Understanding the Rural – Urban Digital Divide

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Abstract: This paper explains the current 'digital divide' in internet use between rural and urban areas using a Logit adoption model with data collected from the August 2000 Current Population Survey. A non-linear decomposition shows that rural – urban household attribute differences account for 66 percent of the digital divide, while place based differences account for the remaining 34 percent of the divide.

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INTRODUCTION

During the 1990s more and more households in the U.S. became 'digitally connected' to the vast amount of information available on the internet. Access to the internet provides households with an array of previously unavailable opportunities for commerce, education, and entertainment. At the same time, disparities in access to and use of the internet emerged among various segments of the population. Recent survey results show that men have greater access to and use of the internet than women (Bimber, 2000). Similarly, Whites have greater access to and use of the internet than Blacks (Compaine, 2001). A third gap emerged between rural households and urban households (U.S. Bureau of Commerce, 2000).[1] These inequalities in internet access and use are generically referred to as the digital divide. Concerns exist that the digital divide may exacerbate existing inequalities in U.S. society (Drabenstott, 2001).

In response to these concerns, a number of policies have been proposed to reduce the digital divide. Examples include federal programs to improve internet access among poor families and to encourage greater use of high-speed networks in underserved areas. A number of state and local initiatives to reduce disparities in internet access in rural areas also exist. For example, the Rural Access Authority in North Carolina was created to provide local dial-up internet access from every telephone exchange in the state. Other states like Washington and Virginia have also provided grants to rural areas to increase high-speed internet access.

[1] In this paper rural denotes U.S. Census designated non-metropolitan counties and urban denotes counties designated as metropolitan.

The effective design of federal, state, and local programs to reduce the rural – urban digital divide must be based on a sound understanding of the underlying causes of differential internet access. If lower rates of household internet use in rural areas stem from lower household income and education levels, efforts to close the divide may need to be linked to broader efforts to increase education and income levels in rural areas. On the other hand, if the rural – urban digital divide stems from place-based differences in either the costs of access to the internet or in the propensity to use the internet – given the same set of household characteristics – then an alternative set of policies may be applicable. The costs of internet access may be higher in rural areas than urban areas if lower population densities in rural areas raise the cost of provision per household. If so, then infrastructure subsidies may be applicable (Parker, 2000). Similarly, lower propensities of households to use the internet in rural areas, given similar household characteristics and costs of access to the technology, may arise from lower aggregate use among peer groups. In this case concerted efforts to promote widespread use in specific areas thorough digital-villages or subsidized rural user groups may be warranted. However, research to date has not identified the relative roles that differences in characteristics of households and place-based constraints play in explaining the rural – urban digital divide.

This paper develops a model of household internet use and uses the estimation results to decompose the rural - urban digital divide into a component associated with underlying differences in the attributes of rural and urban households and a component associated with place-based differences in the propensity to use the internet. The results suggest that 66 percent of the current rural – urban digital divide stems from rural – urban

differences in household attributes (particularly income), while 34 percent is associated with place-based differences in household behavior or regional attributes. These results and the associated policy implications for reducing the rural – urban digital divide are developed in the remainder of the paper as follows. The next section describes the data used in the analysis. Descriptive statistics on household information technology use, characteristics, and economic conditions are provided for urban and rural area households, as well as for internet users and non-users in urban and rural areas. Section four then develops a statistical model of the household internet use decision. Section five presents model estimation results. The paper then concludes with a discussion and summary of policy implications.

DATA

Data on internet access and use among rural and urban area households is obtained from the Current Population Survey (CPS), August 2000 Internet and Computer Use Supplement. The CPS is a sample of rural and urban households, and is nationally representative when survey sample household weights are applied (Bureau of Census, 2001).[2] After dropping households with missing data there are 39,881 households included in the sample. Descriptive statistics on home and office internet use and household characteristics are provided in table 1. As expected, a significantly higher share of urban households (45 percent) have access to the internet at home than rural households (32 percent).[3] A slightly smaller percentage point gap in internet access

[2] Survey household sample weights are used to derive all statistics in the subsequent analysis.
[3] All differences are statistically significant at the p=0.05 level unless otherwise noted.

prevails at the household heads place of work (NETATWORK), where 21 percent of urban household heads use the internet versus 11 percent of rural heads.

Significant differences in rural and urban area household characteristics also exist that may, in part, explain differential home internet access. Household heads in rural areas are, on average, older, more likely to be male, and have lower levels of education. Household heads in rural areas are more likely to be White and non-Hispanic. Rural household heads are also less likely to be employed than there urban counterparts, but more likely to have a business or farm that is run out of the household. Finally, rural households are more likely to have an annual income below $50,000 (76 percent) than urban households (60 percent).

The potential contributions of differences in rural and urban household attributes to the digital divide can be seen by comparing the characteristics of internet users and non-users in urban and in rural areas (table 2). In both urban and rural areas internet users are more likely to use the internet at work. Heads of households with access to the internet at home are also younger, more likely to be headed by a male, have higher levels of education, and are more likely to be married than are heads of households that do not have internet access. In addition, heads of households using the internet in both urban and rural households are more likely to have children at home, more likely to have a family-run business, and are more likely to be white and non-Hispanic.

The influence of household differences in income and employment status on home internet use can be seen by comparing these characteristics for internet users and non-users in urban and rural areas (table 3). In both areas, internet using households are more likely to have a head who is employed and have higher incomes than are

households that do not use the internet. The next section develops a statistical model that identifies the separate contributions that differences in the characteristics of rural and urban households and differences in place-based propensities to use the internet make to the rural-urban digital divide.

A MODEL OF INTERNET USE

The decision on whether to access the internet access at home is a discrete adoption choice of the household based on the household utility from adopting (U_1) and not adopting (U_0) the internet. The household invests in internet access if $U_1 > U_0$, and foregoes investment otherwise.

$$\text{Let } y^*_i = U_1 - U_0 = \beta' X_i + \varepsilon_i,$$

where X_i is a vector of household and place-based characteristics that influence the utility of home internet access relative to no access, β' is the associated parameter vector, and ε_i is the associated error term. While y^*_i is a latent variable, we observe that $y_i = 1$ if $y^*_i > 0$ (meaning the household invests in internet use), and $y_i = 0$ otherwise. Hence

$$\text{Prob } (y_i = 1) = \text{Prob } (\varepsilon_i > - \beta' X_i), \text{ or Prob } (y_i = 1) = 1 - F (- \beta' X_i)$$

where $F( )$ is the cumulative distribution function for the error term ε_i. Each observed y_i is then the realization of a binomial process and the associated likelihood function can be expressed as

$$L = \prod_{yi = 0} F(- \beta' X_i) \prod_{yi = 1} [1-F(- \beta' X_i)].$$

If the cumulative distribution of ε_i is the logistic, then

$$F(- \beta' X_i) = \exp(- \beta' X_i)/ (1+\exp(- \beta' X_i))= 1 / (1+\exp(- \beta' X_i)), \text{ and}$$

$$[1- F(- \beta' X_i)] = \exp(\beta' X_i) / (1+ \exp(\beta' X_i)).$$

The associated statistical model is estimated by the maximum likelihood method as

$$\log L = \sum_{yi=0} \log [\ 1/(1+\exp(\beta' X_i) + \sum_{yi=1} \log [\exp(\beta' X_i)/(1+\exp(\beta' X_i)].$$

The explanatory variables in matrix **X** are grouped into three major categories (household attributes, household employment and income; and place-based) and discussed below.

Household Attributes

The age (AGE) of the household head is likely to influence to propensity to use the internet at home. All else equal, younger household heads are more likely to have been exposed to digital technologies in school and, therefore, more comfortable gaining access to the internet from home. But the influence of age may not be linear, so a quadratic age (AGE2) term is also included in the model. Similarly, more educated household heads likely have greater exposure to digital technologies. Household propensity to use the internet is, therefore, expected to increase with the household head's level of education. Men have also been found to have greater access to the internet than women (Bimber, 2000). Therefore, households headed by males (SEX=1) are expected to be more likely to use the internet at home than are households headed by females. On the other hand Blacks and Hispanics have a lower propensity to use the internet than White - non-Hispanics (Compaine, 2001). Households headed by Blacks and other non-White racial groups (OTHRACE) and Hispanics (HISP) are, therefore, likely to have a lower propensity to access the internet at home.

Five discrete indicators for number of children in the family (CHLD1-CHLD5) are also included in the analysis. Children are often exposed to

computers and the internet at school, thus increasing the propensity of the household to access the internet from home. With an additional child the benefits of internet use are also spread over an additional household member, while the cost of internet access remains fixed. Thus, household propensity to use the internet is expected to increase with the number children in the family, but the effect of an additional child is likely to decrease with family size. Similarly, the propensity to use the internet may be higher for married household heads (MARRIED = 1) than for single household heads as the costs of access are split between two adults.

Household Employment and Income

Households with heads who are employed may be more likely to use the internet at home. But the effect of employment on internet use is likely much greater if the internet is used at work (NETATWORK) or if a family business is run from within the household (FAMBUS). The household propensity to use the internet is also expected to increase with household income, particularly after controlling for household size through the marriage and number of children indicators. However, the influence of income may not be linear so thirteen discrete indicators of household income are employed (FAMINC1-FAMINC13) to demarcate increasing levels of household income.

Place-Based Characteristics

A rural area indicator variable (RURAL) is included in the model to test if the households' base propensity to use the internet differs across rural and urban areas. Parameter estimates for all previously discussed household attributes,

employment, and economic characteristics are also allowed to differ in urban and rural areas by including a rural interaction term for each variable. There are few a-priori expectations about rural – urban parameter differences and the nature and magnitude of these rural parameter shifts is left as an empirical question.

Urban and rural South, Midwest, and West regional indicators and a rural Northeast indicator are also included to allow propensities to use the internet to fluctuate across region – urban / rural groupings relative to the Northeast urban region. Regional rates of home internet use range from 48.7 percent in the urban West to 27.7 percent in the rural South. The strength of the relationship between regional rates of home internet use and individual household use propensities is later explicitly tested in an alternative model specification, where the percent of households using the internet in each urban - rural region is included as an explanatory variable that replaces the set of regional indicators.

RESULTS

Parameter estimates for the Logit adoption model are presented in table 4. Column two presents parameter estimates for urban households with associated standard errors presented in column three. Column four then presents the estimated shifts in parameters for rural households relative to urban household estimates. The results are discussed within the previously designated household attribute, household employment and income, and place-based characteristic variable groupings.

Household attributes

A household's propensity to use the internet at home is found to be initially positively related to age in urban areas. But the quadratic term is negative and the propensity reaches a maximum at 28 years of age and then declines. Rural areas show a significantly different relationship between head's age and internet use, as the propensity increases much more rapidly with age. In urban areas, the probability of internet use is also slightly higher in male-headed households than in female-headed households, *ceteris paribus*, and no significant difference in this tendency is found for rural area households. Similarly, the propensity to use the internet at home increases with the household heads education level in both urban and rural areas. The only significant urban – rural difference with respect to education is a slightly greater increase in internet use propensity from a college education in rural areas.

As in previous studies, urban and rural households headed by Blacks and Hispanics show sharply lower propensities to access to the internet from home relative to Whites and non-Hispanics, respectively. Households headed by other non-White racial groups show a lower propensity to use the internet at home in rural areas, but do not show a significantly different propensity to use the internet in urban areas. Turning to family structure, the propensity to use the internet increases when the head of the household is married, and this effect is stronger in rural areas than in urban areas. The propensity to use the internet also initially increases with the number of children up to three, but the fourth child has no influence on internet use, and in urban areas five or more children in the family decreases the households propensity to use the internet.

Household Employment and Income

Internet access at work (NETATWORK) and having a family business (FAMBUS) increase the likelihood of having access to the internet at home in an urban area. A family business in the home also increases the likelihood of household internet access in a rural area. As expected, the propensity to have home internet access also progressively increases with household income levels above $15,000 per year (FAMINC4). However, no significant rural – urban differences in the influence of income on home internet use are identified. Contrary to expectations, the probability of home internet use in an urban area is found to decrease if the head of the household is employed (EMPLOYED), but this effect is not significant for households in a rural area. The negative association between household head employment and home internet use, after controlling for household income and other factors, may stem from an increase in leisure time available to use the internet.

Place-based Characteristics

The probability of home internet use also varies by region, with lower propensities in urban and rural areas of the Midwest and South. Of particular note is the large negative shift in household propensity to use the internet in the rural South. As indicated by the rural intercept term, the base propensity to use the internet is also lower in rural areas than urban areas after controlling for these regional effects and household attributes and economic characteristics.

DISCUSSION

Only a handful of estimated rural area parameter shifts are statistically significant. But a comparison of the log-likelihood of the model against an alternative model where urban and rural parameters an each variable are constrained to be equal suggests that differences in urban and rural internet adoption behavior are statistically significant ($p=0.05$).[4] The importance of these structural differences in urban – rural internet adoption behavior is further explored by decomposing the urban – rural gap in home internet use into the component associated with urban – rural parameter differences and the component associated with differences in underlying household attribute, employment, and income variables.

Since the Logit estimator is non-linear, the standard Oaxaca – Blinder decomposition method can not be used (Oaxaca, 1973). Instead, we follow Nielsen (1998) in implementing a generalized decomposition made up of three simulated probabilities:

$$\hat{P}_u = \sum_{i=1}^{N_u} F[X_{ui}\hat{B}]/N_u$$

$$\hat{P}_r = \sum_{i=1}^{N_r} F[X_{ri}(\hat{B}+\hat{\delta})]/N_r$$

$$\hat{P}_r^0 = \sum_{i=1}^{N_r} F[X_{ri}\hat{B}]/N_r$$

[4] Log-likelihood tests allowing place-based characteristic parameter estimates to vary in rural and urban areas, but constraining household attributes, employment, and income variable parameter estimates to be

where $\hat{P}_u$ and $\hat{P}_r$ are the average probabilities of internet use among urban and rural households, respectively. N_u is the sample size for urban households and N_r is the sample size for rural households. $\hat{B}$ is the estimated parameter vector for urban households and $\hat{\delta}$ is the estimated shift for rural household parameters relative to urban household parameters. $\hat{P}_r^0$ is calculated for each rural household as the probability of internet adoption with urban parameter estimates.

The urban – rural household internet use gap $(\hat{P}_u - \hat{P}_r)$ is then divided into the component associated with urban – rural household attribute difference differences $(\hat{P}_u - \hat{P}_r^0)$ and the component associated with difference in underlying parameters, or behavioral differences $(\hat{P}_r^0 - \hat{P}_r)$, including differences in regional propensities. The results of the decomposition are shown in table 6. Consistent with the results in table 1, $\hat{P}_u$ is calculated as 45.1 percent and $\hat{P}_r$ as 32.2 percent, while $\hat{P}_r^0$ is calculated as 36.7 percent. Thus of the total gap of 12.9 percentage points in urban and rural household internet use, 8.5 percentage points (66 percent) is associated with differences in household characteristics and 4.4 percentage points (34 percent) is associated with place-based differences in adoption behavior. This result clearly indicates that underlying household attribute differences between urban and rural areas go a long way towards explaining the current digital divide.

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the same, also indicate significant structural differences arise from household attribute, employment, and income parameter estimates alone.

Most of the behavioral differences in urban – rural internet decisions stem from differences in the rural intercept term and region specific indicator variables. The factors underlying the large negative rural intercept shift in the propensity to adopt the internet may stem from several sources. The shift might be related to urban – rural differences in the costs of internet access, but the survey data indicates that the average monthly amount paid by households for internet service in urban areas ($17.81) is essentially the same as that paid in rural areas ($17.31) (table 7). Similar average access costs may, however, mask urban – rural differences in telecommunications infrastructure.

Rural – urban differences in high-speed internet access may influence the quality of internet service that is provided at a given price (Malecki, 2001). Evidence on the importance of infrastructure differences is not, however, compelling. CPS survey data indicates that 7.0 percent of rural household internet users had high-speed connections compared to 11.5 percent of urban users (table 7). This high-speed connection gap also varies by region – it is the largest in the West, where the percentage of urban users with high-speed access is twice that of rural users. In the northeast, however, the difference between rural and urban users with high-speed access is less than three percentage points.[5] It is also worth noting that rural users are less, not more, reliant on long-distance carriers to obtain internet access, suggesting that additional carrier's costs for internet access are not higher in rural areas.

Regional differences in internet use may also arise, in part, from positive network externalities in regional internet use. Specifically, the value of the internet to a household in the region may increase as the share of other connected households (and businesses) in

the region increases. An alternative model specification that includes a variable measuring the share of households with internet access in each region (REGDENSITY) is also estimated (table 8). The parameter coefficient is positive and significant; indicating that regional rates of internet use do have positive association with individual household's propensities to use the internet. It is also instructive to compare the results from the decomposition of this alternative specification with the results from the initial specification. Under the alternative specification, the regional density variable captures some of the place-based differences in urban – rural internet use. Regional density differences now become part of the household attribute portion of the decomposition $(\hat{P}_u - \hat{P}_r^0)$, while under the initial specification they were captured as part of the behavioral difference component $(\hat{P}_r^0 - \hat{P}_r)$ through regional intercepts. As a result, attribute differences under the alternative specification account for 108.9 percent of the urban – rural gap in home internet use. In other words, differences in household attributes and regional rates of household internet use appear to account for all of the urban – rural digital divide.

Summary

The urban – rural gap in household internet use has been closing over the past decade (U.S. Department of Commerce, 2002). This trend has lead some to suggest that the remaining gap is part of the normal pattern of core to periphery spatial diffusion of innovations and will dissipate over time (Compaine, 2001). The findings in this paper lead to a less optimistic conclusion. Urban - rural household attribute differences account for two-thirds of the current urban – rural gap in household internet use. These

[5] High speed access is more important for many business applications than home applications.

differences are unlikely to dissipate rapidly. Thus, a significant share of the gap in household internet use that is associated with lower levels of economic well-being in rural areas is likely to show the same persistence that urban – rural differences in household well-being have shown.

Place-based differences account for about one-third of the remaining gap. A small portion of place-based differences may stem from lower levels of infrastructure in rural areas to support high-speed internet access. But the weight given to these urban – rural infrastructure differences in explaining the digital divide needs to be tempered by the fact that an overwhelming majority of households in both urban and rural areas currently connect to the internet using a dial-up modem and local phone line.

Regional densities of home internet use also appear to be strongly associated with individual household decisions. Further research is needed to disentangle underlying causes of differences in regional household internet use densities, particularly the roles that regional infrastructure differences and network externalities play. As part of this effort, data that provides a more spatially sensitive classification than county based designations of urban – rural areas may be required. The current findings do, however, cast significant doubt that policies which focus solely on infrastructure and technology access can significantly mitigate the current urban – rural digital divide.

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Table 1: Household Characteristics by Urban - Rural Residence

Description	Variable Name	Mean Data Urban Area	Mean Data Rural Area	
Computer Characteristics				
% with Internet Service at Home	internetuse	45.13	32.23	*
Household Characteristics				
Household Head Age	age	47.13	49.84	*
Household Head Sex (%Male)	sex	55.14	57.01	*
Household Head Education				
% with H.S. degree	hs	27.81	38.02	**
% with some college	scoll	27.48	24.81	**
% with a college degree or more	coll	29.89	16.07	**
Married	married	53.69	57.44	**
1 Child under 16 in Household	chld1	14.65	14.47	**
2 Children under 16 in Household	chld2	13.41	12.42	**
3 Children under 16 in Household	chld3	4.97	4.80	**
4 Children under 16 in Household	chld4	1.26	1.64	**
5 Children (or more) under 16 in Household	chld5	0.48	0.57	**
Racial Characteristics				
% Black	black	13.54	8.24	*
% Other Race	othrace	4.67	2.65	*
Ethnic Characteristics				
% Hispanic	hisp	10.64	4.70	*
Employment / Income Characteristics				
% Employed	employed	69.07	63.31	*
% using Internet at work	netatwork	21.14	11.45	*
% with Business or Farm in Family	fambus	12.01	15.65	*
% of Households making less than $5,000		3.18	4.77	**
% of Households making $5,000 - $7,499	faminc1	3.06	5.58	**
% of Households making $7,500 - $9,999	faminc2	3.11	4.60	**
% of Households making $10,000 - $12,499	faminc3	3.94	6.01	**
% of Households making $12,500 - $14,999	faminc4	3.60	5.15	**
% of Households making $15,000 - $19,999	faminc5	5.67	8.08	**
% of Households making $20,000 - $24,999	faminc6	7.21	9.72	**
% of Households making $25,000 - $29,999	faminc7	7.33	8.42	**
% of Households making $30,000 - $34,999	faminc8	6.94	7.53	**
% of Households making $35,000 - $39,999	faminc9	6.26	6.49	**
% of Households making $40,000 - $49,999	faminc10	9.27	10.06	**
% of Households making $50,000 - $59,999	faminc11	9.05	7.41	**
% of Households making $60,000 - $74,999	faminc12	9.35	6.79	**
% of Households making $75,000 +	faminc13	22.03	9.41	**
Household Location				
Northeast		19.94	10.36	**
Midwest	midwest	21.22	31.33	**
South	south	34.43	43.53	**
West	west	24.40	14.77	**

Note: * - Indicates that the means are significantly different from each other at the P = 0.05 level
** - Indicates rejection of the null hypothesis that the samples are from the same distribution
Means and Variances are derived using survey sample weights

Table 2: Household Characteristics by Urban - Rural Residence and Internet Use

		Mean Data					
		Urban Area		Rural Area		Total	
		Internet	No Internet	Internet	No Internet	Internet	No Internet
Characteristics	Variable Name						
Household Characteristics							
Household Head Age	age	43.62	50.03 *	45.15	52.07 *	43.84	50.49 *
Household Head Sex (%Male)	sex	60.88	50.41 *	65.42	53.02 *	61.54	51.01 *
Household Head Education							
% with H.S. degree	hs	19.99	34.24 **	30.27	41.71 **	21.50	35.95 **
% with some college	scoll	31.05	24.55 **	33.89	20.49 **	31.47	23.62 **
% with a college degree or more	coll	45.01	17.46 **	30.57	9.18 **	42.89	15.57 **
Married	married	66.16	43.42 *	76.56	48.34 *	67.69	44.55 *
1 Child under 16 in Household	chld1	17.56	12.26 **	19.00	12.31 **	17.77	12.28 **
2 Children under 16 in Household	chld2	17.56	9.82 **	18.37	9.59 **	17.68	9.76 **
3 Children under 16 in Household	chld3	5.90	4.21 **	6.81	3.85 **	6.03	4.12 **
4 Children under 16 in Household	chld4	1.20	1.31 **	1.98	1.48 **	1.31	1.35 **
5 Children (or more) under 16 in Household	chld5	0.34	0.59 **	0.74	0.49 **	0.40	0.56 **
Racial Characteristics							
% Black	black	7.32	18.65 *	3.04	10.71 *	6.69	16.83 *
% Other Race	othrace	5.59	3.93 *	1.83	3.05 *	5.04	3.73 *
Ethnic Characteristics							
% Hispanic	hisp	5.75	14.66 *	2.05	5.96 *	5.22	12.67 *
Household Location							
Northeast		19.97	19.97 **	13.55	8.85 **	19.03	17.38 **
Midwest	midwest	21.07	21.35 **	32.69	30.69 **	22.77	23.49 **
South	south	32.46	36.05 **	36.28	46.97 **	33.02	38.55 **
West	west	26.49	22.69 **	17.47	13.49 **	25.17	20.58 **

Note: * - Indicates that the means are significantly different from each other at the P = 0.05 level
** - Indicates rejection of the null hypothesis that the samples are from the same distribution
Means and variances are defived using survey sample weights

Table 3: Employment and Income Characteristics by Urban - Rural Residence and Internet Use

		Mean Data					
		Urban Area		Rural Area		Total	
Characteristics	Variable Name	Internet	No Internet	Internet	No Internet	Internet	No Internet
% Employed	employed	79.93	60.14 *	79.83	55.45 *	79.92	59.07 *
% using Internet at work	netatwork	31.13	12.93 *	20.10	7.34 *	29.52	11.65 *
% with Business or Farm in Family	fambus	17.71	7.33 *	24.92	11.24 *	18.77	8.22 *
Income Characteristics							
% of Households making less than $5,000		1.19	4.80 **	1.60	6.23 **	1.26	5.14 **
% of Households making $5,000 - $7,499	faminc1	0.69	5.02 **	1.01	7.71 **	0.73	5.64 **
% of Households making $7,500 - $9,999	faminc2	0.69	5.10 **	1.30	6.14 **	0.79	5.34 **
% of Households making $10,000 - $12,499	faminc3	1.11	6.26 **	1.42	8.15 **	1.15	6.70 **
% of Households making $12,500 - $14,999	faminc4	1.41	5.41 **	2.50	6.37 **	1.54	5.64 **
% of Households making $15,000 - $19,999	faminc5	2.44	8.31 **	4.51	9.71 **	2.75	8.66 **
% of Households making $20,000 - $24,999	faminc6	3.76	10.05 **	6.03	11.40 **	4.10	10.38 **
% of Households making $25,000 - $29,999	faminc7	5.01	9.23 **	6.52	9.27 **	5.22	9.25 **
% of Households making $30,000 - $34,999	faminc8	5.83	7.85 **	8.12	7.20 **	6.18	7.70 **
% of Households making $35,000 - $39,999	faminc9	5.62	6.80 **	7.26	6.07 **	5.87	6.64 **
% of Households making $40,000 - $49,999	faminc10	10.23	8.48 **	14.12	8.71 **	10.79	8.39 **
% of Households making $50,000 - $59,999	faminc11	11.13	7.35 **	12.03	5.19 **	11.26	6.87 **
% of Households making $60,000 - $74,999	faminc12	13.57	5.89 **	12.89	3.85 **	13.46	5.43 **
% of Households making $75,000 +	faminc13	37.30	9.44 **	20.71	4.01 **	34.89	8.23 **

* - Indicates that the means are significantly different from each other at the P = 0.05 level

** - Indicates rejection of the null hypothesis that the samples are from the same distribution

Table 4: Logistic Regression of Urban - Rural Internet Use

LOG LIKELIHOOD OF MODEL: -20399.95
Rural coefficient is "difference from" urban coefficient

	Urban			Rural		
Variables	Coefficient		Standard Errors	Coefficient		Standard Errors
Household Characteristics						
age	0.0388	**	0.0061	0.0316	**	0.0144
age2	-0.0007	**	0.0001	-0.0002	**	0.0001
sex	0.0525		0.0325	0.0672		0.0762
hs	0.6429	**	0.0612	0.0120		0.1364
scoll	1.2159	**	0.0620	0.1876		0.1401
coll	1.4988	**	0.0670	0.2651	*	0.1607
collplus	1.6508	**	0.0758	0.1509		0.1871
married	0.3297	**	0.0367	0.2067	**	0.0876
chld1	0.2286	**	0.0466	0.0605		0.1059
chld2	0.2926	**	0.0490	0.0972		0.1115
chld3	0.2150	**	0.0708	0.1170		0.1668
chld4	0.0089		0.1418	0.2437		0.2806
chld5	-0.4925	**	0.2297	0.6558		0.4109
Racial Characteristics						
black	-0.8155	**	0.0509	-0.0207		0.1744
othrace	-0.0759		0.0721	-0.5226	**	0.2179
Ethnic Characteristics						
hisp	-0.7787	**	0.0571	-0.0846		0.1934
Employment / Income Characteristics						
employed	-0.2187	**	0.0430	0.1675	*	0.0995
netatwork	0.1419	**	0.0413	-0.1552		0.1059
fambus	0.3854	**	0.0480	-0.0875		0.0953
faminc1	-0.2382		0.1547	-0.1975		0.3337
faminc2	-0.2331		0.1564	0.2474		0.3404
faminc3	-0.0370		0.1375	-0.3097		0.2919
faminc4	0.2173	*	0.1320	0.0883		0.2828
faminc5	0.2332	*	0.1193	0.0936		0.2497
faminc6	0.3267	**	0.1132	-0.0297		0.2407
faminc7	0.5801	**	0.1117	-0.1303		0.2414
faminc8	0.7860	**	0.1121	-0.0369		0.2420
faminc9	0.7986	**	0.1135	-0.0760		0.2484
faminc10	1.0507	**	0.1088	-0.0131		0.2379
faminc11	1.2106	**	0.1104	-0.0237		0.2447
faminc12	1.4909	**	0.1113	-0.1322		0.2514
faminc13	1.8311	*	0.1083	-0.1294		0.2475
Household Location						
midwest	-0.1910	**	0.0443	-0.2336	**	0.1146
south	-0.0852	**	0.0416	-0.4162	**	0.1105
west	0.0926	**	0.0453	-0.1391		0.1204
Intercept	-1.2778	**	0.4386	-2.4036	**	0.1715

** - Indicates that the coefficient is significantly different from zero at the P = 0.05 level
* - Indicates that the coefficient is significantly different from zero at the P = 0.10 level

Table 5: Logit Regression with Urban - Rural Parameters Equal

LOG LIKELIHOOD OF MODEL:			**-20470.00**
Variables	Coefficient		Standard Errors
Household Characteristics			
age	0.0423	**	0.0054
age2	-0.0007	**	0.0001
sex	0.0412		0.0294
hs	0.6467	**	0.0545
scoll	1.2682	**	0.0554
coll	1.5703	**	0.0606
collplus	1.7046	**	0.0689
married	0.3445	**	0.0331
chld1	0.2295	**	0.0417
chld2	0.2969	**	0.0437
chld3	0.2261	**	0.0638
chld4	0.0453		0.1216
chld5	-0.3520	*	0.1897
Racial Characteristics			
black	-0.7848	**	0.0485
othrace	-0.1156	*	0.0670
Ethnic Charasterics			
hisp	-0.7459	**	0.0540
Employment / Income Characteristics			
employed	-0.6692	**	0.0386
netatwork	0.1298	**	0.0380
fambus	0.3570	**	0.0412
faminc1	-0.2967	**	0.1364
faminc2	-0.1768		0.1214
faminc3	-0.1001		0.1163
faminc4	0.2489	**	0.1162
faminc5	0.2715	**	0.1044
faminc6	0.3368	**	0.0996
faminc7	0.5846	**	0.0987
faminc8	0.8127	**	0.0991
faminc9	0.8239	**	0.1056
faminc10	1.0827	**	0.0964
faminc11	1.2477	**	0.0981
faminc12	1.5182	**	0.0992
faminc13	1.8638	**	0.0965
Household Location			
midwest	-0.2470	**	0.0405
south	-0.1762	**	0.0381
west	0.0698	*	0.0421
Intercept	-2.5839	**	0.1547

** - Indicates that the coefficient is significantly different from zero at the P = 0.05 level
* - Indicates that the coefficient is significantly different from zero at the P = 0.10 level

Table 6: Logit Decomposition

Variable	*Description*	*Percent*	*Gap to P_u*	*Share of Gap (%)*
P_u	Urban parameters and urban sample	45.13		
P_r^o	Urban parameters and rural sample	36.67	8.46	65.56
P_r	Rural parameters and rural sample	32.23	4.44	34.44

Table 7: Urban - Rural Differences in Quality of Internet Access Among Users

	Rural	Urban	
Cost per Month ($)	17.31	17.81	
Type of Internet Access (%)	Rural	Urban	
Regular Dial-up	92.81	88.42	*
High-speed	7.19	11.58	*
High-Speed Use by Region (%)	Rural	Urban	
Northeast	9.08	11.95	**
Midwest	6.23	10.50	**
South	7.61	10.64	**
West	6.64	13.53	**
Long Distance Access (%)	Rural	Urban	
Local Provider	94.95	95.96	*
Long Distance Provider	5.05	4.04	*

Note: * - Indicates that the means are significantly different from each other at the *P = 0.05* level
** - Indicates rejection of the null hypothesis that the samples are from the same distribution
Means and Variances are derived using survey sample weights

Table 8: Logistic Regression Including REGDENSITY

LOG LIKELIHOOD OF MODEL: -20417.6

Rural coefficient is "difference from" urban coefficient

	Urban			**Rural**		
Variables	Coefficient		Standard Errors	Coefficient		Standard Errors
Household Characteristics						
age	0.0387	**	0.0061	0.0322	**	0.0144
age2	-0.0007	**	0.0001	-0.0003	*	0.0001
sex	0.0520		0.0325	0.0676		0.0762
hs	0.6380	**	0.0611	0.0130		0.1363
scoll	1.5000	**	0.0670	0.1881		0.1397
coll	1.2136	**	0.0619	0.2671	*	0.1603
collplus	1.6525	**	0.0758	0.1505		0.1869
married	0.3297	**	0.0366	0.2048	**	0.0875
chld1	0.2291	**	0.0466	0.0586		0.1057
chld2	0.2902	**	0.0491	0.0978		0.1116
chld3	0.2084	**	0.0706	0.1241		0.1664
chld4	0.0075		0.1410	0.2420		0.2799
chld5	-0.4970	**	0.2297	0.6455		0.4109
Racial Characteristics						
black	-0.8057	**	0.0507	-0.0146		0.1717
othrace	-0.0553		0.0714	-0.5127	**	0.2132
Ethnic Characteristics						
hisp	-0.7482	**	0.0563	-0.0852		0.1908
Employment / Income Characteristics						
employed	-0.2234	**	0.0430	0.1670	*	0.0992
netatwork	0.1434	**	0.0413	-0.1505		0.1057
fambus	0.3885	**	0.0480	-0.0914		0.0951
faminc1	-0.2402		0.1549	-0.1827		0.3333
faminc2	-0.2321		0.1562	0.2507		0.3400
faminc3	-0.0341		0.1374	-0.3001		0.2918
faminc4	0.2240	*	0.1322	0.0848		0.2825
faminc5	0.2372	**	0.1194	0.0968		0.2494
faminc6	0.3308	**	0.1133	-0.0302		0.2406
faminc7	0.5847	**	0.1118	-0.1332		0.2413
faminc8	0.7901	**	0.1122	-0.0379		0.2419
faminc9	0.8026	**	0.1136	-0.0791		0.2483
faminc10	1.0501	**	0.1089	-0.0128		0.2379
faminc11	1.2099	**	0.1105	-0.0237		0.2443
faminc12	1.4893	**	0.1115	-0.1333		0.2514
faminc13	1.8312	**	0.1083	-0.1274		0.2474
Regional Density Term						
regdensity	3.0507	**	0.4140			
Intercept	-3.8279	**	0.2525	-1.2249	**	0.4309

** - Indicates that the coefficient is significantly different from zero at the P = 0.05 level

* - Indicates that the coefficient is significantly different from zero at the P = 0.10 level