



## A LONGITUDINAL ANALYSIS OF COMPUTING IN THE HOME CENSUS DATA 1984-1997

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# A LONGITUDINAL ANALYSIS OF COMPUTING THE HOME

*Based on census data 1984- 1997*

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**Key words:** Diffusion, Personal, Computer, Home, Use, US Census, Current Population Survey.

**Abstract:** This paper reports on the use of personal computers in the home. Analyses were conducted on US Census Current Population Survey data on computer usage from 1984 to 1997. Findings are presented with regard to the diffusion of ownership and usage patterns of personal computers in the home. Implications and social impact of home computing are discussed.

## 1. INTRODUCTION

In the two decades beginning from the early 1980s, the PC-based technology has advanced tremendously. In sheer power and versatility, the modern day computer bears very little resemblance to its earlier origins. Clearly, the most recent and significant technological development is due to the emergence of the Internet. This has truly revolutionized computing in the home giving rise to what is being termed as the emergence of the “networked home.”

This report is based on a longitudinal analysis of census data on home computer ownership and use. As part of the Current Population Survey (CPS), the US Department of Commerce Census Bureau has been collecting data on computer ownership and use among US households. The data were collected five times since the 1980s; in 1984, 1989, 1993, 1997. The data for 1997 include Internet use for reasons that the Internet emerged as a

network technology only after 1993. The research reported here is primarily based on four data points, 1984, 1989, 1993, and 1997. The methodology for this data collection is available in the census report and can be accessed easily from [www.census.gov](http://www.census.gov), as such it will not be repeated here.

**Table 1. Sample Description of CPS**

	1984		1989		1993		1997	
	Number	%	Number	%	Number	%	Number	%
<b>All</b>								
Households	56900		56955		55960		47995	
Individuals	151832		146850		143129		122860	
Age 0-14	32427		33372		32764		27755	
Age 15+	119405		113478		110365		95105	
<b>PC</b>								
<b>Owners</b>								
Households	4495	7.9%	8355	14.7%	12674	22.7%	17814	37.1%
Individuals	15539	10.2%	26749	18.2%	38514	26.9%	53120	43.2%
Age 0-14	4326	13.3%	7067	21.2%	9756	29.8%	13406	48.3%
Age 15+	11213	9.4%	19682	17.3%	28758	26.1%	39714	41.8%
<b>PC Users</b>								
HH $\geq$ 1 user	4129	7.3%	7453	13.1%	11356	20.3%	16963	35.3%
Individuals	8907	5.9%	15671	10.7%	23883	16.7%	39035	37.8%
Age 0-14	2731	8.4%	4293	12.9%	5683	17.4%	9209	33.2%
Age 15+	6176	5.2%	11378	10.0%	18200	16.5%	28826	30.3%

The computer/Internet-based questions are added to the general population survey conducted by the census bureau. The sample for the four wave data is described in Table 1. It consists of approximately 50,000 households with the largest sample size in 1984 of 56,900 households and 47,995 households in 1997. The total sample of individuals covered by the surveys is 151,832 in 1984 and decreasing to 122,860 in 1997. The sample is divided into two basic age groups, 0 to 14 and 15 and above.

## 2. DEMOGRAPHICS AND COMPUTER OWNERSHIP

Table 1 gives the distribution of computer ownership among the households. In 1984, only 7.9% of the households owned a computer. This rose to 37.12% in 1997 and 42.6% in 1998. Table 1 also gives data on the number of users in the population. In 1984, 5.87% of the population used computers at home with an increase to 37.77% in 1997. Of the total number of users, 72.3% were in the 15+ age group in 1997. If one were to look at the population of individuals that have computer access at home, we find that number of individual users has increased over the years from 55.1% in 1984

to 72.3% in 1997. The big jump in 1997 may be due to the introduction of the Internet.

As income increases so does computer ownership (Table 2). In 1984, 2.4% of the income group \$0-15K owned computers. In the same year, 22.7% of the households \$75K and above owned computers. In 1997, the proportions are 13.0% and 75.4% respectively for the two groups while in 1998 they are 14.7% and 79.9%. We see two trends here. All income groups show increase in computer ownership with the lower income groups growing faster. However, a considerable gap persists between the lower income groups and the higher income groups.

**Table 2. Computer Ownership**

		1984	1989	1993	1997
<b>Income</b>	0-15K	2.4%	4.9%	6.8%	13.0%
	16-30K	7.9%	10.9%	15.3%	24.2%
	31-50K	15.2%	20.3%	28.2%	43.0%
	51-74K	21.9%	32.6%	44.9%	61.2%
	75K+	22.7%	43.6%	59.7%	75.4%
<b>Education</b>	HS or less	3.1%	5.1%	7.3%	15.3%
	Some College	9.8%	15.8%	24.4%	40.3%
	College	12.8%	23.9%	39.6%	58.1%
	Grad. Degree	18.3%	35.1%	52.9%	69.0%
<b>Race</b>	White	8.6%	15.9%	24.1%	40.8%
	Black	3.9%	6.9%	10.3%	19.3%
	Hispanic	NA	NA	12.3%	19.4%
<b>Family Structure</b>	Have Children	4.4%	12.9%	21.6%	30.0%
	No Children	14.1%	22.7%	32.0%	50.5%

In a similar fashion to income, education is positively correlated with computer ownership (Table 2). This relationship has been consistent from 1984 through 1997. It is important to note that income and education are correlated and so the same relationship to computer ownership holds for both.

Having children in the family makes a difference to a household having a computer or not. For example, in 1997, 51% of the households with children owned computers compared to 30% without children. This gap existed even in 1984 when the figures were 14% and 4% respectively (Table 5, Figure 4).

Race has received much attention recently in the popular press and government publications. There are two basic issues concerning “race” and several sub-issues. The two basic issues are, what is the proportion of households in the population who have computers and what is the percentage of users in each category of users? The first issue concerns access and resources and the second issue concerns skills.

In terms of access to the computers, the racial disparities are quite wide. Table 6 reveals the statistics in a compelling fashion. If we examine the 1998

figures, it is clear that twice as many white households own computers compared to blacks and Hispanics (46% to 23%). The figures for Asians are the highest (55%). However, the rate of computer ownership among underrepresented minorities is increasing faster than for any other group. Similarly, if we control for income, the differences between white and black households seem to disappear (Table 7). For example, in 1997, 65.3% of the black families and 75.7% of the white families in the income group \$75K and higher owned computers. Compare this with 15.5% for white households and 6.2% for black households in \$0-15K-income group or 44.8% and 28.8% respectively in the 31-50K income group. A similar situation also occurs with respect to education. Blacks in the highest education category are closer to the whites in computer ownership (61% to 70%). The implications of this are that race is a central concern at the lower socio-economic levels and the society faces some stiff challenges in bringing about racial parity.

### 3. DEMOGRAPHICS AND COMPUTER USE

Computer use was measured in terms of the number of days of computer use per week. The lowest value is zero days per week and the highest value is 7 days per week. This does not measure the actual hours of use, only the frequency of use on a per week basis.

Computers are generally understood to be male dominated technology. Since the term “male domination” can have several meanings, in our analysis we chose to examine the proportion of male and female users of computers in the home. As Table 3 shows, the gap between male and female users at home has considerably diminished during the fifteen period. In 1984, the proportion of male users was 64.8% and female users were 44.5%. In 1997 the corresponding figures are 73.2% and 71.4%. Thus one might say that the gender gap has practically disappeared in so far as the percentage of users goes. When asked how many days per week men and women use computers the figures for 1984 are 2.6 and 2.0 and for 1997, they are 3.8 and 3.4 respectively (Table 4), once again showing that the gender gap is closing.

Education seems to be positively correlated with computer use (Table 3). Among adults, in 1997, only 55% of those with high school or lesser education are shown to be computer users while 85% of those with graduate degree are in this category. The figures for both groups were lower in 1984 (41% and 67%). Although both groups have shown improvement, those with less education are lagging behind over time. It must be noted that children at the high school level or lower dominate any other group in this regard. For example, 77% of the children used computers in 1984 and 80% did so in 1997. Given the nature of the technology and related cultural norms promoting it to young people especially in the schools, this should come as

no surprise. Instead of looking at the percentage of users in each group, if we looked at the rate of use, the group that has consistently been at the top is adults with highest education.

**Table 3. Computer Use at Home Among Those with Access**

		1984	1989	1993	1997
<b>Gender</b>	Female	44.5%	51.2%	59.6%	71.4%
	Male	64.8%	64.2%	67.1%	73.2%
<b>Race</b>	White	55.4%	58.8%	64.6%	73.7%
	Black	54.3%	47.2%	54.3%	66.9%
	Hispanic	47.2%	53.6%	55.7%	62.6%
	Asian		51.6%	53.7%	62.3%
<b>Education</b>	<HS-child	76.7%	74.1%	87.8%	80.2%
	<=HS	41.3%	40.1%	43.5%	55.2%
	HS+	54.7%	57.2%	64.8%	73.1%
	College	56.5%	66.3%	71.3%	80.8%
	Graduate	67.2%	73.8%	77.1%	84.9%
<b>Age</b>	15-17	75.9%	73.3%	74.9%	88.6%
	18-25	53.8%	57.8%	63.0%	71.2%
	26-35	63.6%	64.4%	69.8%	79.4%
	36-50	47.4%	56.8%	64.0%	72.8%
	51-60	40.1%	46.7%	55.3%	64.4%
	61+	27.6%	36.0%	42.1%	51.8%
<b>Family Structure</b>	Have children	56.7%	54.4%	59.4%	71.2%
	No child	54.4%	57.8%	64.0%	73.3%
	Empty nest	41.3%	42.6%	48.2%	58.9%
	No children	60.1%	61.8%	66.8%	75.6%
	All children 5 and under	60.4%	63.1%	67.3%	75.7%
	All children 6-13	53.2%	58.2%	64.3%	72.2%
	All children 14+	50.0%	51.9%	59.7%	72.3%
<b>Employment</b>	Full Time	57.2%	60.5%	66.1%	74.6%
	Part Time	48.6%	55.7%	64.4%	74.9%
	Self Employed	56.2%	57.3%	64.0%	72.0%
	NIL+Unemployed	54.6%	55.3%	59.3%	66.7%

Clearly the age group that dominated computers is 15-17 years (87%) (Table 3) in 1997. This group also headed the list in 1984 (76%). There is a slight drop in the next age group (18-25, 71%) but it goes up to 79% for the third group (26-35). The trend seems to be that the older age groups are showing dramatic increases over time. In the 61+ age group the proportion of users was 28% in 1984 and is 52% in 1997. In terms of rate of use, age does not seem to make a difference. All groups hover around 3.5-3.7 days per week.

Although a larger proportion of families with children *own* computers compared to families without children, the difference disappears when it comes to the *use* of computers. Once the computer comes into the home, the

usage rate is quite similar (Table 3). However, if we break the no-children family into empty-nest and non-empty-nest, the difference is quite significant (59% to 76% for the year 1997). This may have to do with the age of the head of the household.

**Table 4. Number of days use of the computer at home per week**

		1984	1989	1993	1997
Sex	Female	2.00	2.19	2.44	3.34
	Male	2.65	2.72	3.03	3.80
Race	White	2.37	2.48	2.75	3.58
	Black	2.56	2.55	2.70	3.41
	Hispanic	2.47	2.68	2.93	3.51
	Asian	N/A	2.57	2.87	3.70
Age	15-17	2.73	2.37	2.48	3.65
	18-25	2.26	2.21	2.62	3.72
	26-35	2.35	2.62	2.79	3.57
	36-50	2.30	2.53	2.79	3.48
	51-60	2.39	2.55	2.89	3.62
	61+	2.44	2.63	2.87	3.62

Among those who have access to computers, in 1997, more whites (74%) reported using computers compared to blacks (67%), Hispanics (63%) and Asians (62%). For each of the groups there has been a steady increase since 1984 (Table 8 and Figures 14 and 15). What this means is that racial differences are less pronounced when it comes to use but remain strong when the focus is on ownership. When we look at the number of days per week people use computers, the differences between races are not very significant although Asians report using the computer most frequently (4 days per week) compared to the other groups (Table 4).

### 3.1 Cross-tabulations

We also performed cross-tabulations between key demographic variables and frequency of use. For the cross tabulations we pooled the data across all the years. The results are presented in Table 9. In almost all categories, the modal distribution seems to be 1 to 3 days per week or 7 days per week. Very few people who own computers are not using at all. However, a significant proportion (20%) use the computers either once a

week or less frequently. About 45% to 50% of the users use the computers 1 to 3 days per week while 10-14% use it everyday of the week.

Income does not differentiate between the users. Race also has no impact on the level of usage. Males seem to be using slightly more than females. For example, 25% of the males use computers 5 to 7 days per week while 16% of the females do so. In terms of age, users in the 55+ age category (26%) seem to use the computers 5 to 7 days per week, more than any other adult group. People with higher educational qualifications use the computers slightly more than the less educated user. Similarly, families with no children use computers more frequently than those with children. In any cases, these differences are rather small.

**Table 5: Cross Tabulation of Key Demographic Variable and Computer Use**

		1 day/mo. v	1 day/wk v	1 day/wk	2 days/wk	3 days/wk	4 days/wk	5 days/wk	6 days/wk	7 days/wk
<b>Income</b>	0-25K	11%	9%	16%	17%	13%	7%	8%	3%	13%
	25-45K	10%	10%	19%	17%	14%	8%	7%	3%	10%
	45K+	8%	10%	19%	17%	14%	8%	9%	3%	10%
<b>Gender</b>	Female	9%	12%	21%	18%	14%	7%	7%	2%	7%
	Male	8%	8%	16%	16%	14%	8%	9%	3%	13%
<b>Race</b>	White	9%	10%	19%	17%	13%	8%	8%	3%	10%
	Black	9%	9%	13%	19%	16%	8%	6%	2%	12%
	Hispanic	7%	8%	17%	16%	18%	8%	8%	3%	12%
	Asian	7%	9%	15%	14%	16%	8%	6%	4%	14%
<b>Age</b>	15-18	7%	9%	20%	18%	16%	8%	8%	2%	9%
	19-24	13%	10%	15%	17%	13%	7%	7%	2%	10%
	25-55	8%	10%	19%	17%	13%	8%	8%	3%	11%
	55+	10%	10%	16%	14%	13%	7%	9%	4%	13%
<b>Education</b>	< HS	7%	10%	19%	18%	15%	7%	8%	2%	9%
	HS	11%	12%	20%	17%	13%	6%	6%	2%	9%
	Some Col.	11%	10%	18%	16%	13%	7%	8%	3%	10%
	College	7%	8%	18%	17%	14%	9%	9%	4%	12%
<b>Family Structure</b>	Children	9%	10%	20%	18%	14%	7%	8%	3%	9%
	No Child	9%	10%	17%	16%	13%	8%	8%	3%	12%

We believe that here may be usage differences across the groups based on the type of use (e-mail, shopping, chat groups, games, school work etc). An analysis based on the use category will be very meaningful and is presented below in a rudimentary fashion.

### 3.2 Computer Use by Categories

During the period between 1984 and 1997, computer use for e-mail, word-processing have shown considerable increase. The game use has been somewhat steady and so are work-related and educational uses (Figure 1).

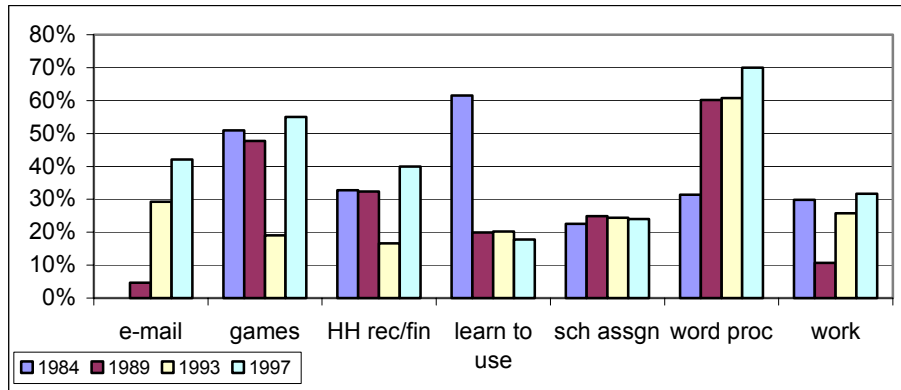


Figure 1. Reasons for Using Computer at Home

When asked how frequently people use computers during a week, there seem to be two key clusters. Most users report using computers 1 to 3 times per week but a large percentage uses them every day. In fact, the largest single group (22%) report computer use every day (Figure 2). This represents an increase from 9% in 1984 to the present levels.

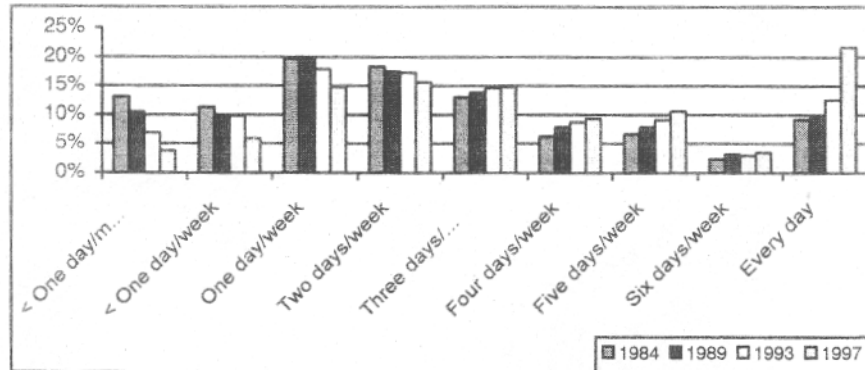


Figure 2. Frequency of computer use at home per week

Specific questions were directed toward Internet use in 1997. As shown in the Figure 18, the highest uses are for e-mail (76%), information search

(78%), and news/sports (49%). This is followed by travel/reservation (24%), chat groups (20%), and shopping (14%).

#### 4. REGRESSION ANALYSIS OF COMPUTER USE

In order to establish the relationship between the key variables and computer use, we performed a regression analysis using the longitudinal data. The results are shown in Table 6. To keep the analysis simple, we used

**Table 6. Pooled regression results**

Category	Description	Beta
HH STRUCTURE	HH income	-0.034***
	HH size	-0.007
	# of child in HH	-0.018***
	Total # user @home	0.010*
DEMOGRAPHIC	Sex	0.082***
	Age	0.018***
	Highest education level	0.019***
RACE	White vs. other	-0.032**
	Black vs. other	-0.012
	Hispanic vs. other	-0.006
	Asian vs. other	-0.003
EMPLOYMENT	FT vs. other	-0.115***
	PT vs. other	-0.054***
	Self-emp vs. other	0.000
	Not in labor force vs. other	-0.019*
WHERE ELSE USE	Use comp @work	0.035***
	Use comp @school	0.055***
TECHNOLOGY	Age of comp	-0.160***
REASON USE	Email	0.103***
	Games	-0.035***
	HH rec/finance	0.003
	Learn to use	-0.078***
	School assignment	0.039***
	Word processing	-0.045***
	Work @home	0.047***
	% reason use	0.327***
YR DUMMY	1989	0.151***
	(control=1984) 1993	0.303***
	1997	0.285***

\*  $p < 0.10$        $N$       64460  
 \*\*  $p < 0.05$        $R^2$       0.212  
 \*\*\*  $p < 0.01$        $Adj - R^2$       0.211  
                                   $F$       518.068\*\*\*

the ordinary least-squares method pooled across the 4 years. Because of the nature of the variables and a high degree of multi-collinearity, the results are not as clean as one would expect. However, some variables seem to have a greater impact than the others. For example, in terms of the household variables, income and education seem to be significant. We know that from the univariate analysis and also from various other studies computer use is positively correlated with income and use. The variables that are positively related to computer use are total number of users, gender (male), age, and education. Negatively correlated are income, household size and the number of children. Some of the results appear to be contradictory. Here is an explanation. Since education and income are positively correlated with each other, there is a confounding effect the coefficients for these two variables may be taking an opposite sign. Similarly, the household size is positively correlated with the number of computers in the home. For example, the table shows that the number of computers in the home contributes to higher computer use. While this may appear to be obvious, it is also a function of the number of users. In terms of race, the use of the computers by whites appears to be statistically the most significant. In general there seems to be an inverse relationship between employment status and computer use.

The two variables of very high significance in terms of their contribution to computer use at home are using the computers at work and using computers at school. Both show a very significant. The implication is that computer use outside the home has a causal effect on computer use at home. One might say that there may be mutual causation but this is less plausible except in some cases.

The age of the computer(s) seems to be negatively correlated with use. It is very difficult to interpret this result in the absence of other pertinent information.

Overall, the regression analysis indicates that the most important variables are, gender (male), race (white), education, income, number of computers in the home, use of computers outside the home.

## 5. SOME GENERAL CONCLUSIONS

Computer ownership seems to be on the increase for all groups since 1984. One can look at this optimistically and say that every group is benefiting. On the other hand one is entitled to have some concern that under-represented minorities continue to lag behind and have a lot of catching up to do. Hopefully, such a concern will lead to some concerted social action.

In general, education and income seem to be the most important variables that determine computer ownership. This may have something to do with the fact that computing technology is still not universally affordable.

In addition, computers represent a complex technology and are not easy to master. At the same time, if the young people are given exposure to computers at school, this problem may be reduced. But there seem to be some problems with this situation also because many schools in lower income districts are not able to afford high quality computer infrastructure or trained teachers. This is indeed a vicious circle. Over all, considering how computer use outside the home has positive impact on computer use at home, one can also examine the possibilities at community oriented locations where most people may have access.

Families with children are more likely to own computers. This means that computers are viewed as an indispensable technology by families in preparing their children to future citizenry. Given the global expansion of computerization, exposing children to computing technology is certainly a imperative.

The results clearly show that the transition from 1994 to 1997 is a watershed transition. Across all the demographic criteria, the weekly use of the computer has shifted dramatically in the aggregate. It was steady from 1986 to 1993 with a short increase hovering round the low 2s (two days per week) to slightly higher 2s but the jump from 1993 to 1997 is almost one extra day across the board. Clearly, what accounts for the difference is the introduction of the Internet. Internet access also means that the computer is becoming primarily a communication tool. There are also other uses for the computer which make the technology quite interesting. People use the Internet for information search, games and recreation, for work and school related activities. All this suggests that we are moving away from a traditional industrial model to a post-industrial model. The Internet access also suggests that we are getting more and more connected with the rest of the world. Connectivity can mean several things. One can work at home, can shop from home, can get educated at home, can contact friends and relatives at all times of the day, and do so many things from the home that were not possible before. Of course, the darker side of this is that those who are not connected cannot enjoy the fruits of the new technology.