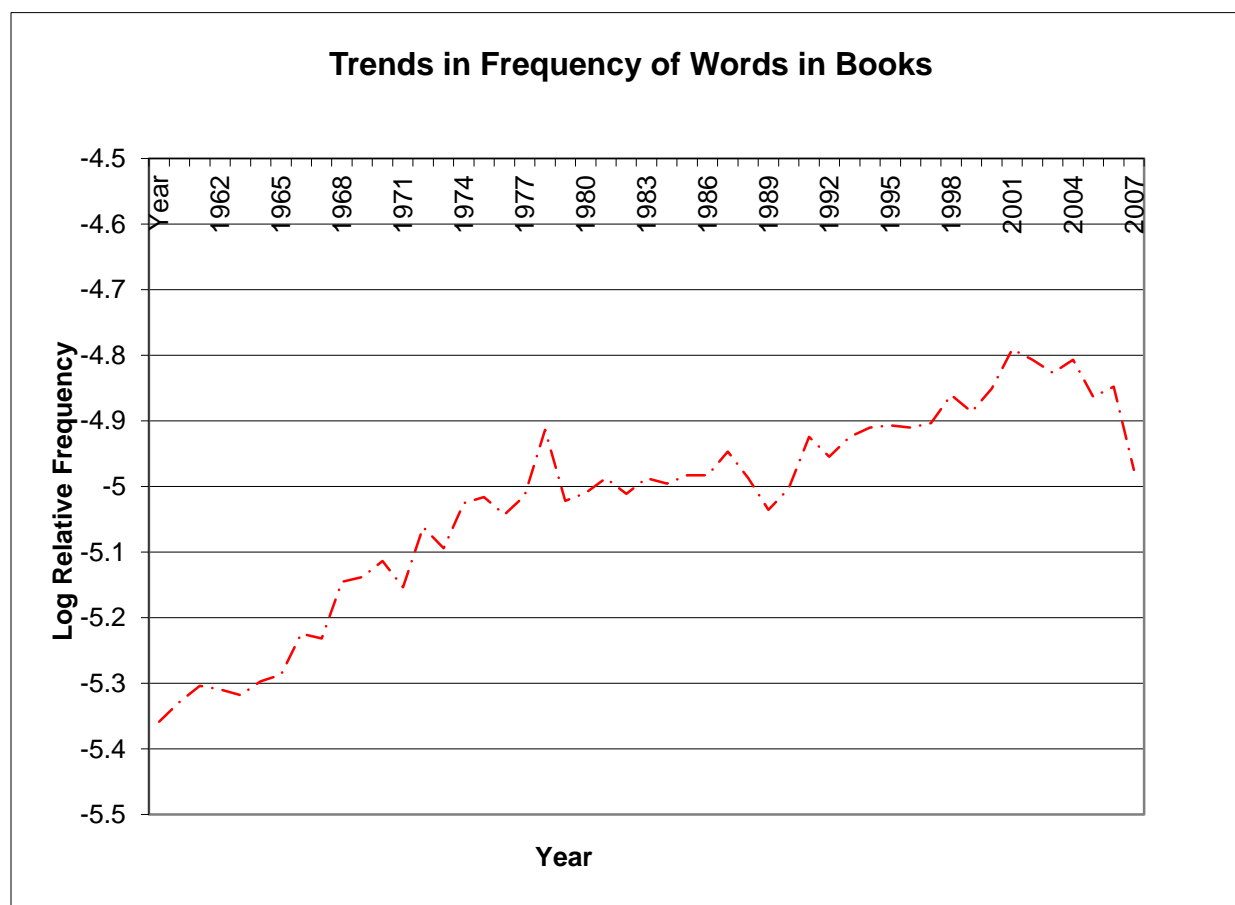


Google Trends.

Note that there is no apparent increasing trend in the keyword “privacy.” “Facebook privacy,” as a keyword, has increased over this time. However, that could be due to the increase in prevalence of Facebook, not privacy. What is interesting are the spikes in the frequency of this search term, which perhaps suggest that consumers become much more sensitive to how their private data are used on social networks at times when newspaper stories highlight privacy concerns.

Google Ngrams, which shows the frequency with which words appear in books, yields an intermediate result. Figure 6 shows that privacy as a term may have grown in frequency slightly in books.

Figure 6



Google Ngrams

A likely explanation is that consumers do not concern themselves with privacy on a daily basis. But authors, researchers, and regulators, for whom privacy issues are recognized as an on-going concern, consistently are attentive to privacy issues. If policy makers successfully prevent problems related to privacy, maybe it will never be on consumers' radar.

Section 4: International Data

The focus of this document has been on the U.S. Those interested in international data should refer to data from the OECD Broadband Portal, and the Europe's Digital Competitiveness Report (2010). Wallsten (2008) provides a good discussion of the limitations of international data.

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