Closing the Rural Broadband Gap

Final Technical Report

November 30, 2008

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This research was supported by the U.S. Department of Agriculture CREES Program, Grant Number 2004-35401-14985. The opinions expressed are those of the authors.

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Executive Summary

Substantial public and private investments are being made in rural broadband networks, but how do rural residents and communities benefit? The basic question to be answered is: What are the impacts of rural broadband networks on the adoption and usage of broadband services and community development? An integrated approach to understanding the adoption, usage and social effects of broadband networks was developed. These impacts were examined through a quasi-experimental research project covering four counties, one in Michigan, one in Kentucky, and two in the Texas borderlands. Each county was home to a rural broadband provider funded by the Rural Utilities Service. The impacts of broadband service deployment were examined through two waves of surveys with community residents and ethnographic studies of the four counties.

Some key findings:

□ Urban-rural differences in the adoption of high speed Internet were previously attributed to the demographics of rural communities, including age, education, and household income. The research found that the precursors of broadband adoption were the perceived benefits of high speed Internet connections, the ability to experience those benefits for oneself, and a sense of efficacy when using the Internet. These are factors amenable to community-based, self-development interventions that can close the broadband gap despite the challenging demographics of rural communities.

□ The Connect Kentucky program apparently closed digital divides between young and old and better educated and less educated residents at the Kentucky site. There, the levels of broadband adoption reached levels close to those found in urban areas. This offered further evidence that the broadband gap may be closed through a combination of access to technology and targeted community development efforts.

□ Social uses of the Internet increased the social support experienced by rural residents, leading to higher levels of community satisfaction and attachment, and ultimately lower intentions to relocate away from rural communities. However, the development of social connections and interests beyond local communities also increased intentions to relocate. Balancing these contravening trends, perhaps with the development of local web content and a focus on local social networks, is important to sustain rural populations.

□ The broadband grants provided by the Rural Utilities Service had observable effects in two of the communities included in the study, in that the wireless broadband operations that were funded served a substantial number of residents, including many in areas not reached by wireline carriers. The RUS grant was suspended in a third community. In a fourth, the grant went to a local telco and it was not possible to separate the impact of the grant from the normal operations of the provider. However, broadband adoption increased substantially in all four communities. The grants also had indirect effects by hastening the entry of wireline broadband providers in rural towns.

□ All of the RUS grants included provisions for improved public access and the utilization of broadband Internet connections through libraries increased dramatically in all four counties. The increases were from a very small base, so that less than ten percent of the broadband users took advantage library access in the 2008 surveys and two-fifths of those also had home broadband connections. Low income residents were especially likely to utilize high speed library connections.

□ Home broadband users were more likely than non-users to plan further education, a consistent finding across all four sites. Interviews with library patrons suggested that form of public access is not suitable for online courses owing to limited hours of operation, short duration appointments for library computers, and overcrowding. Improved broadband access for educational purposes is thus in need of further attention.

Closing the Rural Broadband Gap

Background and Overview

The Problem

The adoption of rural broadband services in the rural United States presents something of a paradox. At the time of the inception of this project broadband adoption lagged behind that in urban areas even where access was available (Prieger, 2003; Bell, Reddy, and Rainie, 2004; Schadelbauer, 2002; U.S. Department of Commerce, 2004; Horrigan & Murray, 2006). Education and income were significant factors when explaining household-level urban-rural differences in Internet adoption (Mills & Whitacre, 2003), suggesting that infrastructure improvements alone may not be the answer to closing the urban-rural digital divide. Beyond the question of access to broadband is the issue of whether rural residents can use the technology effectively to build rural communities or whether access to the online world will weaken the fabric of rural life. From the vantage point of 2008, the 94 percent of U.S. schools with Internet access use almost exclusively broadband connections, but residentially-based broadband in rural areas continues to lag the availability in metropolitan regions. Peha (2008) estimates that "one third of households in rural America cannot subscribe to broadband Internet services at any price" (2), while Horrigan (2008) cites the Pew Internet and America Life statistic that 24 percent of rural households do not purchase broadband because the service simply is not available. California's Broadband Task Force (2008) undertook a study that found limited broadband availability in more rural regions and estimates that about one and a half million people in the state do not have access to the service.

The public sector stands ready to subsidize rural broadband access through the Rural Utilities Service (Pittman, 2002), but how will these investments improve rural life?

Potential Benefits of Rural Broadband

Economic Benefits

The impact of broadband development on rural America is potentially far-reaching. Information technology may help rural areas make the transition to an information-based economy and so reverse the decline in nonmetropolitan employment (Hudson & Parker, 1990), link rural employers to the global information economy (OTA, 1991; Dillman, 1991), and preserve the rural middle class (Stauber, 2001) and provide broad social goods (Atkinson, 2007; Peha, 2008). There is evidence of a reciprocal relationship between Internet usage on the job and Internet access in the home (Hollifield & Donnermeyer, 2003). Reliable broadband connections could allow rural residents to hold down jobs with urban enterprises while they continue to reside in rural communities, creating new economic opportunities that can reduce out-migration (Speare, Kobrin & Kinckade, 1982). In a global economy, the emphasis in rural economic development must shift from "smokestack chasing" to cultivating rural entrepreneurs and the telecommunications infrastructure is an important element of that strategy (Drabenstott, Novack, & Abraham, 2003). Broad and positive economic benefits are noted in Gillet et al. (2006) as well as Crandall et al. (2007). If the payoff for information infrastructure development is indeed greater in rural areas than in urban ones as some have argued (Parker, 2000), then the deployment of rural broadband might neutralize the basic disadvantages of rural location: distance and small market size. Investments in rural telecommunications are related to economic development, although the effects take several years to manifest themselves (Cronin, Parker, Colleran & Gold, 1993). Others have argued that access to broadband is imperative to sustain rural America (Malone, 2004; Ruiz, 2004).

There was preliminary evidence from the first phase of the present project that the Internet fosters social interactions that increase attachment to rural communities and reduce out-migration (Gregg, LaRose, Strover & Straubhaar, 2007). Broadband Internet may enhance economic opportunities in rural areas by stimulating the development of home businesses (LaRose, Gregg, Strover et al., 2006).

Social Benefits

Broadband development may produce social benefits as well as economic ones. Rural broadband networks could improve some of the conditions of rural life that lead to depopulation and despair (Kellogg Foundation, 2001), including access to health care and education (Jenkins, 2003). As of 2008, approximately 25 states use telemedicine networks to supplement rural and long distance health care delivery, and under its universal service authority the FCC authorized over $400 million to a Rural Health Care Pilot Program to build state and regional telemedicine networks (Universal Service Fund, August 15, 2008). In one recent study, broadband access was more related to taking online classes for credit in rural areas than in urban and suburban locations (Horrigan & Murray, 2006). Expanded educational and entertainment opportunities might stem the out-migration of young rural residents and attract new residents and enterprises from urban areas. Improved intra-community communication might increase group membership and attachment and lower migration intentions (Fernandez & Dillman, 1979; Herman & Ettema, 2007; Speare et al., 1982). Comparing broadband users with basic dial-up users (Pew Research, 2003), the former use the Internet more for news, work, entertainment, and group participation, so broadband access might improve social and economic conditions beyond levels achievable with basic Internet access.

Other research suggests limited effects. An evaluation of rural telecommunications projects (Hollifield et al., 2000) showed slight improvements in basic Internet usage and attitudes towards technology as the result of community development interventions. However, expected effects on the perceived importance of new technologies for family well-being and satisfaction with the state of telecommunications development were not found. And, no relationship between Internet usage and measures of overall community satisfaction or community attachment was observed (Hollifield & Donnermeyer, 2003). Prior research suggests mediating factors that may explain null and conflicting results such as these. The availability of local private capital, the quality of social networks, and the openness of community boundaries (Flora & Flora, 1993), individual-level perceptions of the benefits of new technologies (Rogers, 1995), collective efficacy (Flora, 2003), and prior adoption of high tech innovations (LaRose & Mettler, 1989) are potential moderating factors.

In tracing the impacts broadband services in rural communities, we should look beyond conventional measures of economic growth. DeJong and Fawcett (1981) identified a variety of factors affecting migration. Wealth goals-- including personal income and access to public benefits-- are supplemented by status goals stemming from obtaining a good education and being respected in the community; comfort goals from having leisure time; stimulation goals such as fun and exciting activities, meeting new people and keeping busy; autonomy goals (being economically independent); affiliation goals (having friends, being part of a community); and morality goals (living in a favorable moral climate, exposing children to good influences). Retail options may also affect migration (Ayres, Leistritz & Stone, 1992). Advanced telecommunications can improve rural health care, education, library resources, employment opportunities, social linkages, and government services (Hales, Gieske & Vargas-Chanes, 2000; Schreck & Hipple, 2000; Leistritz, Allen, Johnson, Olsen & Sell, 1997; Hipple & Ramsey, 2000; Abbott & Gregg, 2000).

Dimensions of social well-being (Smith, Krannich, & Hunter, 2001) such as perceived social integration might increase as a result of richer Internet-based interactions within local communities, while community satisfaction could increase by virtue of improved access to entertainment, education and public services. Indicators of social well-being, or social capital, are related to the success of collective rural community self-development efforts (Flora, Sharp, Newlong & Flora, 1997) and two key aspects of social capital, an unbiased source of local news and linkages to other communities, might improve through effective utilization of broadband networks.

The Possible Downside of Rural Broadband Development

The potential negative consequences of broadband development must also be considered. Anecdotally, computers placed in rural libraries by the Gates Foundation (Egan, 2002) may have encouraged outmigration: library patrons found city jobs online and then moved away. Rural shoppers might establish new commercial relationships to the detriment of rural suppliers, rural employers might be able to tap urban residents for specialized skills instead of developing them in the local economy, and the quality of “virtual” employment and social services may be inferior (Rowley & Porterfield, 1993). Business productivity gains could mean reduced employment (Read & Youtie, 1996).

Psychological well-being may be negatively affected by Internet usage in the short run, a phenomenon called the Internet paradox (Kraut et al., 1998). In an urban study, heavy Internet use was associated with declining commitment to living in one's local area as well as being less knowledgeable about that area (Kraut et al., 2002). Broadband communication might strengthen relationships with distant acquaintances at the expense of local ties or reduce local cooperation and trust. And, the introduction of broadband technology may further widen the information gap between rich and poor (cf. Ettema, 1984).

The Rural Broadband Gap

Recognizing the potential, there has been a concerted effort to improve rural broadband access by deploying both wireless and wireline technologies (Pigg & Crank, 2005) through the Community Connect and Broadband Access programs funded by the U.S. Department of Agriculture. There is conflicting evidence regarding whether rural areas lag behind urban ones in broadband access after adjusting for demographic variables. One study found that rural broadband access lagged, with non-farm rural areas served by independent telephone companies the least likely to have access (Prieger, 2003). However, a GAO study concluded there was no urban-rural difference after controlling for demographic variables (GAO, 2006).

Certainly, rural broadband development faces challenges. Part of problem is economic. Companies tend to focus their investments in urban areas where there are high income consumers and high residential densities that maximize profits (Schmandt, Williams, Wilson et. al, 1991; Venkatachalam & McDowell, 2002; GAO, 2006). Providers must expect a high rate of adoption before they invest (Hollifield & Donnermeyer, 2003). And, while telecommunications infrastructure investment improves community economic development (Parker, Hudson, Dillman, Strover & Williams, 1995; Egan & Wildman, 1992), the case has not yet been made for broadband Internet access has some evidence but requires additional study and context specificity (Crandall et al, 2006; Gillet et al., 2007).

Where broadband service is available, rural residents have significantly fewer competititve choices (Strover, 2003). And, two viable forms of broadband access in urban areas, cable modems and digital subscriber lines (DSL), are unlikely to reach beyond the boundaries of central office dialing service areas in villages and towns (Glass, 2001; Glass, Chang & Petukhova, 2003). While the technology exists to overcome the range limitations of DSL outside of local service areas, the costs of doing so-- at several thousand dollars per line—are considerable (Glass, Talluto & Babb, 2003). The "middle mile" costs of connecting rural Internet Service Providers (ISPs) to Internet backbone networks raise the cost of rural broadband service to levels well above those of urban areas (Glass, Talluto & Babb, 2003). Clearly, rural residents will have to find compelling reasons to subscribe to broadband service to make it worth price and to yield the necessary economies of scale for rural broadband providers.

As a result, only 24 percent of rural adults living outside of Metropolitan Statistical Areas (MSAs), compared to 39 percent of urban and suburban adults in MSAs had broadband Internet in their homes (Horrigan & Murray, 2006). The U.S. Department of Commerce (2004) found that of those who use the Internet, residents of rural areas (defined as places with less than 2,500 inhabitants) were less likely to adopt broadband than urban ones. How then can the apparent paradox of rural broadband adoption be explained: Why is rural broadband adoption so slow given the benefits it would seem to have for rural communities and rural residents?

Closing the Rural Broadband Gap

There are several possible explanations for the gap, the most obvious one being a lack of access to broadband service where one lives. Present policies address that issue, offering public access to those who may not have home access (in the case of e-Rate) and extending network coverage to unserved areas (in the case of the Broadband Access and Community Connect programs). Based on year 2007 filings of FCC Form 477 that required carriers to identify zip codes in which broadband access is available, 99 percent of all zip codes have broadband service providers in them (FCC, 2008). However, there are still gaps in coverage, mostly in sparsely populated areas west of the Mississippi and east of the Sierra Nevada mountain range (Grubesic, 2006) and the zip code data may drastically overestimate accessibility by home users (GAO, 2006).

However, if one believes that broadband access is not available, even when it is, one is naturally unlikely to adopt it. As noted above, rural residents are more likely to believe that they do not have access than those living in urban or suburban areas (Horrigan, 2008). However, the urban-rural gap in broadband adoption cannot be explained by that difference.[1]

Other limiting factors have been suggested. The adoption of complex technology can be problematic for those living in areas resistant to constant self-renewal (DeLong, et al., 2003; Bell, et al., 2004). A lack of relevant content (Wilhelm, 2003), low adoption rates in the workplace (Hollifeld & Donnermeyer, 2003), and the affordability of broadband in rural communities (Foros & Kind, 2003) might also limit adoption. Because benefits are subjective, people can reject an innovation inconsistent with their norms even if the innovation offers advantages (Kwak, Skoric, Williams et al., 2004).

Geographic differences might be explained away as demographic differences between rural and more urbanized areas (e.g., Bell et al., 2004; Mills & Whitacre, 2003; Horrigan & Murray, 2006; GAO, 2006). For example, a Government Accounting Office study found that there was no difference between rural and urban areas after controlling statistically for household income, education, and age (GAO, 2006). The obvious, if unstated, implication of such findings is that there is nothing to be done: rural residents are simply not the sorts of people who want or need broadband service. Or, alternatively, the intractable problems of rural poverty, outmigration of the young, and limited educational access need to be solved to stimulate broadband adoption. For example, in the Pew survey, price was the primary response given to the question why people did not upgrade to broadband services (Horrigan, 2008).

However, while demographic variables play an important role in the adoption of basic Internet service in rural communities, their influence on the further adoption of broadband service is rather weak (Gregg, LaRose, Strover et al., 2006). And, if rural broadband is to be at least a partial solution to rural problems demographic explanations of adoption have a circular reasoning flaw: the Internet cannot solve enduring rural problems until the very same enduring problems that also inhibit Internet adoption are overcome. That rural broadband users access online education more than urban broadband users (Horrigan & Murray, 2006) is illustrative of this paradox: broadband use could improve levels of educational attainment that in turn will lead to more broadband adoption according to the demographic argument. But how to improve educational attainment without first improving educational access through broadband adoption?

Another view is that the regional density of home Internet use explains almost the entire gap between Internet adoption in urban and rural areas, what economists call “network externalities” (Mills & Whitacre, 2003), so the key is to understand how to “kick start” the adoption process. Are the barriers to adoption purely economic? A consequence of low adoption rates in the rural workplace (cf. Hollifield & Donnermeyer, 2003)? A lack of relevant content (Wilhelm, 2003)? A critical mass issue (cf. Korsching, Hipple & Abbott, 2000)?

Objectives

Research Questions

The present project attempts to understand the causes and effects of the rural broadband gap and to evaluate the possibility of closing the gap through public infrastructure investment. An assessment of the consequences of such investments is essential for the formulation of sound public policy. The present research took advantage of a "natural experiment" by tracing the impact of rural broadband grants made by the Rural Utilities Service on rural households over a three-year period, 2005-2008. Accordingly, the proposed research evaluated the social impacts of the Rural Utilities Service's broadband technology grants program four counties: Huron County, Michigan; Pike County, Kentucky; Zapata County, Texas; and Zavala County, Texas. Two basic questions were addressed:

Question 1: What impact did RUS grants have on rural broadband adoption?

Question 2: What impact did broadband adoption have on rural households and rural residents?

Question 3: What are the barriers to broadband adoption and use?

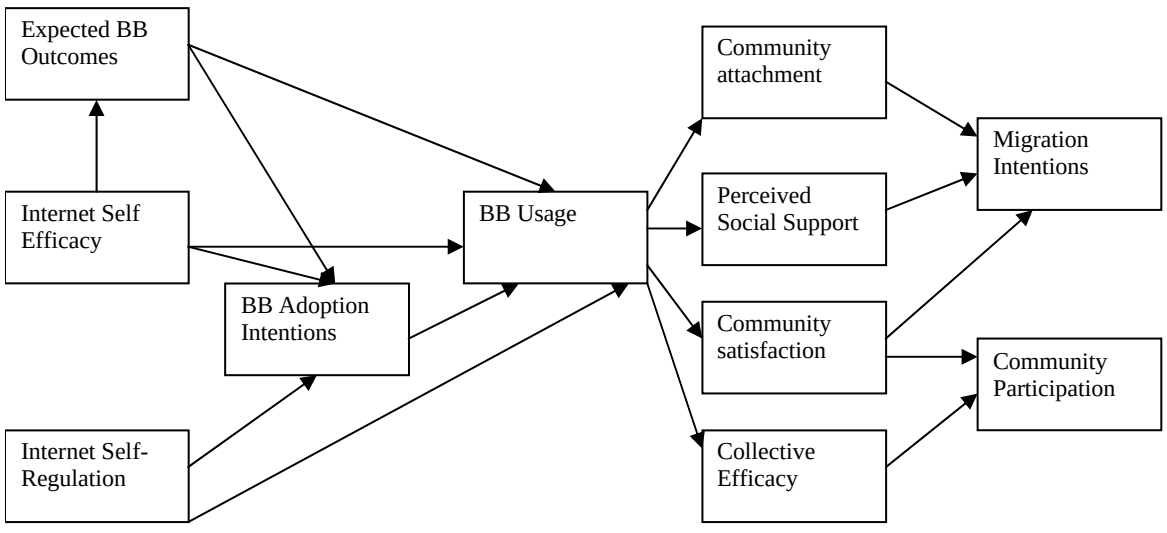
Serendipitously, the first wave of the survey coincided with the initiation of Connect Kentucky, a well-known effort in that state to stimulate the adoption and effective utilization of Internet technology. Connect Kentucky has since become a model for a national effort, Connect America, which aims to extent Internet access to rural residents throughout the United States. A comparison of the 2008 Kentucky results with those from 2005 and with three other counties receiving RUS grants provides information about the impact of that effort as well.

Conceptual Model

Prior efforts to study the impacts of rural infrastructure development focused on community-level data, while an equally important focus of rural broadband development (Pittman, 2002) is individual adoption. Prior research failed to trace the path from individual adoption, to usage, to impacts on individual residents, to community outcomes in a consistent fashion. Indeed, these issues have been confined to disparate fields of study, including Diffusion of Innovation (e.g. LaRose & Mettler, 1989; Rogers, 1995; Premkumar, 2000), rural sociology (Korsching, Hipple & Abbott, 2000), economics (Lentz & Oden, 2001), and the Digital Divide (Hoffman & Novak, 1998; van Dijk, 2005).

Thus, a further objective of the project was to build a model of the relationship between community development and broadband adoption. The hypothesized relationships among variables are illustrated in Figure1. The model incorporates the classical model of innovation diffusion (Rogers, 2003) and social-cognitive theories of diffusion (Bandura, 1994) and Internet usage (LaRose and Eastin, 2004), described further in a later section.

Figure 1 Broadband Adoption and Community Outcomes



Research Methods

Participants

In year 1 (2005), a mail or personal interview survey was completed by 1592 heads of household residing in four rural counties in Kentucky, Michigan, and Texas. In year 2 (2008), a mail or personal interview survey was completed by 1532 heads of household residing in the same four counties. The respondents generally reflected typical rural residents (cf. Bell et al., 2004).

Procedure

The residents of the two counties in Kentucky and Michigan were recruited through mail survey solicitations addressed to heads of household during the spring of 2005 and the spring of 2008. The Tailored Design Method mail survey methodology (Dillman, 2000) was followed to conduct the community surveys. A random sample of residential addresses in the target counties was obtained from a commercial mailing list vendor. A pre-notification letter printed on the letterhead of the participating university from the respondent's home state was sent. After three days this was followed by a questionnaire booklet with a cover letter on university stationary, a self-addressed stamped envelope and a 25-cent incentive. Those who did not respond were sent a follow-up post card, and after a replacement questionnaire sent via certified mail.

Self-administered mail surveys comparable to those administered in Michigan and Kentucky were conducted in Zapata and Zavala Counties in Texas between May and June 2005. Because commercially available address lists for Zapata County contained fewer than necessary number of household addresses, we increased the sample size by distributing surveys directly to households. A geographic cluster sampling was used to select households for direct distribution, by assigning the county's census blocks into clusters (approximately 40 households in each cluster) and randomly selecting 25 clusters as the final sample. Neither the mail nor direct distribution surveys achieved satisfactory response rates (5.5% in Zapata and 10.6% in Zavala). To compensate for the low response rates, trained bilingual interviewers conducted door-to-door surveys for non-responding households between July and November 2008. The final response rates were 20.9% in Zapata, and 23.1% in Zavala.

The second survey in Texas counties (December 2007 – May 2008) collected all cases through door-to-door interviews. In each county, 1200 households were selected though a geographic cluster sampling (approximately 40 households in each census-block cluster). Trained, bilingual interviews conducted personal interviews. After making three attempts to contact each household in the sample, we collected 412 valid cases in Zapata (34.3% response rate), and 386 valid cases in Zavala (32.1% response rate).

Individual county response rates ranged between 21% and 58%.

Operational measures

The dependent variable, broadband intentions, was based on a four-item additive scale[2] of future plans regarding the use of broadband Internet in the home. The validity of behavioral intentions as predictors of future behavior is well established (Ajzen, 1985). Intentions were rated on a seven-point scale ranging from the very likely (scored as seven) to the very unlikely (scored as one).

To operationalize social-cognitive variables, concepts were rated on 7-point scales ranging from strongly agree (scored 7) to strongly disagree (scored 1) and negatively worded items were reflected. The responses to multi-item indices were averaged across the number of items. Missing data were replaced by mean values. Expected outcomes of broadband usage were a 12-item[3] index. Five Internet self-efficacy items[4] were drawn from previous work (Eastin & LaRose, 2000). Observational learning,[5] and enactive learning[6] were single-item measures also assessed on Likert-type agree–disagree scales. The amount of Internet experience was the time, in months, since the respondent first used the Internet. Non-users were assigned a value of zero.

Relocation Intentions were assessed (after Ajzen, 1985) through two behavioral intentions items relating to intentions to move out of the respondent's home county and home state, evaluated on a seven-point scale ranging from very likely (scored as 7) to very unlikely (scored as 1). Community Attachment consisted of four likert-type items[7] from Fernandez and Dillman (1979) that were rated on a seven-point scale ranging from strongly agree (7) to strongly disagree (1). Community membership was measured by a single item.[8] Economic intentions

consisted of a three likert-type items that were rated on a seven-point scale ranging from ver likely (7) to very unlikely (1).[9] Four likert-type social support items[10] relating to social support obtained from friends were drawn from Zimet (1988). Following prior Internet research (LaRose, 2004), social outcome expectations (provide help to others and get support from others) were operationalized on the same seven-point likelihood scales used for behavioral intentions. Online Social Self-efficacy was comprised of three likert-type items that measured confidence in the respondents' ability to obtain social support online[11]. Collective self-efficacy consisted of three likert-type items that were rated on a seven-point scale ranging from strongly agree (7) to strongly disagree (1).[12] The extraversion measure consisted of 6 items from Bendig's (1962) Extraversion-Introversion scale that were presented as seven-point agree-disagree items. Internet usage was a composite variable constructed by adding the log (value +1) transform of the number of minutes spent on the Internet in the typical weekday to the corresponding measure for weekend days.

Respondents also were asked to indicate the year of their birth and that date was subtracted from the year of the survey to assess age. The years of education completed, excluding kindergarten, were recorded for education. Income was broken down into mutually exclusive categories: under $10,000 (scored as 1), $10,000–$19,999, $20,000–$34,999, $35,000–$49,999, $50,000–$74,999, $75,000–$99,999, and $100,000 or more (scored as 7). Gender was coded 1 for female and 2 for male. The ethnicity of the sample varied primarily by site. The Kentucky and Michigan counties were essentially all white, while there were significant Hispanic populations in the two Texas counties. Accordingly, ethnicity was coded 1 if Hispanic and 0 if not.

The Internet status of respondents was defined in relationship to their current usage of dial-up and broadband Internet connections, regardless of the location at which the use occurred. Thus those who used broadband outside the home and had dial-up service – or no Internet service at all—in their homes were classified as broadband users. Those who indicated neither current dial-up nor broadband usage were classified as non-users.

Data Analysis

Data analysis was performed using SPSS version 16.0. Analysis of covariance was used to examine differences between survey years, between communities, and across Internet user categories.

Preliminary analyses revealed that many primary outcome variables were related to age and education. Thus, differences in the age and education composition of the county-level samples between the two years of the survey were a potential confound. Furthermore, it is well-established that age and education are also determinants of the adoption of new technologies (e.g., Rogers, 1995) and the Internet in particular (van Dijk, 2005). Household income also suggested itself as a moderating variable. However, education and household income exhibited similar patterns of relationships with outcome variables and were moderately well correlated with one another (r = .479). There was considerably more missing data associated with household income in with years of education, making education the preferred covariate.

Differences among non-Internet users, dial-up Internet users, and broadband users might also reflect these basic demographic differences. Accordingly, age and education were introduced as covariates to control for demographic differences between years and between Internet adopter categories. The analysis strategy was to examine time- related differences and differences between adopter categories after correcting for these two covariates to examine indications of the effects of broadband deployment in the four communities surveyed. Interactions between the year of the survey and Internet adopter categories were deemed to be those most likely to be the effect of broadband development. For example, a time-related change in community attachment that was more or less pronounced among broadband users than non-users might indicate a possible effect of broadband development. Simple year over year changes in outcome variables might also be attributable to broadband development, but demanded interpretation in light of community interviews that suggested rival alternative explanations.

The multivariate model of community impacts was analyzed with Amos version 16.0. To condition the data for these analyses, missing data were replaced with the mean values. The overall model was split into two parts, the first predicting broadband adoption and the

second examining broadband adoption as a cause of community outcomes. Prior analysis of the first wave survey results was used to further develop these models (LaRose et al., 2007; Gregg et al., 2006). This analysis is described further in the sections below.

Results

Community Case Studies

Huron County, MI

County Description

Huron County is located at the tip of the Michigan thumb region in the state's Lower Peninsula. Compared to the rest of the State of Michigan, the Huron County population is less racially diverse (96% versus 81% White), poorer (median household income of $37,000 versus $44,000), older (20% aged 65 or older compared to 13%), and less educated (78% versus 83% high school graduates). Slightly fewer Huron County residents are below the poverty line compared to the statewide average (12% versus 13%). The 2006 population estimate was 34, 143. This figure represented a population decline of 5.4% since the 2000 census.[13]

Historically, Huron County was originally settled and developed around the lumber industry and the name of the county seat, Bad Axe, is a reminder of that era. Forestry gave way to agriculture which in turn was replaced by automobile-centered manufacturing as the dominant economic activity. In 2006, farm employment accounted for 9% of the total, government 10%, retail 12%, and manufacturing 15%.[14] Manufacturing employment is in long-term decline while health care and social assistance occupations are surging.[15]

During the interval between the 2005 and 2008 surveys Huron County faced significant economic and quality of life challenges. The county was hit especially hard by the overall decline in the Michigan economy and in the automotive sector in particular. As of September, 2008, the unemployment rate was 9%.[16] This represented an increase of 50% over the fall, 2005, unemployment level. The most significant new development during the four-year period was the completion of a wind farm facility by John Deere Wind Energy, which added few permanent employees, however. A persistent environmental problem has been the build-up of human and bovine fecal matter, referred to locally as "muck," on the Lake Huron shoreline that borders the county on three sides.[17]

Economic development sources in the county identified the long-term loss of manufacturing jobs, the consolidation of agricultural enterprises, and the need to stabilize the county's economic base as key challenges. The county's remote location and the perception that it is not a tourist area are further concerns. Concrete highways rather than information highways perhaps pose the greater need. There are no interstate highway system arteries serving the county and, as local residents say, the county "isn't on the way to anywhere." Broadband services, including fixed wireless, are widely available but local businesses and local residents, particularly the county's many senior citizens, have not learned to use them to full advantage. The character and work ethic of the local populace are the county's major assets.

There were few notable examples of local Internet utilization beyond the local newspaper and school districts. There are opportunities for small-scale entrepreneurial activities online such as an upscale tourist goods store in Port Austin that sells more online than in its store location. Local beach towns, including Caseville, Port Hope, and Port Austin, have webcams so Internet users can see views of the beaches.

Huron County Broadband Services

The three main local wireless Internet providers in Huron County are Air Advantage, SpeedNet LLC, and AVCI. Previously, eChoice offered a fourth option for residents, but in September of 2005, SpeedNet LLC acquired eChoice. Air Advantage is the RUS grantee and provides high-speed wireless Internet access to residents across Huron County. It used a $219,000 RUS grant to extend service to the communities of Port Hope and Unionville. Larger towns such as Bad Axe, Port Hope, Sebewaing, and Harbor Beach are covered, but there are areas between cities that do not have service. SpeedNet offers less coverage. The southwestern part of Huron County, extending east to just short of the coastline, is covered by SpeedNet, but the northern third of the county, as well as the eastern coast, does not have SpeedNet

coverage. AVCI covers all portions of the county, at least according to its coverage map.

Each company has a variety of service options. Air Advantage charges a flat rate of $38 per month for residential wireless service, with a $100 one-time set-up fee. Business wireless service costs $55 per month, and the set-up fee is $150. SpeedNet's services include $34.95 per month for Internet access, with a $50-$200 activation fee and the option for add-ons such as monthly modem rental ($7 per month), and additional email addresses or webspace for $4.95 per month. Commercial service starts at $49.95 per month. AVCI offers several residential packages. The basic package costs $34.95 per month, with up to a ½ Meg connection. Up to 1 Meg costs $44.95 per month. Business plans start at 1 Meg connection for $49.95 per month, available for both DSL and wireless packages. The Business Plus plan and the Premium Business Plan are DSL only and cost $69.95 and $99 per month, respectively (See Table 1).

Table 1. Local Provider Broadband Services in Huron County

	Air Advantage	AVCI	SpeedNet
Basic Home	$38	$34.95-$44.95	$34.95
Home Set-Up Fees	$100	$100-$300	$50-$200
Basic Business	$55	$49.95-$99	$49.95
Business Set-Up	$150	$100-$300	$50-$200

Comcast Cable began offering broadband Internet service in the towns of Bad Axe, Elkton, Ubly, Gagetown, and Sebewaing in fall of 2005, after the time of the first survey wave. Introductory rates for broadband Internet service start at $19.95 per month with “triple play” deals of phone, cable and broadband Internet service for under $100 per month. CenturyTel offers broadband cable service in the towns of Kinde, Harbor Beach, Port Hope, and Port Austin. It advertises 256K service for $31.20 per month and 1.5M service at $41.20. AT&T offers Digital Subscriber Lines beginning at $14.99 per month for 368K service.

Results of the 2008 survey indicated that cable operators Comcast and CenturyTel had accounted for much of the increase in broadband connections in Huron County over 2005. eChoice/Speednet had lost market share, apparently to new broadband cable and DSL options. The RUS grant recipient Air Advantage was the fourth leading provider after Comcast in 2008, with a market share about equal to that it had in 2005. Only one satellite Internet connection was reported in 2008 (Hughesnet).

Table 2 Residential Broadband Providers' Market Share (Percent)

Company	2005	2008
Air Advantage	15.9	14.2
AVCI	19.5	19.6
AT&T	-----	11.9
CenturyTel	4.9	8.9
Comcast	-----	17.3
eChoice/Speednet	43.9	21.4
Other	15.9	6.5

Note: Based on home broadband users.

Public Internet Access in Huron County

Local campgrounds have wireless hotspots for public access. The Huron Economic Development Corporation developed the project with the parks, using a $25,000 grant from the AT&T Foundation. Most of the local libraries in the county offer Internet access to anyone with a library card. Port Hope has 10 Internet connections in a community center funded through the RUS grant to Air Advantage. However, budget cuts have translated into restrictions on the hours and days that library access is available.

Interviews with library patrons indicated that in some cases library access was being used in place of home access, including instances in which home computers had been abandoned in favor of library computers. Other patrons said they used library computers as a supplement to home computers for applications that their slower (or less secure) home connections did not support. For example, one interviewee had Internet access at home but because he lived so far out of town that the access was extremely slow and unreliable. He canceled his home service and began using the Harbor Beach Library's Internet access instead. Other patrons used the library computers as a supplement to home computers. For instance, one interviewee at the Bad Axe Public Library was taking distance education courses and found that the speed of her home connection was insufficient to access course content in a reasonable amount of time, so she came to the library to do her schoolwork. Unfortunately, because the library is not always open (and even when it is, computers are not always available), she needed to plan very carefully. Most of the regulars had certain favorite times to come in because traffic in the library was lower. Four p.m. to close was one of the worst times to get online, because students from the local schools usually came in then to either do homework or, in 2008, to use sites like MySpace and Facebook. Although instant messaging is not allowed at most libraries, these sites were a good way to keep in touch with friends and family, according to several interviewees.

Changes in Internet Usage in Huron County 2005-2008

Awareness of the Internet remained high across both waves of the study in Huron County (See Table 2). Nine-tenths of those surveyed in both years said that they had heard of the Internet. The percentage who said that they had ever used the Internet also remained constant between years, at seven-tenths of survey respondents. Those who said they currently used Internet rose slightly, from 61% in 2005 to 67% in 2008. The number of hours spent on the Internet also rose slightly from an average of 1 3/4 hours in 2005 to slightly over two hours on typical weekday in the later survey.

Awareness of high-speed Internet service increased significantly from 82% to 91% (see Table 2), while there was a significant decline in the perception that high-speed Internet was not available or individual respondents lived. The use of high-speed Internet connections more than doubled over four years, from 22% of the households surveyed in 2005 to 48% in 2008. The percentage who used high-speed Internet at

home also more than doubled, from 17% to 39%. Intentions to have broadband service in the home also increased significantly. The average number of years of experience with high-speed Internet also increased, nearly doubling across the two survey periods, with nearly half (46%) of broadband users reporting that they adopted the technology after the time of the 2005 survey. Broadband access outside the home also increased significantly, notably at work and in local schools and public libraries. However, the latter increase was over a very low base rate (.3%) at the time of the 2005 research. Overall, home and work Internet connections were the primary sources of broadband access in Huron County during both years of the study. These results were generally unaffected by demographic differences in the sample between years. The only exception was that the difference in current Internet use reached significance after controlling for age and education.

Table 3. Closing the Huron County Broadband Gap 2005-2008

		Survey Year	
		2005	**2008**
Have you ever heard of the Internet?	Yes	368	364
91.1%	89.0%		
Have you ever used the Internet in your life?	Yes	285	288
70.7%	70.4%		
Do you currently use the Internet?	Yes	245	275
60.8%	67.2%		
The number of hours spent online on a typical weekday	Means	1.76	2.09
Have you ever heard of high speed… **	Yes	264	265
82.0%	91.4%		
High speed Internet is not available where I live*	Means	3.36	2.82
Do you currently use a high speed Internet connection?**	Yes	90	196
22.3%	47.9%		
The number of years on high speed Internet**	Means	1.65	3.11
Use high speed Internet - at Home**	Yes	67	154
16.9%	39.3%		
Use high speed Internet - at School*	Yes	4	15
1.0%	3.8%		
Use high speed Internet - at Work**	Yes	39	79
9.8%	20.2%		
Use high speed Internet - at Public Library**	Yes	1	15
0.3%	3.8%		
In the next year I will have high speed Internet at home*	Means	3.45	3.96
Adopted broadband after 2005	Yes	na	84
na	46.4%		

***** Significant at the .05 level ** Significant at the .001 level

Changes in Huron County Community Outcomes

The results of pre-post analyses of changes in community outcomes are shown in Table 3. After adjusting for the age and education of the respondents there were no differences in community attachment, perceived social support, or relocation intentions either between years or across Internet adopter categories (i.e., those with no Internet, dial-up only, or broadband).

Both collective efficacy and community satisfaction declined significantly between the two years. However, there was no interaction with Internet status, suggesting that these were general community trends unaffected by the further deployment of broadband Internet in Huron County between 2005 and 2008. Rather, it is likely that these declines were the result of a worsening local economy and an inability to solve an intractable environmental problem afflicting the area.

Intentions to engage in further of education were higher among Internet users than among nonusers and highest of all among broadband adopters. Since age and education were controlled in these analyses this is a possible indication that broadband adoption stimulates interest in furthering one's education. However, this relationship did not change between years so it is unlikely that further broadband deployment had an effect.

Similarly, intentions to develop new employment options were higher among broadband users, followed by dial-up users, compared to non-Internet users. In this case there was a significant change between years but in a negative direction. Respondents in 2008 were less likely to say that they planned to form a home business or to seek telecommuting opportunities while remaining in Huron County. However, this decline may be attributable to the worsening economic condition of Huron County rather than broadband development.

A possible Internet effect was found on civic participation. There was a significant interaction effect between year and Internet status. At the time of the 2005 survey respondents who did not use the Internet had higher levels of participation in voluntary community activities than those who used the Internet. However, this relationship reversed at the time of the 2008 survey when those using online connections increased their civic participation. This effect was most notable for dial-up users; however, while broadband users remained at essentially the same level of voluntary participation in both years.

The community satisfaction index had several distinct components and although the general trend across these dimensions was downward in Huron County they shared a distinctive pattern of differences between Internet adopter categories (results not shown in table). At the time of the pretest in 2005, those who did not use the Internet were generally more satisfied than Internet users, but the satisfaction levels plunged for non-users more so than for Internet users by 2008. In the case of satisfaction with opportunities to participate in local government, the trend lines crossed. In 2005 non-users were more satisfied than Internet users with this dimension of community life, but in 2008 they were less satisfied. Satisfaction with this aspect of community life declined in all groups, but was less among dial-up and broadband users.

Table 4 Huron County Community Outcomes

	2005			2008					
	Internet Status			Internet Status			F tests		
	None	Dial Up	Broadband	None	Dial Up	Broadband	Year	I-Status	Yr x I-St
Attachment Mean	5.232	5.066	5.107	5.159	5.186	5.194	.322	.228	.603
Std. Error	.122	.116	.147	.137	.162	.102			
Collective Efficacy Mean	5.800	5.789	5.622	5.379	5.598	5.580	5.69*	.476	1.607
Std. Error	.104	.098	.124	.120	.138	.087			
Satisfaction Mean	4.783	4.384	4.379	4.227	4.108	4.214	15.188**	2.869	2.013
Std. Error	.099	.088	.111	.118	.130	.077			
Social Support Mean	5.680	5.570	5.504	5.615	5.743	5.776	1.976	.010	1.355
Std. Error	.105	.096	.123	.115	.138	.087			
Memberships Mean	2.140	1.800	1.828	1.538	2.127	1.872	.259	.252	3.404*
Std. Error	.172	.162	.209	.193	.230	.148			
Relocation Intentions Mean	1.890	2.091	2.103	1.715	2.219	2.138	.001	2.761	.529
Std. Error	.141	.131	.170	.163	.189	.117			
Economic Intentions Mean	1.800	2.197	2.604	1.456	1.856	2.172	10.784**	13.169**	.075
Std. Error	.129	.119	.155	.153	.171	.106			
Education Intentions Mean	1.663	2.349	2.876	1.582	2.070	2.772	1.754	31.238**	.273
Std. Error	.132	.124	.159	.157	.177	.110			

* Significant at the .05 level ** Significant at the .001 level
Note: Analysis of covariance results. Means adjusted for age and education.

Pike County, KY

Pike County Description

Pike County, Kentucky, is located in the eastern coal field region of the state. It is the largest county in Kentucky in terms of land area, and the furthest east, bordering West Virginia. Pikeville, population approximately 6,500, is the county seat and major trade and economic center in the region. It has been recognized as one of the best small towns in America.[18] The Pikeville cut-through project is the second-largest land removal project in the western hemisphere (second to the Panama Canal).[19]

Approximately 98 percent of the county's population is white. Nearly 62 percent of the residents are high school graduates, though fewer than 10 percent have a bachelor's degree. Nearly 23 percent of Pike County residents live below the poverty line, compared to 16 percent in other parts of Kentucky.[20] The county has seen a steady population decline since 1980.[21] Historically coal mining has been the major industry and largest employer in the area, followed by retail trade and educational services.[22] Pike County also boasts large natural gas reserves. Recently, however, mining has declined in importance while retail, education, and healthcare have increased as important employers in the county.

Pike County Broadband Services

The RUS grantee in Pike county was Southeast Telephone, Inc. (Setel), located in the town of Phelps. The $215,000 grant was a partnership among ARH Phelps Clinic, Good Shepard Nursing Home, Majestic Family Resource Center, Majestic Grade School, Phelps Ambulance Service, Phelps Area Technical Center, Phelps Army ROTC, Phelps Branch Library, Phelps Elementary and High School, Family Resource Center, Volunteer Fire Department, and the Presbyterian Health Center.[23] Southeast Telephone serves other communities in Pike County, including Pikeville. Setel offers a variety of services options to individual users, primarily through service agents. Customers choose their Internet services based on the telephone service package in which they have enrolled. Prices for DSL range from approximately $25 to $60 per month.

Gearheart Communications and AT&T also offer DSL services in Pike County. Gearheart offers a variety of service options, including dial-up connections for as low as $8.95 per month. Gearheart also offers cable Internet, as does Suddenlink and InterMountain Cable, packages beginning at $19.95 per month for residential customers. InterMountain Cable also offers business packages beginning at $69.95 per month. InterMountain offers Voice-over-IP (VoIP) services for its residential and business customers. Hughes Net provides limited high speed satellite Internet services in Pike County with packages beginning at $60 per month.

Public Internet Access in Pike County

Wireless Internet is available in public locations in Pike County as well. A number of hotels in the area offer wireless Internet, some as a free service to guests, other charge a service fee. Free wireless Internet is also available in the public library, and one local church offers free wireless to the community.

Interviews with library patrons indicated that in many cases library access was being used in place of home access. Patrons remarked that occasionally the computers were not available because they were being used by other patrons, but most of the time users were able to access the library computers without too much wait. Library staff indicated that they had increased the number of computers within the last year in order to increase the availability to patrons and decrease the wait time.

The library also offers a computer check-out program to high school students in Pikeville. Students can check out a laptop for home use, then dial-in to the library's databases and other Internet services using a dial-up connection.

One innovative application of Internet services by Southeast Telephone is offering free wireless Internet in the city park in Pikeville. While we did not see people in the park using the wireless service, library patrons indicated they were aware of the service and had seen people in the park with laptop computers.

ConnectKentucky

A discussion of technology in Kentucky is not complete without acknowledging ConnectKentucky, a nonprofit public/private partnership whose mission is “to accelerate the growth of technology in support of community and economic development, improved healthcare, enhanced education, and more effective government.” [24] ConnectKentucky is often held up as a model for expanding broadband nationally.

In Pike County, the ConnectKentucky assessment team worked with county officials to develop a strategic plan for increasing the use of technology in the community. The strategic plan includes development in local government; business and industry; K-12 education; higher education; healthcare; libraries; agriculture; tourism, recreation & parks; and community-based organizations. [25] The project leaders in Pike County developed initiatives to increase the competitiveness of Pike County through the expansion of broadband availability and the increased usage of computers and broadband-related applications. The assessment team found that approximately 75 percent of Pike County residents had easy access to broadband resources. However, for those living outside the larger communities, broadband was much less available. This continues to be a goal for the telecommunications team in Pike County.

Specific goals for telecommunications development in Pike County include: [26]

- implementing technical applications that will increase usage, comfort-level, and adoption of technology in the delivery of healthcare services (telemedicine) in Eastern Kentucky.
- Facilitate economic growth in Pike County through the formation of a collaborative partnership between schools, business and community members with the primary objective to increase the technology comfort level of the community and to implement new and innovative technology solutions for area businesses.
- Organization, promotion and delivery of technology education and awareness to the entire community of Pike County.

Changes in Internet Usage in Pike County2005-2008

Awareness of the Internet was high (95% of respondents) during both waves of the study in Pike County (see Table 5). The percentage of those who said they had ever used the Internet increased significantly between 2005 and 2008, from 73% to nearly 82%. Furthermore, those who said they currently use the Internet increased significantly during the course of the study, from 65 to 75%. The number of hours spent on the Internet also rose slightly.

Awareness of high-speed Internet service was high both years, however, use of high-speed Internet increased significantly, during the study, from 23% to 56%. This was due in large part to more wide-spread availability of high-speed Internet in 2008. Furthermore, the number of people who said they had high-speed Internet at home tripled, from 15% to nearly 50% in 2008. The majority of Pike County residents subscribe to high-speed Internet from Southeast Telephone, the RUS grantee, or through a cable Internet provider. The number of people who used high-speed Internet at work more than doubled during the study period as well.

Table 5. Closing the Pike County Broadband Gap 2005-2008

		Survey Year	
		2005	2008
Have you ever heard of the Internet?	Yes	317	312
95.2%	95.7%		
Have you ever used the Internet in your life?*	Yes	243	265
73.2%	81.5%		
Do you currently use the Internet?**	Yes	216	247
65.1%	75.8%		
Hours spent online on a typical weekday	Means	2.06	2.40
Have you ever heard of high speed…	Yes	220	240
84.6%	85.4%		
High speed Internet is not available where I live*	Means	3.26	2.57
Do you currently use a high speed Internet connection?**	Yes	77	184
23.1%	56.4%		
The number of years on high speed Internet*	Means	2.05	2.73
Use high speed Internet - at Home**	Yes	51	151
15.6%	47.0%		
Use high speed Internet - at School	Yes	7	12
2.1%	3.7%		
Use high speed Internet - at Work**	Yes	33	76
10.1%	23.7%		
Use high speed Internet - at Public Library**	Yes	4	22
1.2%	6.9%		
In the next year I will have high speed Internet at home**	Means	3.36	4.77
Adopted broadband after 2005	Yes	na	92
na	63.4%		

*** Significant at the .05 level ** Significant at the .001 level**

Changes in Community Outcomes in Pike County, 2005-2008

Table 6 summarizes changes in community outcomes in Pike County during the study. After adjusting for the age and education of the respondents, there were no differences in perceived social support, community memberships, or relocation intentions either between years or across Internet adopter categories (i.e., those with no Internet, dial-up only, or broadband).

Both community attachment and collective efficacy declined significantly between year 1 and year 2. However, there was no interaction with Internet status, suggesting that this was a general community trend unaffected by the further deployment of broadband Internet in Pike County between 2005 and 2008. Community attachment can in part be explained by the population decline in Pike County. Residents may feel limited attachment to a community they are hoping to leave.

Interestingly, community satisfaction was not significantly related to year, but it was significant across adopter categories. For non-users and dial-up users, community satisfaction declined during the study period. Broadband users, however, showed an increase in satisfaction during the study period. It is possible that broadband users are more satisfied with their community because of strides in broadband deployment, particularly the wireless options in Pikeville, the largest community in the county and the county seat.

Intentions to engage in further of education were statistically significant across user categories and were higher among Internet users than among nonusers and highest of all among broadband adopters. Since age and education were controlled in these analyses this is a possible indication that broadband adoption stimulates interest in furthering one's education. However, this relationship did not change significantly between years so it is unlikely that further broadband deployment had an effect. Interestingly, however, education intentions increased for non users and broadband users during the study, but declined for dial up Internet users.

Similarly, intentions to develop new employment options were higher among broadband users, followed by dial-up users, compared to non-Internet users. Again, Internet user status proved to be statistically significant while year did not. Interestingly, though it was not a significant finding, economic intentions declined in all three user categories during the study. Respondents in 2008 were less likely to say that they planned to form a home business or to seek telecommuting opportunities while remaining in Pike County. However, this decline may be attributable to of the out-migration of Pike County residents rather than broadband development.

Table 6 Pike County Community Outcomes

	2005 Internet Status			2008 Internet Status			F tests		
	None	Dial Up	Broadband	None	Dial Up	Broadband	Year	I-Status	Yr x I-St
Attachment Mean	5.481	5.296	5.034	4.908	4.779	4.770	11.665**	1.307	.568
Std. Error	.158	.133	.179	.197	.192	.116			
Collective Efficacy Mean	5.883	5.870	5.786	5.279	5.313	5.213	23.945**	.240	.013
Std. Error	.144	.118	.161	.174	.171	.102			
Satisfaction Mean	4.515	4.064	4.022	4.466	4.004	4.088	.015	4.645*	.137
Std. Error	.145	.112	.154	.187	.166	.097			
Social Support Mean	5.664	5.521	5.499	5.738	5.302	5.513	.116	1.402	.489
Std. Error	.155	.127	.176	.187	.183	.110			
Memberships Mean	1.895	1.499	1.522	5.377	1.359	2.030	2.414	2.014	1.715
Std. Error	.962	.782	1.076	1.271	1.249	.744			
Relocation Intentions Mean	2.137	2.042	2.498	2.258	2.277	2.414	.346	1.479	.411
Std. Error	.182	.152	.204	.241	.231	.130			
Economic Intentions Mean	1.754	2.252	2.576	1.743	1.862	2.400	2.149	9.302**	.643
Std. Error	.159	.127	.171	.203	.194	.108			
Education Intentions Mean	1.925	2.713	3.101	1.965	2.244	3.190	.521	17.125**	1.356
Std. Error	.187	.151	.201	.247	.229	.129			

* Significant at the .05 level ** Significant at the .001 level
Note: Analysis of covariance results. Means adjusted for age and education.

Zapata County, Texas

Country Description

Zapata County is large in area, small in population, and predominantly Hispanic, although the Anglo population is growing. It lies on the Rio Grande river border with Mexico, about 60 miles southeast of Laredo on the main highway connecting Laredo with the agricultural area of the Rio Grande valley further south. The latest official estimated population for Zapata County, in 2007, is 13,605. The population is heavily concentrated in the largest city and county seat, Zapata, which has approximately 9,200 residents. Both Census updates and survey data from this project indicate that the population is slightly under 90% Hispanic and that more than 90% of residents speak Spanish fluently, although many do not read Spanish and many also speak English fluently. The non-Hispanic population has increased with a recent economic boom, but immigration from Mexico has also increased.

Zapata is quite mature as both a population center and economy, although that is changing recently. There have been ranches in the area near San Ygnacio in the northwest of the county since 1755 via Mexican land grants, which were given to several families to encourage settlement in the area from Mexico. There were 1250 people by 1860, almost all Hispanic, many still descendents of the original grantees. The area was largely untouched by the slave economy and the Civil War. After the 1860s, the Hispanic landowners rejected proposed new irrigation projects and resisted the sale of their land to Anglo farmers. So the economic and political elite continued to be Hispanic, as were farm and ranch workers. The economy continued to be oriented to large scale ranching.

Change came with a new resource economy and tourism. In 1919, some oil was discovered, but a natural gas boom took place only in the 2000s. That has brought new workers and a new set of managers to town, attracting in more Anglo professionals and skilled workers, but also creating conditions for a great deal of local economic prosperity in a variety of services.

In a parallel development, a tourism boom has taken place, along with seasonal migration. In 1954, the Army Corps of Engineers built a dam and flooded the Rio Grande to create Falcon Lake, both for flood control and tourism. The original town site of Zapata was moved from the riverside to its current location, moving it away from a close connection to a sister city, Guerrero, on the other side of the Rio Grande in Mexico, and removing it from being a border crossing. But tourism boomed as a result. Beyond tourism, many who originally came to Zapata as seasonal "winter Texans," who came from the Midwest to spend winters in Zapata, began to settle in and stay year around. That has created a more year round demand for services.

The overall result has been a new tripartite economy: ranching, tourism, and natural gas.
The latter two are growing fairly quickly, attracting new residents, who are often particularly interested in services like broadband Internet.

Economic development sources in the county identified the opportunities to train more local people for new energy sector jobs, the consolidation of ranching, and the need to upgrade the skills of the growing medical service sector as key challenges. One of the most concrete outcomes of this project took place when project researchers identified to local development planners the lack of a local junior college for such training as a major problem for Zapata, compared to our other Texas site, Zavala. The Chamber of Commerce and Economic Development Authority moved quickly to find several million dollars in government and private sector resources to finance the Zapata County Higher Education Advanced Technology Center, a higher-education institution, focused on training for energy sector jobs, teachers' assistants, and several specific medical assistant specialties. That promises to provide necessary infrastructure for more sustained growth, and will quite likely lead to increased broadband usage by students who continue training with online courses after they reach the limit of residential or onsite courses.

The Zapata County Economic Development Center was established in 2005 to take over the economic development initiatives previously coordinated by the local chamber of commerce. The EDC has since initiated a variety of projects, including the creation of the Higher Education Center, community round-table discussions, community needs surveys, and the drafting of the Zapata County Master Plan (scheduled to be made public in the first quarter of 2009). However, these activities by the EDC and a few visionaries in the community are

not fully supported by some of the county's wealthy and influential residents. Many of them own lucrative mineral rights to natural gas, and do not see benefits in further investments in technology, education, and economic development.

Zapata County Broadband Providers

The earliest entrant to Zapata County's broadband market was Frontera Telecom, a competitive local exchange carrier based out of Kerrville, Texas. Frontera started a fixed-wireless broadband Internet service in the county's populated areas in 2004. Around the same time, Border To Border Communications, the county's second incumbent local exchange carrier and Frontera's sister company, was constructing fiber-to-home networks in Zapata's less populated areas. The new fiber networks became operational in the third quarter of 2005.

Meanwhile, the county's largest incumbent local exchange carrier, AT&T (then, Southwestern Bell) began providing DSL broadband shortly after Frontera's entrance. Although the service was limited to an area within three miles of Zapata's population center, the DSL service offered some local businesses and residents an alternative to more costly and slower wireless broadband.

It was in this context that the RUS Community Connect grantee Blue Moon Solutions began its fixed-wireless broadband services in Zapata County in 2004. Based out of Lubbock, Texas (Austin, Texas, since 2007), Blue Moon Solutions is an IT service company, formed in 2002, with a significant emphasis on the provisioning of broadband Internet in rural areas. Since its inception, Blue Moon has specialized in public-private initiatives in which Blue Moon forms formal partnerships with municipal or county governments to apply for federal and state grants for rural technology development. Blue Moon's public-private initiatives typically involved the provision of free or discount Internet connectivity for public facilities such as the public schools, public libraries, municipal buildings, public safety services, and so forth.

Blue Moon Solutions was awarded six RUS Community Connect grants in the 2002-2003 period in Texas. In Zapata County, the company received $500,000 to design, build and deploy a wireless broadband transmission service to critical community facilities. Blue Moon received two additional RUS grants for similar provisions in Zapata County during the same period; $324,136 in the town of Falcon Lake Estates, and $324,136 in the town of San Ygnacio.

Under the contract, the community and municipal facilities would receive broadband connectivity free of charge for two years. As the Blue Moon began these contractual provisions, it also deployed commercial wireless broadband services for the residential and business customers in Zapata.

In the 2004-2005 period, Zapata County had seen the market entry of four broadband service providers – Frontera, Border To Border, SBC (AT&T), and Blue Moon. Frontera and Blue Moon offered wireless-based broadband services to residential and business customers. The fiber networks by Border To Border, serving sparsely populated areas of the county, targeted ranches, hunting lodges, and oil and gas. Various interviews with public office holders and community leaders in Zapata County suggested that the announcement of the RUS grant awards for Blue Moon in 2003 had encouraged the entry of existing and new telecom companies into Zapata's broadband market.

However, the development of broadband Internet services in Zapata did not expand as much as the situation in 2004 had promised. Frontera Telecom unplugged its wireless broadband service in 2006, due to the lack of customer base and sufficient revenues. AT&T still provides DSL services in Zapata, but its service areas have not expanded beyond the initial deployment. As the result, DSL does not reach many Zapata County communities including San Ygnacio (pop. 853), Falcon Lake Estates (pop. 830), and Siesta Shores (pop. 890). Blue Moon Solution's wireless broadband is still available, but our community surveys and informal conversations with the local residents and community leaders have suggested that installation service and customer service have become less responsive over the years. We have been informed that there is only one Blue Moon employee in Zapata County. Border To Border Communication seems to be performing better than others, having finished the construction of fiber networks and a new switch facility. The fiber networks by Border To Border currently serve about 110 access lines in the less populated areas of the county; for a small minority of remote customers, the company uses a 700 Mhz wireless transmission service. In the more densely populated areas, including Zapata town site, Falcon Lake Estates, and Siesta Shores, Border To Border has offered a wireless-based broadband connectivity since 2006. The market shares of broadband providers are shown in

Table 7.

Table 7. Residential Broadband Providers

Provider	2005	2008
SBC/AT&T DSL	45	76
Blue Moon	25	19
Frontera	14	0
Border To Border	0	1
Other (not specified)	0	2

Note: Counts based on home broadband users.

Public Internet Access in Zapata County

Blue Moon also used the RUS funds to provide broadband connectivity to three public access facilities in the county – the Zapata County Public Library, a computer lab in the Zapata Community Center, and a public computer lab housed in San Ygnacio's elementary school. Interviews at the Zapata Library showed that most such students were using library facilities or one lab created by the RUS grantee, Blue Moon. Public access Internet was also quite heavily used by retirees, seasonal "Winter Texans," and high school students. Interviews revealed that one current dilemma is that migrants from Mexico, who are often used to cybercafés, find no such facilities in town, and often fail to learn that the library has such facilities. The computer labs operated by Blue Moon were unplugged in 2006 as the result of the USDA's debarment of Blue Moon from the RUS grants and other federal programs (see Zavala County section for detail). The county public library and another public library in San Ygnacio (housed in the elementary school) still provide public Internet access, funded by the Federal E-Rate Library program.

Changes in Internet Usage in Zapata County 2005-2008

Awareness of the Internet remained moderately high across both waves of the study in Zapata County (See Table 8). Slightly over three quarters of those surveyed in both years said that they had heard of the Internet. The percentage who said that they had ever used the Internet also remained constant between years at three fifths of survey respondents. Those who said they currently used Internet was also unchanged, 48% in 2005 compared to 49% in 2008. The number of hours spent on the Internet also rose from an average of 2 hours in 2005 to slightly over two and a half hours on typical weekday in the later survey.

Awareness of high-speed Internet service increased significantly from 57% to 64% (see Table 1), while there was a significant decline in the perception that high-speed Internet was not available or individual respondents lived. The use of high-speed Internet connections increased significantly over four years, from 29% of the households surveyed in 2005 to 36% in 2008.

The percentage who used high-speed Internet home also increased somewhat, from 21% to 27%. Intentions to have broadband service in the home also increased significantly. The average number of years of experience with high-speed Internet increased dramatically, since broadband was not available much before the study period so almost all adopted the technology after the time of the 2005 survey. Broadband access outside the home also increased at work and public libraries, but not in local schools, where broadband had been previously available due to earlier State of Texas grants. Overall, home and work Internet connections were the primary sources of broadband access in Zapata County increased considerably over the four years of the study.

Table 8. Closing the Zapata County Broadband Gap 2005-2008

		Survey Year	
		2005	2008
Have you ever heard of the Internet?	Yes	324	325
77.5%	78.9%		
Have you ever used the Internet in your life?	Yes	247	255
59.4%	61.9%		
Do you currently use the Internet?	Yes	200	203
48.1%	49.3%		
Hours spent online on a typical weekday	Means	2.16	2.62
Have you ever heard of high speed…	Yes	192	217
57.1%	63.6%		
High speed Internet is not available where I live	Means	2.90	3.11
Do you currently use a high speed Internet connection?*	Yes	120	147
28.9%	35.8%		
The number of years on high speed Internet**	Means	2.01	3.92
Use high speed Internet - at Home	Yes	86	108
20.8%	26.6%		
Use high speed Internet - at School	Yes	22	12
5.3%	3.0%		
Use high speed Internet - at Work*	Yes	47	69
11.4%	17.0%		
Use high speed Internet - at Public Library*	Yes	10	25
2.4%	6.1%		
In the next year I will have high speed Internet at home**	Means	3.52	4.14
Adopted broadband after 2005	Yes	na	50
na	36.5%		

***** Significant at the .05 level ** Significant at the .001 level

Changes in Community Outcomes in Zapata County

The results of pre-post analyses of changes in community outcomes are shown in Table 9. Non-users of the Internet were more likely to intend to relocate outside Zapata County than Internet users. Differences in relocation intentions were striking both because they were higher among non-users and because they increased notably from 2005 to 2008.

Community satisfaction declined somewhat among those with no Internet access between the two years, while going up slightly among those with either dialup or broadband Internet. However, the differences were significant on only one of three tests. So this was one general community trend probably unaffected by the deployment of broadband Internet in Zapata County between 2005 and 2008. Rather, it is likely that these declines were the result of a worsening local economy and an inability to solve an intractable environmental problem afflicting the area.

Intentions to engage in further of education increased between 2005 and 2008 among almost all those surveyed. Those intentions were significantly higher among Internet users than among nonusers and highest of all among broadband adopters. Since age and education were controlled in these analyses this is a possible indication that broadband adoption stimulates interest in furthering one's education. However, this relationship did not change between years so it is unlikely that further broadband deployment had an effect.

After adjusting for the age and education of the respondents there were no differences in community attachment, perceived social support, organization memberships, or collective efficacy, either between years or across Internet adopter categories (i.e., those with no Internet, dial-up only, or broadband).

Table 9 Zapata County Community Outcomes

	2005 Internet Status			2008 Internet Status			F tests		
	None	Dial Up	Broadband	None	Dial Up	Broadband	Year	I-Status	Yr x I-St
Attachment Mean	5.360	5.178	5.271	5.150	5.214	5.103	1.120	.163	.412
Std. Error	.099	.151	.131	.103	.183	.119			
Collective Efficacy Mean	5.850	5.883	5.812	5.762	5.714	5.801	1.041	.003	.234
Std. Error	.080	.124	.107	.083	.149	.097			
Satisfaction Mean	4.267	3.773	3.913	4.032	3.871	3.937	.141	3.277*	1.287
Std. Error	.093	.139	.121	.098	.170	.109			
Social Support Mean	5.840	5.922	5.921	5.637	5.935	6.027	.081	2.302	1.33
Std. Error	.089	.139	.119	.092	.166	.109			
Memberships Mean	1.093	1.198	1.24	.991	.938	1.452	.145	2.229	1.103
Std. Error	.119	.187	.161	.126	.222	.144			
Relocation Intentions Mean	2.078	1.930	2.022	2.586	2.044	2.209	4.814*	2.408	1.258
Std. Error	.112	.175	.147	.117	.209	.135			
Economic Intentions Mean	2.240	2.516	2.640	2.868	3.166	3.023	16.578**	1.948	.469
Std. Error	.124	.193	.162	.132	.232	.150			
Education Intentions Mean	2.516	3.149	3.616	3.167	3.808	3.897	13.99**	15.881**	.945
Std. Error	.129	.203	.169	.138	.241	.156			

* Significant at the .05 level ** Significant at the .001 level
Note: Analysis of covariance results. Means adjusted for age and education.

Zavala County, Texas

Community Description

Zavala County is sparsely populated and predominantly Hispanic. It is located about 50 miles from the Mexican border crossing at Eagle Pass. From there a major truck route crosses Zavala County, but not its main town, Crystal City, on the way to San Antonio. The latest official estimated population for Zavala County, in 2007, is 11,665. The population is heavily concentrated in the largest city and county seat, Crystal City, which has approximately 8,200 residents. Both Census updates and survey data from this project indicate that the population is over 90% Hispanic and that over 90% speak Spanish fluently, although many do not read Spanish and many also speak English fluently.

Zavala is quite young as both a population center and economy. It was started by Anglo-American growers in 1910 to grow Winter Garden vegetables, particularly spinach. The Hispanic population subsequently exploded to supply cheap labor, and the area was 75% Hispanic by 1930. There was heavy immigration from Mexico pushed by the Mexican revolution and pulled by the availability of work in fields and canneries.

Politically and economically, there was heavy segregation of Hispanic and Anglo populations. There were segregated elementary schools, 8 for Hispanics, 1 for Whites, and 1 for Blacks. That led to a well-known Chicano revolt in 1963-70, with a school board take-over by Hispanics 1963-70. That had political consequences, as the Chicano former radicals gradually became a ruling party in city government, who did not support the broadband project studied here. City and county officials conflicted on the project, 2004-2006, which had negative impact on it.

It also had severe economic repercussions as Anglos pulled families, companies and economic resources out. The economy is still flattened by those events 40 years later according to interviews and visible in economic data. The economy still depends on reduced levels of vegetable growing, reduced levels of canning and processing and federal programs in education, health.

Zavala County Broadband Providers

Broadband services did not exist in Zavala County before the 2004-2005 period. The first broadband service to become available was Southwestern Bell’s DSL service in 2004, which may have been a reaction to the announcement of Blue Moon's deployment plan. At the time of initial deployment, the service became available only for the residents and businesses in Crystal City, and did not reach SBC’s phone customers in the two other population centers of the county, La Pryor and Batesville.

Southwestern Bell was soon followed by Blue Moon Solutions, which began providing residential and business broadband services through its fixed-wireless networks in the first half of 2005. Blue Moon’s coverage extended to both La Pryor and Batesville.

Blue Moon Solutions is the same company that received and used the RUS Community Connect grants in Zapata County (see previous section). The company specializes in public-private partnerships to build and provide broadband connectivity in rural areas. Blue Moon Solutions were awarded with three separate RUS Community Connect grants in the 2002-2003 period for its Zavala County projects; $500,000 in Crystal City, $275,000 in La Pryor, and $275,000 in Batesville.

In the years ensuing the contract awards and infrastructure deployment under the contacts, however, disputes emerged between Crystal City officials and Blue Moon, leading to an early termination of Blue Moon operation in Zavala County. Public records and personal interviews with those who were involved in the contracts indicated that Blue Moon and Crystal City officials disagreed on the contractual provisions of the Crystal City project. The dispute was elevated to federal investigations by the Office of Inspector General at the US Department of Agriculture, and finally to the suspension of Blue Moon from RUS grants and further federal programs in 2006. The USDA [27] cited accounting discrepancies as the main reason for the suspension.

Within each sub-project in Zavala County, Blue Moon would provide free fixed –wireless broadband services (for two years) to the critical community facilities, operate public access computer labs, and offer residential and business broadband services also on the wireless platform. Through the operation of public computer labs, the project aimed at providing publicly accessible computers equivalent in numbers

to one percent of the county population. As the result of the 2006 suspension order by USDA, however, Blue Moon has completely exited from Zavala County.

Zavala County's broadband market was competitive for a brief period between 2004 and 2005, until the exit of Blue Moon in 2006. Our second community survey in 2008 indicated that AT&T is the sole broadband provider available in Zavala County (Table 10). In 2004, AT&T DSL was available only in Crystal City, the most populated town in the county. In the last few years, the service has been extended to La Pryor, the second largest town, but has not reached Batesville, the smallest of the three population centers in the county.

Table 10. Residential Broadband Providers in Zavala County

Provider	2005 survey	2008 survey
SBC/AT&T DSL	43	113
Blue Moon	1	0
Other (not specified)	2	7

Note: Counts based on home broadband users

Changes in Internet Usage 2005-2008

Awareness of the Internet remained moderately high across both waves of the study in Zapata County (See Table 11). Slightly over three fifths of those surveyed in both years said that they had heard of the Internet. The percentage who said that they had ever used the Internet also remained constant between years at two thirds of survey respondents, actually declining slightly from 2005 to 2008. We attribute that decline to increasing new immigrants, who were less likely to have used the Internet. Those who said they currently used Internet also went down slightly, from 52% in 2005 to 51% in 2008, perhaps for the same reason. However, the number of hours spent on the Internet did rise significantly, from an average of 2 hours in 2005 to slightly over two and two thirds hours on typical weekday in the later survey.

Awareness of high-speed Internet service increased significantly from 55% to 76, while there was a significant decline in the perception that high-speed Internet was not available or individual respondents lived. The use of high-speed Internet connections more than doubled over four years, from 19% of the households surveyed in 2005 to 41% in 2008.

The percentage who used high-speed Internet at home also doubled, from 14% to 28%. Intentions to have broadband service in the home also increased significantly. The average number of years of experience with high-speed Internet increased dramatically, since broadband was not available much before the study period so almost all adopted the technology after the time of the 2005 survey. Broadband access outside the home also more than doubled at work, at school, and public libraries. Overall, home and work Internet connections were the primary sources of broadband access in Zapata County increased considerably over the four years of the study.

Table 11. Closing the Zavala County Broadband Gap 2005-2008

		Survey Year	
		2005	2008
Have you ever heard of the Internet?	Yes	358	329
82.3%	85.7%		
Have you ever used the Internet in your life?	Yes	288	250
66.2%	65.1%		
Do you currently use the Internet?	Yes	228	195
52.4%	51.0%		
Hours spent online on a typical weekday*	Means	2.04	2.76
Have you ever heard of high speed… **	Yes	200	215
54.8%	76.2%		
High speed Internet is not available where I live**	Means	3.78	2.61
Do you currently use a high speed Internet connection?**	Yes	82	154
18.9%	40.5%		
The number of years on high speed Internet**	Means	1.47	3.11
Use high speed Internet - at Home**	Yes	60	104
13.8%	27.5%		
Use high speed Internet - at School*	Yes	25	42
5.8%	11.1%		
Use high speed Internet - at Work**	Yes	29	59
6.7%	15.6%		
Use high speed Internet - at Public Library*	Yes	11	27
2.5%	7.1%		
In the next year I will have high speed Internet at home*	Means	3.60	4.13
Adopted broadband after 2005	Yes	na	71
na	51.8%		

***** Significant at the .05 level ** Significant at the .001 level

Changes in Community Outcomes in Zavala County

The results of pre-post analyses of changes in community outcomes are shown in Table 12. Like the situations in Huron and Pike Counties, and unlike Zapata County, users of broadband Internet were more likely to intend to relocate outside Zavala County. Differences in relocation intentions were interesting both because they were lower in 2008 than in 2005 among non-users and largely unchanged among dial up users from 2005 to 2008. Still, these results, while interesting, were not statistically significant.

There was no significant change in expressed community satisfaction between the two years. Likewise there was no significant change between 2005 and 2008 in community attachment, perceived social support, economic intentions or educational intentions.

The index for collective efficacy went up from 2005 to 2008 went up among all groups, those with no access, and either dialup or broadband Internet. However, the differences were significant on only one of three tests. Group memberships showed significant but inconsistent change, dropping notably among those with no access or broadband, going up notably among those with dial-up access.

Table 12 Zavala County Community Outcomes

	2005 Internet Status			2008 Internet Status			F tests		
	None	Dial Up	Broadband	None	Dial Up	Broadband	Year	I-Status	Yr x I-St
Attachment Mean	5.27	5.113	5.183	5.146	4.988	5.354	.056	1.094	.93
Std. Error	.101	.112	.15	.103	.212	.114			
Collective Efficacy Mean	5.573	5.696	5.767	5.943	6.011	5.92	7.75*	.35	.562
Std. Error	.089	.102	.136	.093	.197	.103			
Satisfaction Mean	3.899	3.682	3.695	3.698	3.757	3.774	.023	.213	1.171
Std. Error	.093	.104	.136	.095	.193	.103			
Social Support Mean	5.727	5.977	5.855	5.772	5.751	6.163	.15	1.956	1.663
Std. Error	.099	.111	.149	.102	.214	.113			
Memberships Mean	.99	1.099	1.332	.706	1.398	1.064	.571*	4.634*	2.365
Std. Error	.102	.116	.154	.104	.215	.117			
Relocation Intentions Mean	2.43	2.357	2.02	2.087	2.304	2.3	.088	.488	2.68
Std. Error	.119	.134	.178	.123	.252	.136			
Economic Intentions Mean	2.661	2.586	2.892	2.318	2.474	2.686	2.028	1.441	.212
Std. Error	.142	.158	.214	.147	.297	.159			
Education Intentions Mean	3.077	3.439	4.25	3.033	3.264	3.858	1.63	13.896**	.552
Std. Error	.148	.162	.216	.15	.309	.167			

* Significant at the .05 level ** Significant at the .001 level
Note: Analysis of covariance results. Means adjusted for age and education.

Digital Inclusion Among Traditionally Disadvantaged Groups

Previous research, starting in the 1990s (NTIA, multiple years), showed that a number of groups were often under-represented among Internet and computer users. Notable in average lower use were ethnic minorities, the less educated, the elderly, women (although that began to change in some areas) and rural residents (which was one of the reasons for the RUS program, in general). This study was designed to examine rural users, and non-users, in general, and two of the four counties are heavily Latino. So the study provides a unique opportunity to study demographic differences among rural users and non-users and to examine whether the so-called digital divide is opening or closing over time.

Overall, examining Internet use by three demographic groups often seen as suffering from exclusion by digital divides indicates that differences between age and education groups are more significant than differences between male and female genders. Gender differences were more notable in Pike County than the other three, leading the authors to wonder if some aspects of regional culture or unique gender dynamics might be involved. (Note: since chi-square statistics are sensitive to sample size, a restrictive standard for attaining statistical significance was used in compiling Table 13, $p < .001$).

Young people (29 and under) are more likely to use the Internet and much more likely to use broadband. There were also notable differences in these relationships between counties. Older people (over 60) were notably less likely to use Internet, particularly broadband in the two largely Latino Texas counties. So regional differences seem to magnify age differences in some respects, too.

Education differences were also striking and statistically significant in all four counties. In all four, those with less than a complete high school education were less likely to use the Internet and much less likely to use broadband or high speed Internet. Pike County was the only one in which over 20% of these less educated people were using broadband. There was also a quite significant gap between high-school only and college educated in broadband use. Pike County was, again, the only one in which more than half of those with a high school education were using broadband. So it would be interesting to examine more closely what Pike County was doing to close these gaps in Internet and broadband usage.

Since Zavala was over 90% Latino and Zapata just under 90% Latino, while both Huron and Pike Counties have very few Latinos, comparing the four communities also gives an interesting measure of ethnic differences. Basic Internet use is notably higher in Huron and Pike Counties among most of the groups compared below. On the other hand, Zapata County was actually ahead of the other three counties among some subgroups in terms of broadband usage. That probably has to do with the recent economic dynamism of the county, which is drawing in new workers and encouraging others to upgrade their skills.

Comparing the counties over time, there was a slight “reverse divide” between sexes in 2005 (that is, a lower percentage of males than females were Internet users) in Huron and Zapata Counties, but this gap closed in 2008. A similar broadband gap between males and females in Zapata County also closed. The age gap for current Internet use narrowed in Pike County over three years but widened in the other three counties as a result of rapid uptake by young adults. There was also a notable decline in current Internet use among those age 60 or older in Zavala County, dramatically widening the gap between that county’s oldest and youngest residents. Age-related broadband gaps also widened in each locality. The same pattern held for education.

That Pike County was an exception to both trends is in part attributable to the fact that Internet use was already near saturation level for that county’s youngest and best educated residents in 2005. But also, Pike County registered the strongest gains among older adults and those with less than a high school education compared to the other three counties, a possible impact of the Connect Kentucky initiative targeting disadvantaged populations in that state.

Table 13a: Demographic Comparison of Internet Use in Huron & Pike Counties

Currently use the Internet (%)		Huron 2005	Huron 2008	Pike 2005	Pike 2008
Sex	Female	67.90	69.40	68.60	76.00
	Male	57.40	68.20	63.80	74.30
Age group	29 or younger	68.80	100.00	*91.70*	*90.30*
	30 to 59 years old	73.30	79.10	*78.50*	*87.20*
	60 or older	46.10	52.50	*33.30*	*49.50*
Education	Some high school or less	*17.10*	*13.00*	*30.20*	*50.90*
	High school graduates	*49.70*	*64.20*	*52.70*	*70.40*
	College credits/graduates	*82.60*	*87.70*	*83.90*	*91.40*
Currently use high-speed Internet (%)		**Huron 2005**	**Huron 2008**	**Pike 2005**	**Pike 2008**
Sex	Female	22.90	50.30	24.80	23.10
	Male	23.10	48.60	53.60	59.60
Age group	29 or younger	*37.50*	*75.00*	*25.00*	*64.50*
	30 to 59 years old	*30.60*	*61.70*	*30.10*	*67.60*
	60 or older	*11.60*	*31.10*	*10.40*	*33.30*
Education	Some high school or less	*4.90*	*8.70*	*9.10*	*21.80*
	High school graduates	*18.50*	*44.40*	*13.40*	*54.60*
	College credits/graduates	*31.10*	*65.00*	*33.30*	*73.50*

Note: Italics denote significant differences across demographic categories, by year.

Table 13b: Demographic Comparison of Internet Use in Zapata & Zavala Counties

Currently use the Internet (%)		Zapata 2005	Zapata 2008	Zavala 2005	Zavala 2008
Sex	Female	50.20	48.50	51.40	49.50
	Male	43.50	51.10	54.30	53.90
Age group	29 or younger	*57.60*	*62.70*	*70.80*	*84.70*
	30 to 59 years old	*55.00*	*48.60*	*31.90*	*66.70*
	60 or older	*29.40*	*34.60*	*26.10*	*8.70*
Education	Some high school or less	*16.50*	*14.40*	*17.60*	*16.80*
	High school graduates	*52.80*	*61.60*	*52.20*	*50.00*
	College credits/graduates	*66.90*	*81.00*	*72.80*	*77.80*
Currently use high-speed Internet (%)		**Zapata 2005**	**Zapata 2008**	**Zavala 2005**	**Zavala 2008**
Sex	Female	31.80	36.60	14.40	39.20
	Male	22.30	34.30	25.40	44.10
Age group	29 or younger	*37.30*	*50.50*	*31.90*	*66.70*
	30 to 59 years old	*34.20*	*35.60*	*20.90*	*42.70*
	60 or older	*13.60*	*18.50*	*6.10*	*6.50*
Education	Some high school or less	*9.10*	*9.20*	*4.60*	*11.70*
	High school graduates	*30.90*	*41.60*	*19.40*	*36.60*
	College credits/graduates	*41.70*	*63.20*	*27.20*	*67.40*

Note: Italics denote significant differences across demographic categories, by year.

Multivariate Analyses

Understanding Internet Adoption

Social Cognitive Theory (SCT, Bandura, 1986) provides a framework through which broadband adoption, usage and effects may be broadly understood. SCT, also known as social learning theory, provides the psychological mechanism for understanding the diffusion of innovations (Bandura, 1994; Rogers, 1995; 2003). Individual capabilities and the mechanisms that affect the enactment of behavior are the focus of Social Cognitive Theory (SCT, Bandura 1986). SCT acknowledges the expected outcomes of the innovation's use, defined as judgments of predicted consequences stemming from one's behavior (Bandura, 1997). Expected outcomes of Internet usage were previously found to predict Internet consumption among populations of dial-up (LaRose & Eastin, 2004) and broadband (LaRose, Mastro & Eastin, 2001) users. Thus, intentions to use the Internet should be directly related to positive expected outcomes.

Self-efficacy is an integral construct of social-cognitive theory (Harrison, et al., 1997). Bandura (1986) defined self-efficacy as "people's judgment of their capabilities to organize and execute courses of action required to attain designated types of performances" (p. 391). Self-efficacy has been found to be directly related to Internet usage (Eastin, & LaRose, 2000; LaRose et al., 2001). So, Internet usage intentions should be directly related to self-efficacy.

Another mechanism of SCT, self-regulation, also has a parallel in diffusion research. Self-regulation determines how individuals monitor their own behavior, judge it in relation to personal and social standards, and apply self-reactive incentives to moderate their behavior (Bandura, 1991). Thus, through the self-regulatory mechanism one would judge whether broadband is compatible with personal and social norms. However, it is deficiencies in self-regulation that have proven to be powerful predictors of Internet behavior (LaRose & Eastin, 2004). When self-regulation is deficient, persons lose some degree of self-control over their behavior. Deficient self-regulation is implicated in excessive levels of consumption that some have called problematic or even addictive (LaRose, Lin & Eastin, 2003). Deficient self-regulation occurs when persons habitually seek the outcomes associated with a particular behavior. Since many of the applications that are enabled or

improved by broadband connections have potentially "addictive" qualities – music downloads and multiplayer games to name two -it is logical to assume that deficient self-regulation may cause continuing Internet usage.

Multiple regression was used to examine variables affecting Internet usage in the 2005 data set. The dependent Internet usage intentions measure was a composite of two variables, intentions to have a dial-up connection in the home in the next year and intentions to have a broadband connection. Since persons might intend to have a dial up connection even if they did not desire a broadband connection, dial up intentions were substituted for broadband intentions among those who stated they were unlikely to have broadband (i.e. less than 5 on a seven-point scale). The expected outcomes generally associated with the Internet were drawn from a set of 24 items addressed to all respondents who had ever heard of the Internet and adapted from prior research (LaRose & Eastin, 2004). Exploratory factor analysis suggested reducing these two three dimension: conventional media outcomes (e.g., "have fun, get immediate knowledge of big events"), economic outcomes (e.g., "I could start a home business"), and social outcomes (e.g., "get support from others"). However, preliminary screening of these variables revealed that social outcomes were unrelated to the dependent variable and so these were dropped from regression analysis. Five general Internet self-efficacy items [28] were drawn from previous work (Eastin & LaRose, 2000) as were nine items [29] measuring deficient self-regulation (after LaRose & Eastin, 2004).

The results of regression analysis are shown in Table 14. The overall regression was significant, with income, ethnicity, employment, conventional media outcomes, and self-efficacy as the important predictors of Internet usage intentions. Income and economic outcomes were important predictors in Pike County, while education and conventional media outcomes were important in Huron County. Self- efficacy and children living at home were significant predictors in both Texas counties, while conventional media outcomes were significant in Zavala County. Hispanic ethnicity was significant only in Zavala County, but it should be noted that the other counties had too little variation (i.e. almost no Hispanics in Pike and Huron County, almost entirely Hispanic in Zapata County) in ethnicity to provide meaningful results except in the total sample.

Table 14 Multiple Regression of Demographic and SCT Variables on Internet Intentions, All Respondents Ever Using the Internet

Variable	Total	Pike	Huron	Zapata	Zavala
Demographics					
Income	**.107**	**.178**	.100	.030	.132
Education	.031	.045	**.137**	.026	-.031
Father's Education	-.033	.141	-.103	.059	-.120
Children	.057	-.019	.060	**.138**	**.032**
Hispanic	.177	.136	.000	.128	**.110**
Gender	-.011	-.097	.019	-.080	.033
Employed	**-.075**	.003	-.087	-.062	-.085
Change in F	**5.76**	**3.01**	1.81	1.75	**2.58**
SCT Variables					
Deficient Self-Reg	.064	-.024	.132	.052	.064
Media Outcomes	**.132**	.112	**.215**	.029	**.172**
Econ Outcomes	.072	**.181**	.012	.082	-.001
Self-Efficacy	**.189**	.071	.132	**.231**	**.294**
Change in F	**30.88**	**3.95**	**8.31**	**5.69**	**13.05**
R-square	**.152**	**.128**	**.162**	**.138**	**.221**

Note: Table entries are standardized beta weights. Significant results are shown in bold, $p < .05$

Understanding Broadband Adoption

In a previous publication based on the 2005 survey data we re-examined diffusion of innovations in SCT terms (LaRose et al., 2007), developing a causal model of broadband adoption and utilization.

The expected outcomes (a.k.a, the relative advantage) of an innovation (e.g., that broadband service will improve access to education) is a primary determinant of adoption and use of broadband. The observability attribute of innovations is captured in the SCT mechanism of observational learning, describing how we learn by observing others, while trialability reflects the mechanism of enactive learning, or how we learn from our own experience. To these, SCT adds self-efficacy, or belief in one's ability to execute a behavior to attain important outcomes (Bandura, 1994). Self-efficacy plays an important role in the adoption of complex technologies like broadband communication that impose daunting requirements on their users (e.g., learning to operate new software and new security measures) and it subsumes the issues of complexity and compatibility found in the diffusion literature. Together, these concepts provide an elaboration of the left hand side of the conceptual model proposed earlier by defining relationships among variables that lead to broadband adoption and utilization.

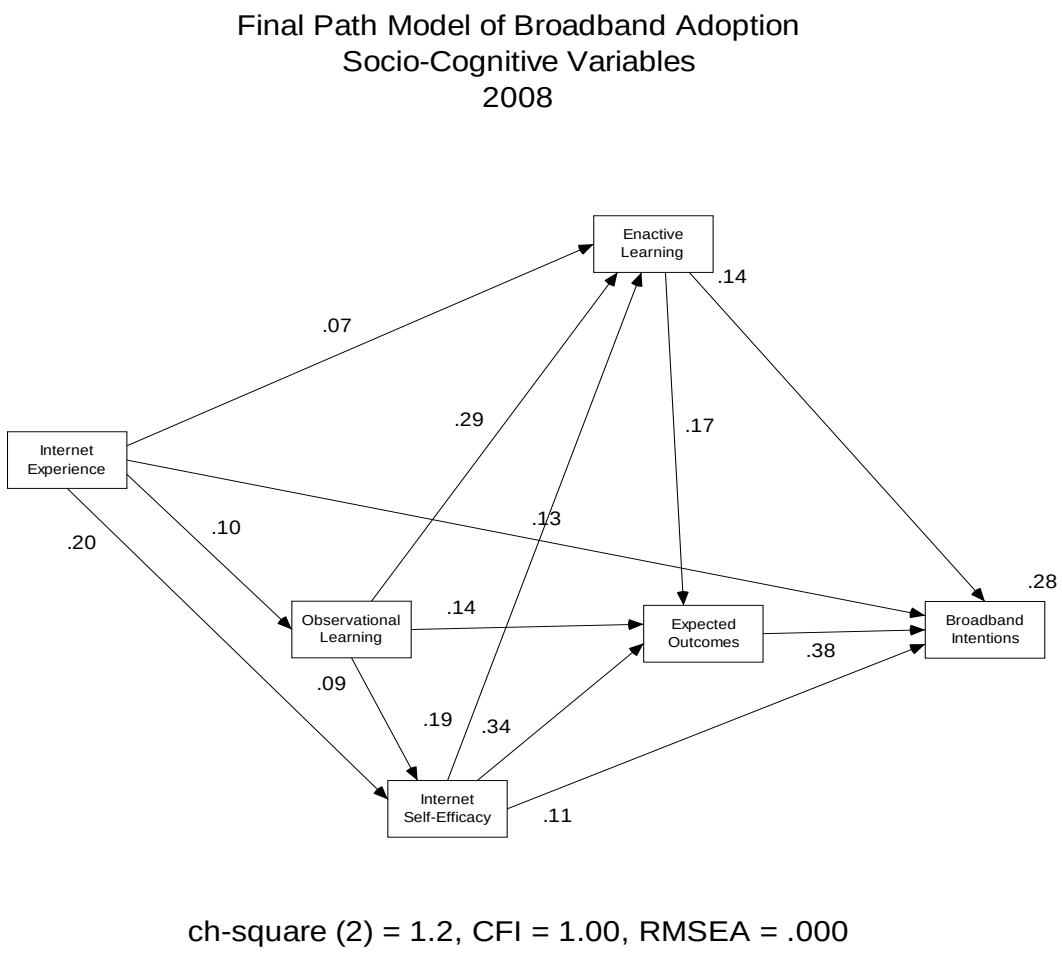
The causal model derived from the 2005 data was applied to the posttest data, shown in Figure 1. For this analysis, only respondents who indicated they were aware of broadband Internet were included. To focus on those who had volitional control over broadband adoption, those who stated that broadband was not available in their area were excluded. The dependent variable, broadband intentions, asked about intentions to obtain and use a broadband connection either inside or outside the home and to utilize technology that generally require broadband connections to be effective; namely, Internet telephony and wireless networks.

The 2008 data were an excellent fit to the model. All of the causal paths shown in Figure 1 were statistically significant. Overall, 28% of the variance in broadband adoption intentions was explained. The immediate precursors of broadband intentions were the expected outcomes of broadband use. These included a variety of beliefs about the relative advantage of broadband Internet connections including its overall value and its ability to support downloads of media files and to improve educational, economic, and health outcomes. (For further details see the methods section). Internet self-efficacy, or the belief in one's ability to use the Internet successfully for an important attainments, and enactive learning, or personal experience with the benefits of broadband use, were also direct antecedents of broadband adoption intentions. Finally, the amount of prior experience on the Internet, measured in months, was also a predictor of broadband intentions.

In the model, Internet experience also causally preceded Internet self-efficacy and enactive learning. That is, the more experienced one had with the Internet in general the more confident one became in using it and also the more likely they were to learn for themselves the benefits of broadband Internet.

Prior experience was also a related to a final key element of the model, observational learning. Observational learning takes place when potential adopters learn about the benefits of innovation by observing others or by hearing from others about their experiences. In this case, users of basic Internet service may learn about the relative advantage of broadband Internet connections by interacting with others online. In turn, observational learning was a determinant of enactive learning, expected broadband outcomes, and Internet self-efficacy. That means that potential broadband adopters may frame their expectations about broadband Internet in part from the experiences of others as well as from their own direct experience and their online interactions with other users may also bolster their confidence in using the Internet effectively. Observational learning also had a significant impact on enactive learning. That is, potential adopters may become more likely to try broadband connections for themselves after learning about the experiences of previous adopters.

Figure 1



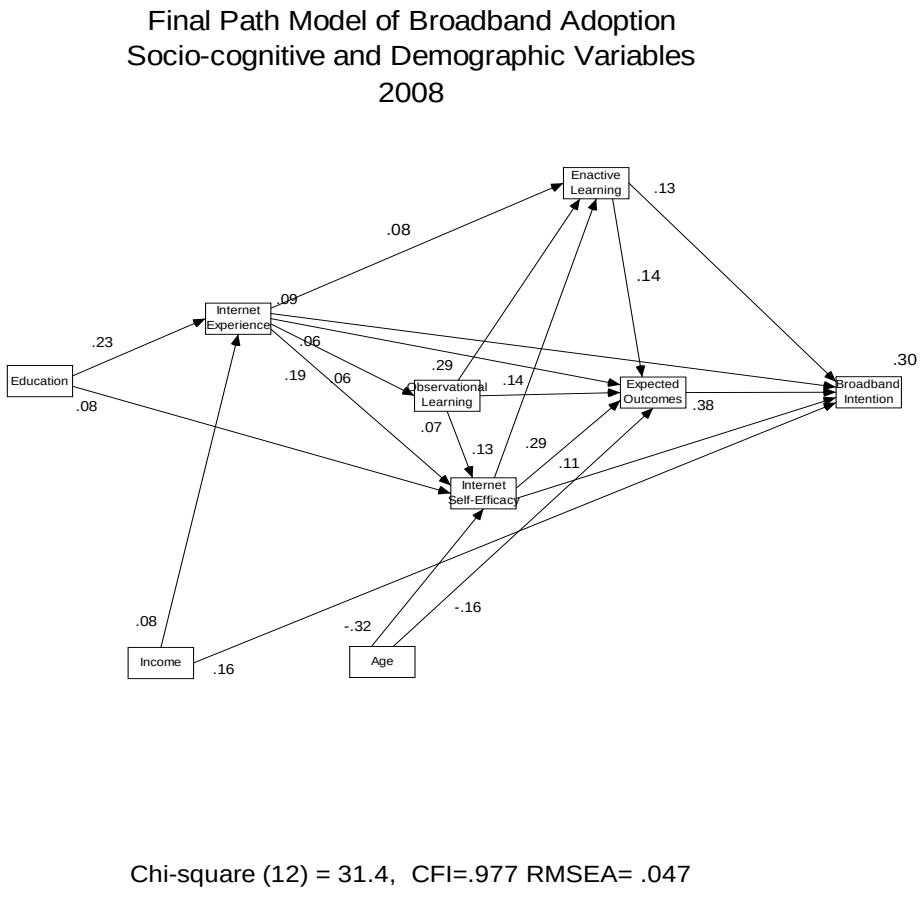
Following the socio-cognitive paradigm, the demographic variables associated with adoption in both the classical diffusion of innovations literature (e.g., Rogers, 1995) and in digital divide research (e.g., Hoffman & Novak, 1998; GAO, 2006) are thought to act through SCT variables. In other words, demographic characteristics such as age, income, and education do not necessarily have a direct effect on behavior. Rather, membership in various demographic groups creates characteristic patterns of life experiences and resulting expectations about the outcomes of behavior. Thus, demographic variables may be conceptualized as exogenous variables in the model which affect key socio-cognitive variables that ultimately determine behavior.

Age, education, and income were added to the basic model of broadband adoption, as shown in Figure 2. The resulting causal model had an overall good degree of fit to the 2008 data. All of the path coefficients shown in the figure were statistically significant. There was only one direct relationship between the demographic variable in broadband intentions, that of household income. This produced a modest increase in the overall variance in broadband intentions explained (from 28% to 30%). Household income as well as education affected the amount of prior Internet experience. Education also predicted Internet self-efficacy. Age had negative relationships to Internet self-efficacy and to outcome expectations, meaning that younger respondents tended to have greater self-efficacy and higher expectations than older ones.

These results might be interpreted to mean that income and education affect basic access to the Internet that is important in building experience with the medium and knowledge of its advantages. Internet use within educational institutions, which is more likely to have been experienced by younger respondents than older ones, may be important in establishing confidence in the use of online media. The age relationship with outcome expectations might be attributable to the many broadband applications, such as the downloading of media files and multiplayer games, that selectively appeal to younger adults.

There were important variations among predictors of broadband intentions across the four counties, as shown in appendix B. In each case, the expected outcomes of broadband use and enactive learning, or seeing those benefits for oneself, were immediate predictors of broadband intentions. However other aspects of the model varied between communities. For example, in Huron County demographic variables were not important other than the linkage between education and the level of prior Internet experience. In contrast, demographic variables were the most important in Zavala County and several causal paths in the model faded to nonsignificance.

Figure 2



Understanding Community Impacts

In understanding the impacts of Internet usage, SCT explains (LaRose, Eastin & Gregg, 2001) how rising Internet self-efficacy may empower socially isolated users to seek social support online. The same basic mechanism can be used to understand other second-order impacts on rural residents. For example, broadband entertainment, education, and career development options might influence beliefs about the expected positive outcomes of continued rural residency, improve life satisfaction, and so reduce outmigration intentions (DeJong & Fawcett, 1981; Stinner & VanLoon, 1992). Psychological attachment to rural communities and participation in local organizations should also increase interest in community change (Ayres & Potter, 1989). SCT also recognizes a dimension of social well-being, collective efficacy (Bandura, 1997), which is essential to the success of collective actions. Prior research suggests that Interactions between Internet exposure and personality traits (e.g., extraversion, Kraut et al., 2002) should be included in these analyses.

An analysis of the 2005 survey data yielded a causal model of community attachment similar to that shown in Figure 3 (Gregg et al., 2007). These analyses were conducted among those who were current users of the Internet. A positive relationship between Internet usage and intentions to relocate was uncovered at that time that demanded further exploration. Accordingly, a battery of questions was added to the 2008 survey which addressed the question of using the Internet to establish connections and interests beyond the local rural community. This quality is known in the scholarly literature as bridging social capital (Williams, 2005).

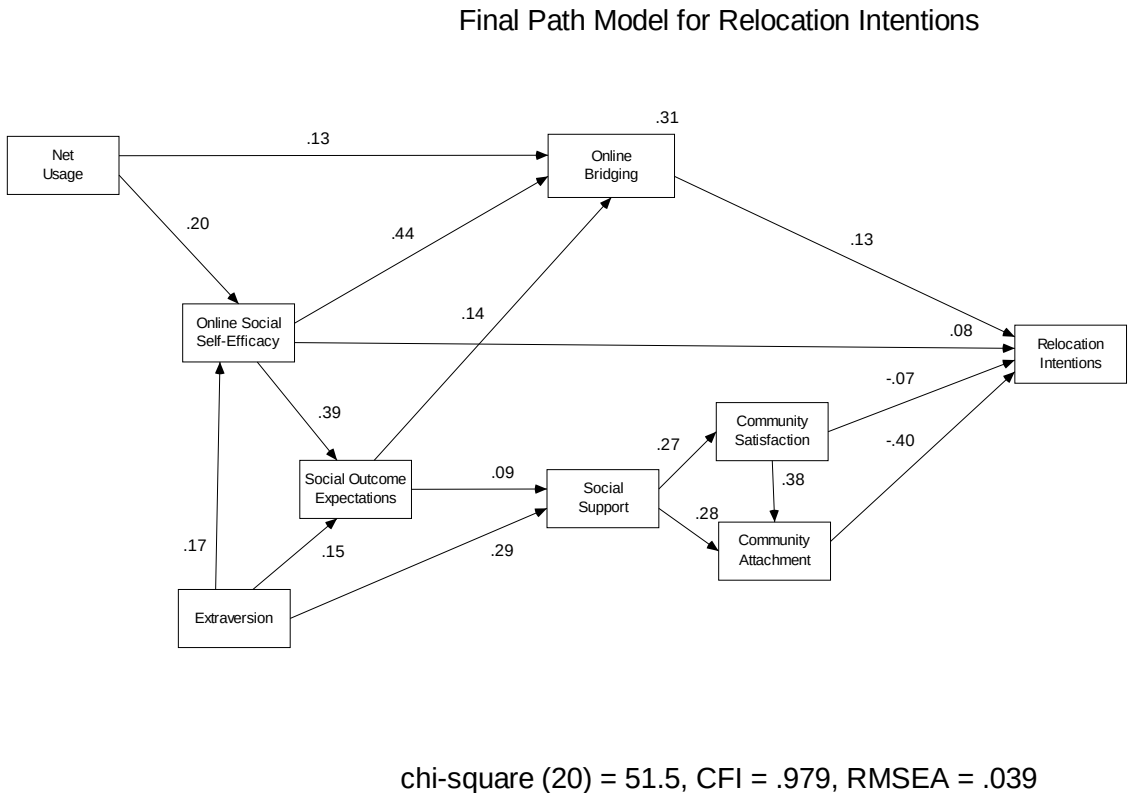
With this addition, the 2008 data provided a good fit to the causal model shown in Figure 3 and the model explained 22% of the variance in relocation intentions. Internet usage caused an increase in bridging social capital which in turn was related to relocation intentions. Belief in one's ability to obtain social support online, or online social self-efficacy, and the expectations that online interaction would lead to social support were also positively related to bridging social capital. Thus it appears that exposure to the outside world on the Internet and the ability to use the Internet to form new social ties online appeared to have the effect of stimulating outmigration from rural communities. Online social self-efficacy had a similar direct effect on relocation intentions.

A connection between Internet usage and increased community attachment, resulting in lowering intentions to migrate, was also discovered although the relationship was more complex. As seen in the lower part of Figure 3, Internet use stimulated community attachment by increasing beliefs in one's ability to form meaningful relationships online. This led in turn to expectations that the Internet could be used to both provide and obtain social support (social outcome expectations) and then to perceptions that social support was in fact available. The

latter link bridged the gap between the online world and the real world in that social support was assessed in a general sense and not limited to social support obtained online. Then, social support was linked to community attachment and community satisfaction, with satisfaction positively related to attachment. Finally, there was a strong negative relationship between community attachment and relocation intentions. Thus, there was a causal chain ultimately linking Internet usage to community attachment and thereby reducing intentions to relocate. However, the results were virtually identical among those who used broadband in the home and those who did not (results not shown) so there is no evidence to the effect that broadband connections either further or detract from community attachment.

County level analyses shown in Appendix B indicate that the path from Internet usage to relocation intentions through bridging social capital was found in each of the counties individually. However, the lower path linking Internet usage with community attachment and reduced relocation intentions was found neither in Zapata or Zavala counties, where the connection between online social outcomes and generals social support was not found.

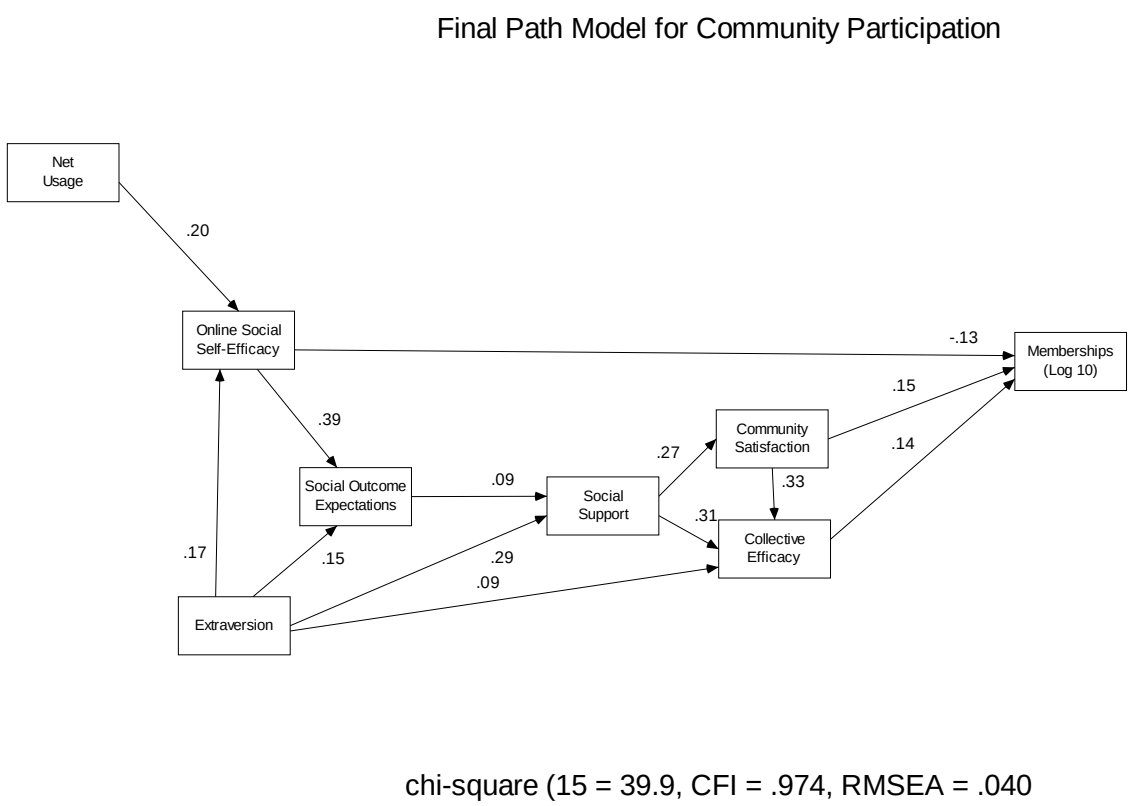
Figure 3



The second key outcome variable of interest was community participation which was measured in terms of the number of voluntary memberships respondents said they maintained in their community. This number was subjected to a log (value +1) transform to reduce the effect of outlying values The resulting model resembles the lower part of the preceding one for relocation intentions except that community memberships are now the dependent variable. Also, collective efficacy, an indicator of belief in community effectiveness, replaced community attachment.

A good fit was obtained to the data; however, only 7% of the variance in community memberships was obtained. A link between Internet usage and community memberships passing through bridging social capital was tested but was insignificant and was dropped from this model. However there was a direct negative relationship between online social self-efficacy and community memberships. As with the preceding model of relocation intentions a path between Internet usage and positive community outcomes was also found, shown in the lower part of the figure.

Figure 4



Discussion

Closing the Rural Broadband Gap

Is Demography Destiny?

The present study revisited the role of demographics in explaining inequalities in information access in rural America. A consistent finding across the four communities was that the immediate determinants of intentions to use broadband Internet were beliefs about positive changes that high-speed Internet connections could bring about in the life of rural residents. The ability to experience the benefits of high-speed Internet for oneself and also belief in one's ability to use the Internet effectively were also determinants of broadband adoption. Among demographic variables only household income had a direct connection to broadband adoption intentions in this had only a minor impact.

And, the factors that immediately preceded broadband adoption, as well as second-order factors that preceded them, are amenable to marketing, economic development, and educational interventions that could spur broadband growth in rural communities. For example, in Zapata County, an economic upturn and new growth in energy, medical, education and service sectors seem to have increased demand for Internet use among younger and middle aged residents, although not senior citizens. In both Zapata and Zavala, having a local community college to start younger people toward training seems to increase demand, according to our field interviews. There were significant increases in broadband penetration in each of the communities and, with one exception, across all gender, age, and education groups.

In one case (Pike County, Kentucky), the level of broadband adoption nearly matched that found in the general U.S. population. It is noteworthy that the digital divide that separates the well educated and less educated and young from old with respect to basic Internet access was closing in the one community that had a concerted outreach effort (i.e., Connect Kentucky) targeting disadvantaged populations.

So, demographic characteristics of rural residents are not a complete explanation for disparities between rural and urban America. Scholars and policy makers alike should perhaps consider whether the Digital Divide issue has been defined in terms of variables that are merely convenient to measure rather than ones that truly explain differences in information access.

This is not to say that the social categories to which one belongs have no effect on information equality. Indeed, both income and education had a direct bearing on the amount of previous Internet experience that one had, a key precursor for all of the intervening factors that lead to broadband adoption. And, in three of the communities, the gap between old and young and the highly educated and less educated widened over time. However, the present results suggest that these divides are not the inevitable consequence of one's demographic condition but rather are amenable to self- development initiatives that communities might undertake for themselves.

This viewpoint is a counter to that found in a recent Government Accounting Office (GAO, 2006) study that concluded that differences in broadband adoption between urban and rural areas could be explained by the demographic differences between the two types of communities. However, since one's demographic characteristics are difficult (e.g., education, income, gender) or in some cases impossible (e.g., age) to change this can lead to the mistaken conclusion that rural communities deserve to be left behind, or least that there is very little that can be done aside from assuring that the technical means of access are available for the younger and better educated rural residents who might desire it.

The Role of the Internet in Community Well-Being

There were many changes in overall community outcomes such as collective efficacy, community satisfaction and relocation intentions during the course of the study. In Huron and Pike communities these were in a downward direction while there was an upward trend in Zavala County. There was an upswing in relocation plans in Zapata County. These changes were probably not a result of broadband deployment, and brought about by the RUS grants. Rather, local economic and environmental conditions would seem to account for these changes. There was some evidence of what might be called a buffering effect in Pike and Huron Counties. That is, residents who were not

Internet users tended to experience the sharpest declines while Internet users suffered smaller declines or no change between years. Also in Huron County there was an interaction effect between year and Internet status, suggesting a possible effect of broadband deployment in that county: The number of community memberships declined among non-users, while dial-up and broadband users increased their community participation over time.

A consistent finding in all four counties was that users of high speed Internet connections were the most likely to have plans to further their education. This was also true of intentions to use the Internet for personal economic development (i.e., starting a home business, telecommuting to an urban job) in Pike and Huron counties and tended to hold in the two Texas counties as well.

Another consistent finding highlighted a potential downside to Internet use in rural communities: the Internet may have a negative effect on the ability of rural communities to retain their residents. A connection was found in all four communities between Internet use, the development of interpersonal associations and interests beyond the rural community, and intentions to relocate. The development of one's ability to form online relationships also had a direct impact on relocation intentions, suggesting that the social networking components of life online may be potentially problematic for rural communities, even though rural residents form fewer social networking relationships than urbanites (Gilbert et al., 2008). A connection was also found between Internet usage and the development of social support in one's home community which in turn strengthened community attachment and reduced relocation intentions. However this was a relatively weak connection and was found in two of the communities but not in the two others.

The Role of RUS Grants

The impact of the broadband development grants from the Rural Utilities Service is difficult to quantify. In one community (Zavala County) the grant was terminated amid charges of financial mismanagement and thus had no discernible effect. In a second (Pike County) the grant was made to a rural telco and it was not possible to separate the impact of the RUS grant from other broadband development efforts undertaken by the company, nor from the Connect Kentucky initiative. In Zapata and Huron counties the RUS grants funded wireless broadband networks, but both operators underwent a decline in their market share over the course of the study.

Still, the RUS grants added to broadband coverage in the latter two communities and the decline in the percentages of those who believed broadband was unavailable in their area can be attributed at least in part to their efforts. Wireless broadband reaches some areas where DSL does not in Zapata and where there are neither cable nor DSL connection in Huron County.

The RUS grants also had an indirect effect on the availability of high speed internet connections by motivating competition. The announcement of RUS program in Zavala County clearly sparked initiation of DSL service according to interviews with county officials. In Huron County, DSL and cable television options became available shortly after the RUS grant was awarded there.

The Role of Public Access

The RUS grants also included public access components and broadband access through public libraries increased markedly in all four communities by 2008, although beginning with a very small base in 2005, and reaching less than 8% of those surveyed in each community. In contrast, broadband access in the workplace reached at least double the library access figures in each county. Furthermore, nearly two-fifths (39%) of those using high speed connections in the library also had broadband connections at home, indicating that much of the public access is complementary to home use. Interviews with library patrons also turned up cases where home connections had been abandoned in favor of library terminals, although this did not appear to be a widespread problem according to the survey results.

Still, public access was very important as a bridge technology until home availability ramped up and continues to be very important for students and (in Zapata County) tourists and seasonal residents, who are important to the economy. Users of library public access terminal are also disproportionately from lower income strata. Over a third (37%) of broadband users with annual household incomes under $10,000 reported library access, compared to only 4 percent of broadband users with incomes of $75,000 or more.

Educational needs help drive demand for public access. The Director of Zavala community college (branch of Uvalde Community

College) stated that young people doing initial certificate programs in residence (primarily in nursing and education) frequently led to demand for continuing, higher level training in the same fields which usually had to be done online. Both the Zavala and Zapata experiences reinforce that this works better with a local junior college branch to anchor and stimulate online courses. After hearing from us about how much lift Zavala was getting from this, the Director of the Zapata County Chamber of Commerce found several million in grants to start a branch of Laredo Community College in town. Half (50%) of those who planned to take an online course used broadband access at public libraries. However, interviews with library patrons indicated that library access conditions are not very conducive to intensive online course participation, owing to limited hours of operation, narrow windows (e.g., one hour at a time) for online access, and overcrowding during hours (e.g., late afternoon and early evening) most convenient to adult learners. Educational needs might be met through junior college computer labs, but these require travel to centrally located facilities, entailing long commutes from remote households amid unstable gasoline prices. In the case of families, child care arrangements may also be required. Thus, broadband access in support of online training and education continues to be a need in rural communities.

Does Broadband Matter?

The data here do not show overwhelming evidence that broadband is absolutely essential for the social and economic health of rural communities. However, it does underscore that the Internet is in fact used by a growing number of people for an increasing array of purposes. Demand for broadband does indeed exist, and the prospect of increased reliance on broadband connectivity for a range of educational and other business-related purposes appears certain. One aspect of the question whether broadband matters therefore is simply whether or not communities can do *without* broadband.

Broadband connectivity appears to be capable of generating new expectations and behaviors regarding self improvement, and to that extent it seems to be an important opportunity to preserve and even expand. As population continues to migrate from rural areas, and inasmuch as many of the economic endeavors located in rural regions, such as farming and manufacturing, now require very little human labor because they have been mechanized, it is incumbent on our society to formulate a compelling vision of how we expect rural America to function. Daniel Bell's vision of an Information Society (Bell, 1973) nourished critics who warned that the uneven pattern of development associated with contemporary economic drivers of telecommunications technology could lead to profound inequities in certain regions and for certain populations. Others argued that the "trickle down" effects of telecommunications-based capabilities would bring important benefits to even the most remote areas. In the 1970s and 1980s, the optimistic arguments around the so-called "death of distance" thesis were particularly popular (later publicized by Frances Cairncross, 1997); however, such arguments have given ground to the more recent, spatially-based views of the society and the economy that can explain the geography of a new information economy with specific reference to dynamics such as the uneven telecommunications capabilities evident in rural America - indeed, in rural regions throughout the world.

The distribution of telecommunications capabilities tracks that of other human resources: where there is more wealth and more education, the resources tend to be more plentiful; where there is knowledgeable leadership, the capabilities increase; where multifaceted coalitions of groups or organizations join together to plan and share assets, they multiply. In other words, the spatial distribution of telecommunications resources has to do in part with the actual hard- and software, but it also has to do as well with human resources being available in order to exploit the infrastructure's potential.

We observe that rural regions share with urban areas the broader economic trends that have incorporated information technology into all productive activities. While companies such as Goggle, AOL, Cisco and Dell epitomize contemporary information companies, in fact virtually all consumption and production sites in the U.S. - from Wal-Mart to the local paper mill, from the grocery store to the concert theatre - incorporate computer-based information systems and technologies. Rural regions' traditionally resource-dependent industries are no exception, and some of the newer activities expanding in such areas – recreation and retirement centers are locating increasingly in rural regions – will also depend on information infrastructures. For example, as retirement communities begin to flourish in rural regions, one can

anticipate a migration of the information-intensive health industry will follow. Research in some of the most distressed region of Appalachia found that in locations where local businesses and services - whether health, education, banking, manufacturing or services - incorporated telecommunications capabilities, the communities enjoyed improved productivity (Strover and Oden, 2002). Telecommunications-intensive industries have a special role in bringing more infrastructure and knowledge to a community, and while many such industries are not located in rural areas, their influence is particularly striking when they do locate in less populous regions.

Information industries and technologies penetrate virtually all sectors of life, and they dynamically interact with local strengths to create new capabilities. This pattern renders pointless any policy-based separation of information and telecommunications technologies from activities in the normal domains of education, culture, and work. These technologies create access to opportunities on all fronts, and rural regions must be able to use them, to harness their power lest we move toward a two-tier society, with rural areas a true backwater.

Thus the challenges to rural access are several. They entail (1) recognizing the significance of this infrastructural element to all aspects of life in rural – and metro – regions of the country, and incorporating into economic, educational, and social policies the budgets and practices that exploit telecommunications' potential; (2) conceding that marketplace dynamics do not deliver timely services to more remote and less populous regions and developing improved mechanisms to improve services in those regions; (3) crafting programs that systematically augment the range of services and available training and expertise around broadband services in rural regions.

Closing the Rural Broadband Gap with New Approaches

A number of state policies have supported and will continue to support broadband deployment and use. The initiatives include: assembling task forces or commissions the evaluate broadband availability and that recommend targeted state activity to maximize the potential benefits of deployment; creating tax incentives for deployment policies; providing funds specifically for infrastructure roll out on the part of the private sector; using techniques of demand aggregation through public-private partnerships or using public services as anchor tenants for infrastructure development. The utility of having states undertake such activities is that they are able to cope with the granular level of detail and information that can help such programs operate most effectively.

Infrastructure deployment alone is an insufficient driver, so it would be wise to encourage programs that link investments in training and use. The education-related outcomes of this research suggest that a useful priority may be insuring that community colleges provide distance education or online classes, specifically targeting rural regions and rural students. Grants for Internet training could be distributed as block grants and target individual users but also small businesses, or community colleges could receive special incentives to design classes for small businesses and possibly for elderly residents. Although this recommendation goes beyond our data, increasing small business use of the Internet could have tremendous economic impact on rural regions.

Universal service funds, already under the authority of the FCC, could enhance communities' prospects for extending their telecommunications capabilities by being used to match local investment in infrastructure, connectivity, public access, and local training initiatives. It may be feasible for the Rural Utility Service to work with universal service grants in order to provide broadband infrastructure development and use *incentives to communities* – not just to telecommunications vendors – targeting sites that can demonstrate they are ready to develop both their own facilities and expertise as well as their abilities to use these facilities. Communities should match federal investment in some manner.

The RUS might create "Rural Leadership Academies" that select aspiring or actual rural leaders for two-three weeks of leadership training, which would include training in not only using the Internet but also training in running computer education clinics or courses, in "nuts and bolts" of broadband infrastructure, and in resource-sharing across institutions. Our qualitative interviews underscore that access to technical expertise is a critical problem in rural regions, and one goal of these academies might be to insure that more communities have access to such expertise locally. The Leaders would be charged with catalyzing Internet availability and use in their respective communities, leaving it to them to decide what makes most sense for their own unique circumstances.

With the price of computers declining, the actual purchase of a computer does not appear to be the impediment that the recurring cost of a subscription to a broadband connection is. Therefore, community-based subsidies for people actually using broadband might be considered. The next Presidential administration appears poised to reformulate universal service, so the time is ripe to become more creative about both its goals and its mechanisms. By espousing a universal service program that focuses on broadband connectivity, and by targeting the funds to the actual users or user groups (rather than infrastructure providers), there is a stronger likelihood that some of the desired economic and social outcomes linked to broadband might materialize more quickly. To the extent that locally relevant content can be emphasized, there may be some opportunity to stem the sorts of out-migration that our data turned up by increasing the volume ot pertinent information about opportunities locally. We also note that libraries continue to remain significant "third places" in some communities, suggesting that their neutral broadband presence be enhanced by ensuring that more sites can be accessed from libraries (for example,e in Zapata community linking to MySpace.com was prohibited) and that training is available on an on-demand basis.

Limitations

The generalizability of the present study is limited by the inclusion of only four counties which are not statistically representative of all rural communities. The research sites were selected for to control for their participation in the RUS grant program and their proximity to the home universities of the four principal investigators. Since the results varied considerably across communities it is likely that many of the results

are particular to the conditions found in the four counties which acted as case studies.

The validity of the findings is also limited by the pre-post design that was employed. Internal validity threats including history, maturation, and statistical regression could account for changes between the 2005 and 2008 surveys. Independent samples were drawn in both years so while selective mortality is not an issue differences in the demographic composition of the samples across years and between communities could also explain some of the results particularly those related to community outcomes. It was for this reason that those results were statistically adjusted for to control for age and education differences between years and across research sites.

For Future Research

Future research might further examine the locus of "community" in rural areas. The Internet potentially extends one's community beyond local geographic boundaries, with the potential to stimulate out-migration and deplete precious human capital. At the same time, online connections with those in nearby communities (e.g., other neighborhoods in town, nearby towns in the same county), potentially multiplying community resources. Experimental interventions that focus on developing local content and networking local residents and entrepreneurs might serve to identify effective community development strategies that capitalize on the development of broadband applications.

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Appendix A

2005-2008 Survey Results by County

Appendix A Mean/percent of all variables, 2005-2008

		Zapata, TX		Zavala, TX		Huron, MI		Pike, KY	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
COMMUNITY ATTACHMENT									
The number of years lived in the county	mean	26.22	23.10	34.46	34.50	34.43	36.78	42.78	39.76
	N	344	397	312	370	244	222	201	309
The longer I live in this town, the more I feel that I belong.	mean	6.01	5.88	5.86	6.05	5.72	5.37	5.93	5.28
	N	413	411	429	383	384	380	328	319
If I was in trouble, most people in this community would go out of their way to help me.	mean	5.47	5.42	5.25	5.60	5.52	5.27	5.62	4.94
	N	415	410	430	386	389	388	325	326
My neighbors would be helpful in the event of a personal emergency or crisis.	mean	6.05	6.00	5.85	6.03	6.07	5.81	6.10	5.48
	N	415	409	431	383	387	391	326	326
I would never consider leaving here.	mean	4.66	4.30	4.50	4.08	4.53	4.52	4.48	4.11
	N	412	410	428	381	384	391	330	322
I would really like to leave this community if I had the opportunity.	mean	3.27	3.99	3.76	4.01	2.87	3.01	3.12	3.66
	N	413	398	425	384	380	388	327	319
I feel very much at home in this community.	mean	6.01	5.86	5.92	6.14	5.81	5.75	6.14	5.38
	N	411	408	430	384	388	392	332	324
If I had to move away from this community for some reason, I would be very sorry to leave.	mean	5.25	5.22	5.11	5.30	5.15	5.25	5.37	4.83
	N	417	411	431	386	388	391	330	322
COMMUNITY SATISFACTION									
Living in my community	mean	6.00	5.88	5.81	5.89	5.86	5.76	5.95	5.65
	N	416	409	435	383	388	388	330	318
My opportunities for further education	mean	4.49	4.22	4.91	4.62	4.39	4.08	4.73	4.59
	N	405	408	423	383	365	371	324	308
The recreational services and opportunities available	mean	3.88	3.83	3.82	3.72	4.73	4.31	4.08	3.91
	N	412	405	428	382	378	380	323	310
The quality of streets and roads	mean	4.02	3.86	2.26	1.78	4.96	4.60	4.09	3.97
	N	415	409	426	381	385	393	325	318
The shopping facilities in my community	mean	3.63	3.24	3.00	2.83	4.37	3.93	4.19	4.06
	N	410	409	427	381	384	387	328	318
		Zapata, TX		**Zavala, TX**		**Huron, MI**		**Pike, KY**	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
My employment opportunities	mean	3.96	3.73	3.33	3.05	3.72	3.34	3.82	3.61
	N	403	406	422	382	367	367	315	305
My opportunities to participate in the local government	mean	4.20	3.85	3.68	3.33	4.47	4.22	4.12	3.82
	N	407	401	423	377	367	370	323	309
The programs for youth in my community	mean	3.61	3.66	3.42	3.46	3.99	3.63	3.25	3.25
	N	409	407	424	378	373	380	321	312
My cultural opportunities	mean	4.05	3.84	3.91	3.96	3.96	3.72	3.74	3.67
	N	410	410	417	382	369	368	322	310
Educational opportunities for young people	mean	3.75	4.07	3.97	4.09	4.25	3.88	4.15	4.11
	N	411	411	429	380	383	380	328	320
Best size community for you	mean	3.36	3.06	3.24	3.02	4.26	4.36	4.17	4.30
	N	374	376	337	364	336	382	306	269
Social Circle									
I have a special person who is a real source of comfort to me.	mean	6.38	6.31	6.28	6.44	5.91	5.87	6.10	5.94
	N	415	410	430	383	381	388	328	320
My friends really try to help me.	mean	5.91	5.87	5.80	5.97	5.57	5.62	5.62	5.49
	N	415	411	427	384	382	389	325	321
I can count on my friends when things go wrong.	mean	5.82	5.80	5.73	5.91	5.70	5.70	5.61	5.55
	N	415	411	431	384	384	390	330	324
I can talk about my problems with my family.	mean	6.27	6.21	6.03	6.18	5.72	5.79	5.71	5.59
	N	414	410	432	384	385	389	330	324
I have friends with whom I can share my joys and sorrows.	mean	6.00	5.98	5.88	6.01	5.70	5.82	5.70	5.56
	N	415	410	427	385	383	385	324	324
There is a special person in my life who cares about my feelings.	mean	6.40	6.40	6.28	6.43	5.92	5.93	6.18	5.94
	N	416	411	430	385	385	386	330	320
I can talk about my problems with my friends.	mean	5.72	5.64	5.72	5.89	5.43	5.60	5.51	5.42
	N	415	410	430	385	386	388	330	324
Estimate the size of your "social circle." (actual number)	mean	27.23	28.79	27.78	25.12	27.75	30.77	36.74	39.88
	N	401	396	411	377	375	376	314	284
The number of voluntary associations you are member of. (actual number)	mean	1.27	1.06	1.15	0.90	1.93	1.79	1.61	2.53

	N	399	397	415	380	379	374	316	257

		Zapata, TX		Zavala, TX		Huron, MI		Pike, KY	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
LIFE ON THE INTERNET: ***Using the Internet, I will. . .***									
Improve my future prospects in life	mean	5.25	5.64	5.51	5.59	4.47	4.15	4.46	4.34
	N	307	322	338	329	316	330	274	285
Have my credit card number stolen	mean	4.44	4.53	4.34	4.42	3.96	3.43	4.20	4.01
	N	303	319	330	323	319	326	276	289
Find people like myself	mean	4.10	4.73	4.56	4.40	3.45	3.42	3.70	3.82
	N	295	316	330	324	306	318	272	285
Find cool new Web pages	mean	5.19	5.63	5.25	5.29	4.50	4.33	4.60	4.72
	N	300	319	334	322	304	324	268	286
Have fun	mean	5.18	5.54	5.46	5.46	4.80	4.74	4.70	5.00
	N	303	322	337	325	310	331	273	290
Find a way to pass the time	mean	5.14	5.64	5.47	5.45	4.77	4.70	4.81	5.16
	N	306	319	337	323	312	338	280	292
Spend money on things I don't need	mean	3.44	3.98	3.60	3.97	3.17	2.91	3.33	3.62
	N	303	320	331	327	314	329	270	293
Save time shopping	mean	4.12	4.73	4.28	4.66	3.80	3.98	4.07	4.31
	N	304	319	333	324	317	330	271	292
Provide help to others	mean	4.65	4.77	4.72	4.81	3.76	3.54	3.97	3.91
	N	301	318	329	321	309	329	270	287
Get support from others	mean	4.19	4.68	4.63	4.65	3.65	3.48	3.75	3.75
	N	302	318	328	324	309	327	270	289
Get up to date with new technology	mean	5.21	5.61	5.40	5.59	4.59	4.39	4.72	4.75
	N	304	317	340	325	312	331	273	287
Maintain a relationship I value	mean	4.17	4.52	4.08	4.01	3.51	3.76	3.65	3.59
	N	296	319	328	324	304	327	271	284
Find information about my local community	mean	4.51	5.00	4.43	4.89	4.22	4.21	4.45	4.37
	N	300	321	331	327	313	332	274	288
Find products I can't get locally	mean	5.02	5.52	5.29	5.49	4.95	4.89	5.03	5.28
	N	298	320	331	322	317	332	271	295
Find a job in another area	mean	4.41	5.08	4.77	5.37	3.62	3.29	3.81	3.64
	N	297	320	328	322	306	322	268	281
Find information I can understand	mean	5.58	5.82	5.62	5.78	5.07	4.85	5.17	5.34
	N	298	321	330	322	313	327	276	287
		Zapata, TX		**Zavala, TX**		**Huron, MI**		**Pike, KY**	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
Start a home business	mean	3.89	4.07	4.24	4.19	2.99	2.61	3.11	2.86
	N	294	320	327	324	308	319	266	279
INTERNET DISADVANTAGES									
My computer is not capable.	mean	3.22	3.55	3.18	3.47	2.94	3.01	2.92	2.76
	N	269	302	293	318	289	279	255	234
I moved.	mean	2.76	3.30	2.75	3.06	2.26	2.41	2.39	2.30
	N	269	299	289	317	278	260	243	223
The Internet is too expensive.	mean	3.76	3.73	3.77	3.83	3.67	4.33	3.43	3.81
	N	283	309	297	319	291	293	258	246
I do not have enough time.	mean	3.92	4.04	3.61	3.84	3.85	3.80	4.01	3.83
	N	279	310	297	315	294	282	257	244
I can use the Internet somewhere else.	mean	3.95	4.77	4.25	4.66	3.43	3.80	3.36	3.60
	N	280	308	292	318	289	279	252	236
I do not want it.	mean	3.14	3.40	3.30	3.61	3.06	3.26	3.05	3.12
	N	283	311	295	315	301	305	257	243
I am concerned about children seeing pornography	mean	4.83	5.11	5.18	5.74	4.27	4.25	4.89	4.84
	N	281	309	301	320	292	284	264	250
I will have problems with computer viruses	mean	4.44	4.54	4.74	4.88	4.12	4.03	4.16	3.95
	N	280	307	301	320	288	283	259	240
I do not understand it.	mean	3.46	3.65	3.48	3.93	3.23	3.57	3.30	3.22
	N	285	310	305	320	289	296	261	245
I will lose my privacy	mean	3.52	3.85	3.91	3.95	3.58	3.60	3.73	3.66
	N	281	309	294	320	292	281	263	245
INTERNET IN MY LIFE									
I feel confident using the Internet to gather data.	mean	6.03	6.11	5.89	6.25	5.65	5.58	5.92	5.91
	N	244	255	280	250	279	281	237	260
I feel confident explaining why a task will not run on the Internet.	mean	4.74	4.89	4.67	4.83	4.00	4.07	4.33	4.35
	N	237	253	278	249	275	279	235	255
I feel confident I know how to learn advanced skills related to the Internet.	mean	5.38	5.60	5.25	5.63	4.48	4.37	4.98	4.84
	N	239	254	280	246	278	278	232	256

		Zapata, TX		Zavala, TX		Huron, MI		Pike, KY	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
I feel confident understanding terms/words relating to Internet software.	mean	5.19	5.49	5.09	5.39	4.29	4.19	4.78	4.66
	N	239	254	279	246	276	281	236	257
I know how to make new friends on the Internet	mean	3.77	4.54	3.99	4.75	3.43	3.59	3.88	4.30
	N	239	255	278	248	272	280	232	252
I use the Internet so much it interferes with other activities.	mean	2.43	2.70	2.76	2.86	2.22	2.46	2.27	2.56
	N	239	253	268	245	274	281	236	254
I get strong urges to be on the Internet	mean	2.37	2.71	2.59	2.69	2.26	2.34	2.27	2.39
	N	238	253	276	247	273	280	231	257
I have a hard time keeping my Internet use under control.	mean	2.21	2.48	2.41	2.35	1.90	2.12	2.00	2.15
	N	237	250	275	246	272	280	234	255
I know how to get help with my personal problems through the Internet.	mean	2.87	3.15	2.88	3.10	2.59	2.84	2.88	3.05
	N	237	255	272	247	273	275	234	255
I have to struggle with myself to limit my time online.	mean	2.27	2.34	2.29	2.26	2.05	2.16	2.07	2.08
	N	237	253	270	246	275	278	236	255
I am confident I can find social support on the Internet.	mean	3.13	3.63	3.12	3.54	2.49	2.78	2.89	3.14
	N	236	254	273	247	275	277	234	255
I spend much longer on line than I intend	mean	2.35	2.67	2.61	2.55	2.24	2.57	2.36	2.62
	N	237	254	274	249	275	278	237	256
The number of years using the Internet	mean	5.83	7.59	5.11	6.10	6.06	8.16	6.56	8.56
	N	193	196	217	190	239	255	214	203
Hours online on a typical weekday	mean	2.16	2.62	2.04	2.76	1.76	2.09	2.06	2.40
	N	195	195	221	186	240	259	208	175
Hours online on a typical weekend day	mean	1.80	2.09	2.04	2.77	1.71	2.82	1.86	2.24
	N	192	193	216	183	240	249	204	164
Use Internet at: Home	percent	77.00%	80.90%	75.30%	75.40%	90.50%	89.40%	93.40%	85.60%
	N	154	161	171	147	219	227	199	190
Use Internet at: School	percent	17.00%	10.10%	27.90%	33.30%	3.30%	3.90%	6.60%	10.80%
	N	34	20	63	65	8	10	14	24
Use Internet at: Work	percent	46.00%	46.70%	39.80%	40.50%	40.50%	39.40%	33.30%	38.30%
	N	92	93	90	79	98	100	71	85
		Zapata, TX		**Zavala, TX**		**Huron, MI**		**Pike, KY**	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
Use Internet at: Public Library	percent	12.00%	23.10%	16.40%	15.40%	5.80%	12.20%	7.00%	11.30%
	N	24	46	37	30	14	31	15	25
Use Internet at: Other public Internet access sites	percent	5.00%	4.00%	4.00%	4.10%	1.20%	1.60%	0.50%	5.40%
	N	10	8	9	8	3	4	1	12
Use Internet at: Internet Enabled Cell Phone	percent	6.50%	13.60%	7.50%	16.40%	0.80%	0.40%	2.80%	8.10%
	N	13	27	17	32	2	1	6	18
HIGH-SPEED INTERNET									
It is not worth the cost	mean	3.39	3.30	3.59	3.41	3.98	3.71	4.16	3.54
	N	181	211	189	212	255	252	214	234
I can share pictures with my family and friends	mean	5.27	5.79	5.46	5.73	5.21	5.53	5.33	5.70
	N	186	215	194	213	245	253	210	233
It is easy to install	mean	5.11	5.61	5.04	5.30	4.82	5.06	4.80	5.25
	N	186	214	196	213	243	251	209	232
I can download music and movies more quickly	mean	5.41	5.71	5.59	5.81	4.90	5.05	5.28	5.44
	N	189	213	195	212	243	250	206	228
I haven't seen for myself what it can do.	mean	3.83	3.13	3.94	3.21	4.19	3.42	4.04	3.21
	N	189	206	192	211	245	249	212	227
I can listen to near-CD quality radio stations on the Internet	mean	5.21	5.52	5.32	5.55	4.69	4.67	4.85	5.13
	N	185	207	194	209	236	245	205	226
It's too much trouble to reconfigure a computer for it	mean	3.42	3.05	3.44	3.34	3.15	2.96	3.27	2.96
	N	183	209	192	212	236	247	209	226
It would improve my life	mean	4.41	5.07	4.68	4.60	4.19	4.26	3.90	4.69
	N	184	207	195	211	243	253	205	229
There is nothing I need it for	mean	3.35	2.91	3.25	3.14	3.51	3.05	3.55	2.86
	N	186	208	192	212	248	249	212	228
I haven't heard good things about it from people I know	mean	2.92	2.77	3.06	2.80	2.90	2.64	2.96	2.61
	N	185	209	192	211	240	250	207	225
I could take online courses more easily	mean	5.25	5.62	5.20	5.60	4.65	4.75	4.65	5.10
	N	184	210	196	210	238	245	205	228
I could start a home business	mean	4.76	5.04	4.58	4.86	4.13	4.20	4.04	4.35
	N	182	211	194	210	234	248	204	228
I would have to buy too much new equipment.	mean	3.30	3.21	3.50	3.09	3.17	3.18	3.31	3.05
	N	183	210	193	210	238	246	208	225
		Zapata, TX		**Zavala, TX**		**Huron, MI**		**Pike, KY**	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
It could improve my health care options	mean	4.14	4.40	4.19	4.06	3.65	3.54	3.60	3.93

	N	184	209	193	209	232	247	202	227
The computer I use isn't capable of high speed Internet	mean	2.75	2.54	3.05	2.70	2.70	2.34	2.73	2.27
	N	185	210	192	212	236	244	204	228
I could work at job in the city while still living here	mean	4.11	4.55	4.16	4.49	3.62	3.31	3.56	3.55
	N	180	210	191	209	233	244	203	227
I could play multi-user games over the Internet	mean	4.57	5.03	4.47	4.98	4.00	3.97	4.00	4.46
	N	184	213	190	209	234	242	205	225
I could use it to make phone calls	mean	4.20	4.43	4.20	4.39	4.04	3.98	3.94	4.09
	N	182	211	191	210	232	242	204	227
It's not worth the hassle	mean	3.01	2.67	3.20	2.95	3.17	2.76	3.46	2.65
	N	185	210	193	209	239	245	205	226
I have heard good things about it through the media	mean	4.92	4.93	4.94	4.89	4.90	4.51	4.82	4.88
	N	185	213	192	212	240	244	209	226
It's not available where I live	mean	2.90	3.11	3.78	2.61	3.36	2.82	3.26	2.57
	N	185	209	192	211	237	245	207	229
The number of years using high-speed Internet	mean	2.01	3.92	1.47	3.11	1.65	3.11	2.05	2.73
	N	115	137	81	137	84	181	70	145
Use high-speed Internet at: Home	percent	72.90%	76.10%	74.10%	68.40%	80.70%	86.00%	71.80%	84.40%
	N	86	108	60	104	67	154	51	151
Use high-speed Internet at: School	percent	18.60%	8.50%	30.90%	27.60%	4.80%	8.40%	9.90%	6.70%
	N	22	12	25	42	4	15	7	12
Use high-speed Internet at: Work	percent	39.80%	48.60%	35.80%	38.80%	47.00%	44.10%	46.50%	42.50%
	N	47	69	29	59	39	79	33	76
Use high-speed Internet at: Public Library	percent	8.50%	17.50%	13.60%	17.50%	1.20%	8.40%	5.60%	12.30%
	N	10	25	11	27	1	15	4	22
Use high-speed Internet at: Other public Internet access sites	percent	4.20%	1.40%	4.90%	0.70%	0.00%	1.10%	0.00%	2.20%
	N	5	2	4	1	0	2	0	4
Use high-speed Internet at: Internet Enabled Cell Phone	percent	4.20%	7.00%	6.20%	6.60%	1.20%	0.60%	5.60%	5.60%
	N	5	10	5	10	1	1	4	10

		Zapata, TX		Zavala, TX		Huron, MI		Pike, KY	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
FUTURE PLANS									
Move out of this County	mean	2.32	2.65	2.70	2.63	2.23	2.18	2.31	2.56
	N	407	401	422	377	382	378	315	305
Move to another home in this County	mean	2.20	2.65	2.43	2.57	2.16	1.98	2.33	2.31
	N	405	399	422	375	380	375	313	305
Move out of this state	mean	1.71	2.10	1.93	1.88	1.83	1.98	2.03	2.18
	N	406	401	422	374	380	377	313	303
Start a small business	mean	2.50	3.00	2.70	2.43	2.12	1.84	2.12	2.11
	N	408	397	414	375	377	372	308	300
Work from home using the Internet	mean	2.29	2.89	2.71	2.57	2.10	2.02	2.13	2.27
	N	405	392	415	375	378	370	307	301
Run a business from my home	mean	2.38	3.05	2.74	2.42	2.28	1.95	2.21	2.16
	N	406	395	414	376	376	369	310	300
Place phone calls over the Internet from my home	mean	2.19	2.75	2.51	2.50	2.19	2.00	2.15	2.40
	N	403	392	412	374	375	373	307	301
Take a course through the Internet	mean	3.01	3.65	3.55	3.55	2.37	2.39	2.66	2.90
	N	400	390	413	372	379	374	307	301
Look for employment in another area	mean	2.50	3.24	3.15	3.38	2.37	2.33	2.42	2.67
	N	404	394	414	373	378	371	304	300
Have high speed Internet at home	mean	3.52	4.14	3.60	4.13	3.45	3.96	3.36	4.77
	N	398	386	405	372	373	366	301	287
Use a high speed Internet connection outside my home	mean	3.15	3.76	3.42	3.56	2.86	3.32	3.02	3.94
	N	398	389	405	373	375	367	300	293
Complete a degree or training program	mean	2.77	3.51	3.28	3.31	2.12	2.17	2.36	2.74
	N	399	392	410	373	378	370	301	294
Have a member of my family move away	mean	2.51	3.05	3.04	2.61	2.47	2.42	2.70	2.84
	N	403	387	410	372	374	371	303	297
Have dial-up Internet at home	mean	2.86	2.62	3.32	2.29	3.12	2.04	3.77	2.54
	N	395	386	407	373	374	365	302	292
Install a wireless computer network at home	mean	2.96	3.64	2.92	3.45	2.70	3.02	2.55	3.44
	N	395	392	412	375	375	365	305	296

		Zapata, TX		Zavala, TX		Huron, MI		Pike, KY	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
TYPE OF PERSON									
I like to have a lot of people around me.	mean	5.10	5.18	5.05	5.32	4.56	4.34	4.59	4.49
	N	415	402	429	376	388	389	316	310
I really enjoy talking to people.	mean	6.24	6.07	6.06	6.27	5.62	5.42	5.82	5.42
	N	415	402	430	376	389	391	314	314
I like to be where the action is.	mean	5.23	5.18	5.40	5.10	4.79	4.47	4.75	4.40
	N	415	404	427	376	384	391	314	311
I am a cheerful, high-spirited person	mean	5.95	6.06	5.81	5.99	5.25	5.23	5.32	5.44
	N	413	403	431	375	388	393	313	312
DEMOGRAPHY									
Age	mean	48.92	43.64	47.94	44.85	55.88	57.41	53.20	51.55
	N	411	405	421	378	388	389	316	318
Female	percent	68.50%	66.70%	59.80%	73.00%	40.10%	44.00%	49.50%	56.80%
	N	285	274	257	279	157	173	157	179
Male	percent	31.50%	33.30%	40.20%	27.00%	59.90%	56.00%	50.50%	43.20%
	N	131	137	173	103	235	220	160	136
Race: BLACK	percent	0.80%	0.80%	0.30%	0.60%	0.00%	0.30%	0.00%	0.30%
	N	3	3	1	2	0	1	0	1
Race: WHITE	percent	40.60%	52.30%	30.70%	12.10%	99.50%	99.00%	99.70%	98.50%
	N	162	206	107	43	386	395	319	319
Race: ASIAN	percent	0.30%	0.80%	0.60%	0.30%	0.30%	0.00%	0.30%	0.00%
	N	1	3	2	1	1	0	1	0
Race: PACIFIC ISLANDER	percent	0.00%	0.00%	0.30%	0.00%	0.00%	0.00%	0.00%	0.00%
	N	0	0	1	0	0	0	0	0
Race: NATIVE AMERICAN OR ALASKAN NATIVE	percent	1.80%	1.80%	0.90%	0.30%	1.50%	1.50%	0.90%	1.90%
	N	7	7	3	1	6	6	3	6
Race: SOMETHING ELSE	percent	60.70%	46.70%	69.80%	86.70%	1.30%	1.00%	0.00%	1.50%
	N	242	184	243	306	5	4	0	5
Hispanic origin	percent	82.70%	89.80%	89.20%	97.40%	1.60%	0.30%	0.70%	0.70%
	N	339	369	379	369	6	1	2	2

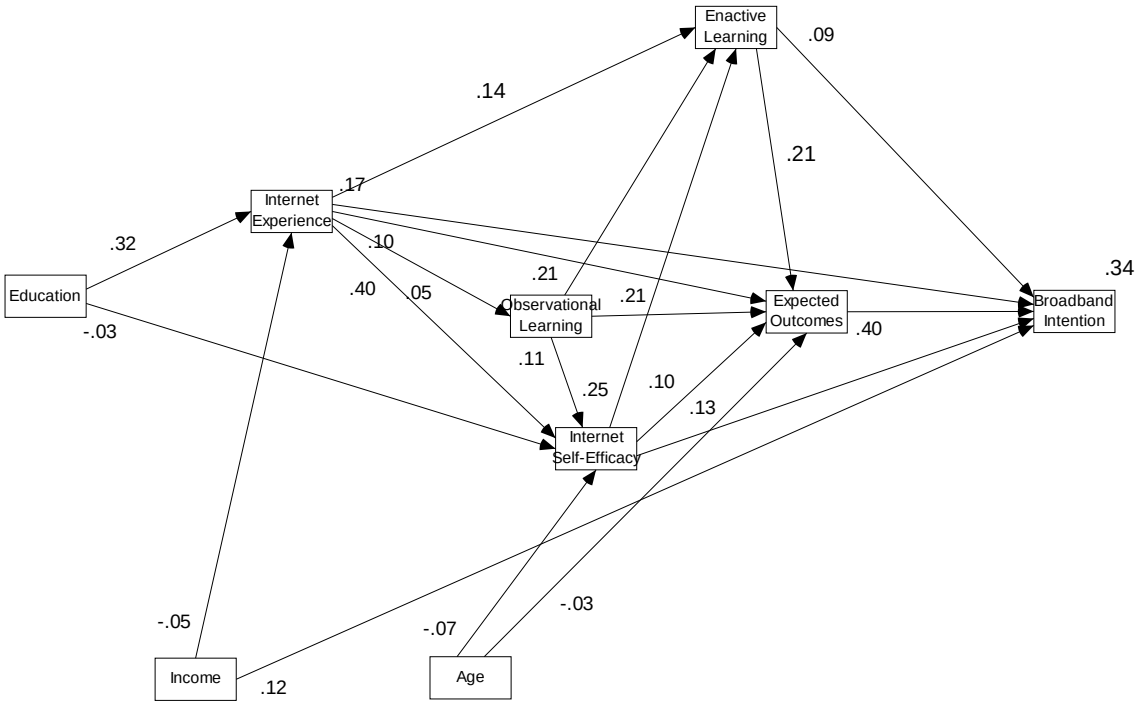
		Zapata, TX		Zavala, TX		Huron, MI		Pike, KY	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
Household income: Under $10,000	percent	19.20%	25.50%	21.70%	27.60%	6.50%	8.20%	10.60%	12.90%
	N	77	96	87	97	22	27	30	38
Household income: $10,000 to $19,999	percent	21.00%	19.90%	20.40%	25.10%	13.30%	20.10%	15.20%	16.00%
	N	84	75	82	88	45	66	43	47
Household income: $20,000 to $34,999	percent	20.20%	14.10%	26.20%	20.80%	22.80%	21.30%	20.90%	19.00%
	N	81	53	105	73	77	70	59	56
Household income: $35,000 to $49,999	percent	17.20%	14.60%	13.50%	11.70%	20.40%	19.50%	17.40%	12.90%
	N	69	55	54	41	69	64	49	38
Household income: $50,000 to $74,999	percent	9.80%	10.10%	12.00%	10.30%	22.20%	22.30%	19.50%	20.70%
	N	39	38	48	36	75	73	55	61
Household income: $75,000 to $99,999	percent	7.20%	7.70%	4.70%	2.80%	7.10%	8.50%	8.50%	9.50%
	N	29	29	19	10	24	28	24	28
Household income: $100,000 or more	percent	5.20%	8.00%	1.50%	1.70%	7.70%	0.00%	7.80%	8.80%
	N	21	30	6	6	26	0	22	26
Years of education ex kindergarten - SELF	mean	12.09	11.39	12.15	11.58	13.37	13.00	13.48	13.27
	N	415	404	422	378	393	396	324	314
Years of education ex kindergarten - MOTHER	mean	7.70	7.58	6.86	7.25	10.80	10.90	10.25	9.99
	N	363	358	391	337	364	357	278	286
Years of education ex kindergarten - FATHER	mean	7.49	7.47	6.30	7.05	10.29	10.27	9.24	8.86
	N	348	344	377	324	361	352	272	284
Number of CHILDREN at home	mean	1.32	1.56	1.38	1.37	0.68	0.64	0.60	0.78
	N	408	397	413	369	375	392	321	268
Residency: Permanent home	percent	94.00%	90.40%	97.40%	95.70%	94.40%	97.70%	99.10%	99.70%
	N	390	356	406	353	374	388	318	320
Residency: Seasonal/vacation home	percent	6.00%	9.60%	2.60%	4.30%	5.60%	2.30%	0.90%	0.30%
	N	25	38	11	16	22	9	3	1
Employment status: Employed	percent	56.50%	60.20%	58.40%	53.90%	60.90%	52.20%	51.60%	48.90%
	N	235	242	247	205	231	206	141	157
Employment status: Unemployed	percent	17.10%	24.40%	18.90%	25.00%	39.10%	6.80%	48.40%	14.00%
	N	71	98	80	95	148	27	132	45
Employment status: Retired	percent	26.40%	15.40%	22.70%	21.10%	0.00%	41.00%	0.00%	37.10%
	N	110	62	96	80	0	162	0	119
		Zapata, TX		**Zavala, TX**		**Huron, MI**		**Pike, KY**	
		2005	*2008*	*2005*	*2008*	*2005*	*2008*	*2005*	*2008*
TECHNOLOGY AT HOME									
Have at home - Phone line	percent	84.70%	72.10%	92.70%	83.80%	90.80%	69.20%	97.90%	94.10%
	N	354	292	396	316	363	276	322	304
Have at home - 2nd phone line	percent	17.20%	12.10%	18.50%	11.90%	12.80%	6.30%	21.10%	14.20%
	N	72	49	79	45	51	25	69	46
Have at home - Cell Phone	percent	79.20%	81.20%	68.10%	75.60%	71.20%	80.70%	66.40%	75.50%
	N	331	329	291	285	285	322	217	244
Have at home - Cable television	percent	68.40%	62.70%	73.10%	69.00%	65.40%	52.40%	76.50%	67.50%
	N	286	254	312	260	261	209	250	218
Have at home – Personal computer	percent	52.40%	46.70%	57.60%	49.30%	67.20%	36.30%	69.60%	73.10%
	N	219	189	246	186	269	145	227	236
Have at home – Satellite television	percent	28.00%	24.50%	28.60%	35.00%	25.50%	60.40%	32.50%	34.70%
	N	117	99	122	132	102	241	105	112
Have at home – Computer modem	percent	33.30%	25.50%	31.40%	26.60%	45.00%	39.80%	47.00%	51.40%
	N	139	103	134	100	180	159	154	166
Have at home - High-speed Internet	percent	22.70%	24.30%	13.60%	29.50%	17.50%	36.10%	18.70%	46.40%
	N	95	98	58	111	70	144	61	150

Note: Most variables were measured in 7-point Likert scales. The variable “Best size community for you” used the following values instead: 1. A large city (over 500 thousand people), 2. A medium city (between 50 and 500 thousand people), 3. A small city (between 10 thousand and 50 thousand people), 4. A town (under 10 thousand people), 5. In the county. Percentage values are used to report the frequencies of the response “Yes” for categorical variables.

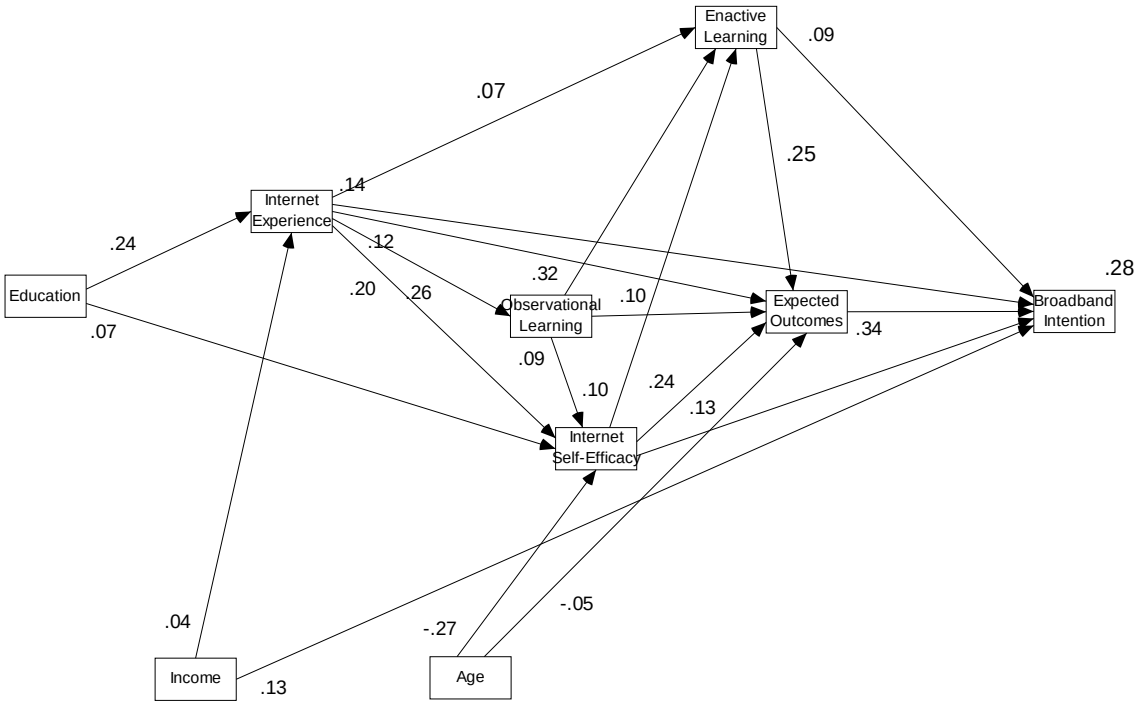
Appendix B

County-Level Multivariate Analyses

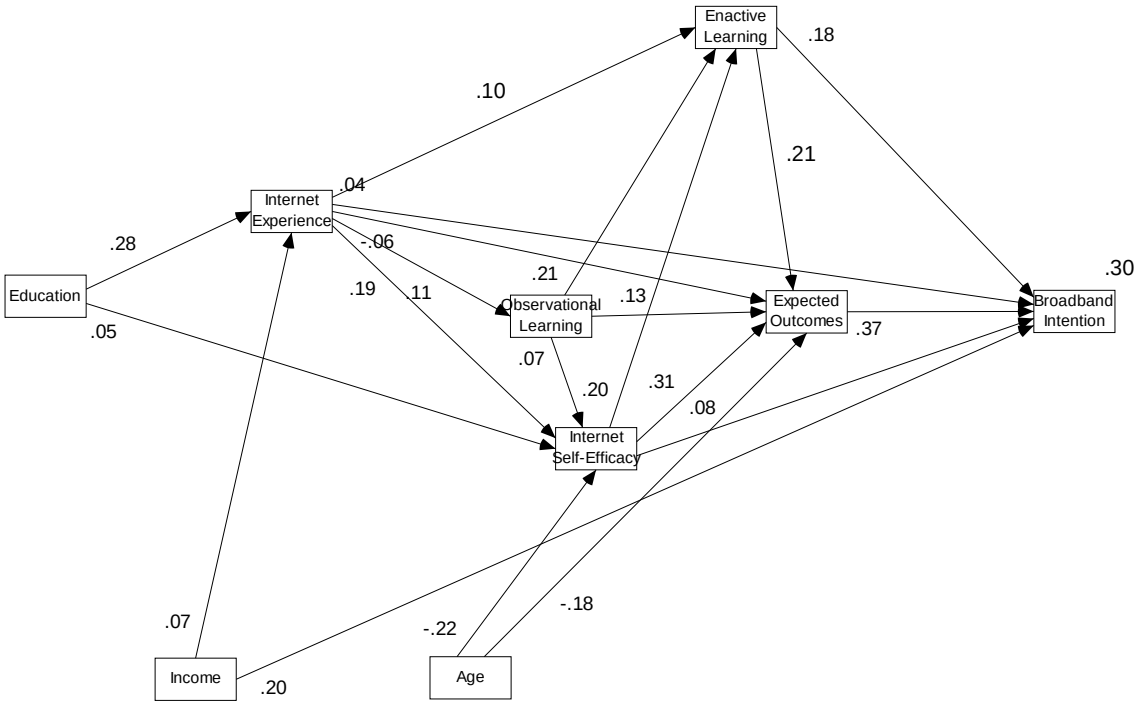
Final Path Model of Broadband Adoption
Socio-cognitive and Demographic Variables
Huron County, 2008



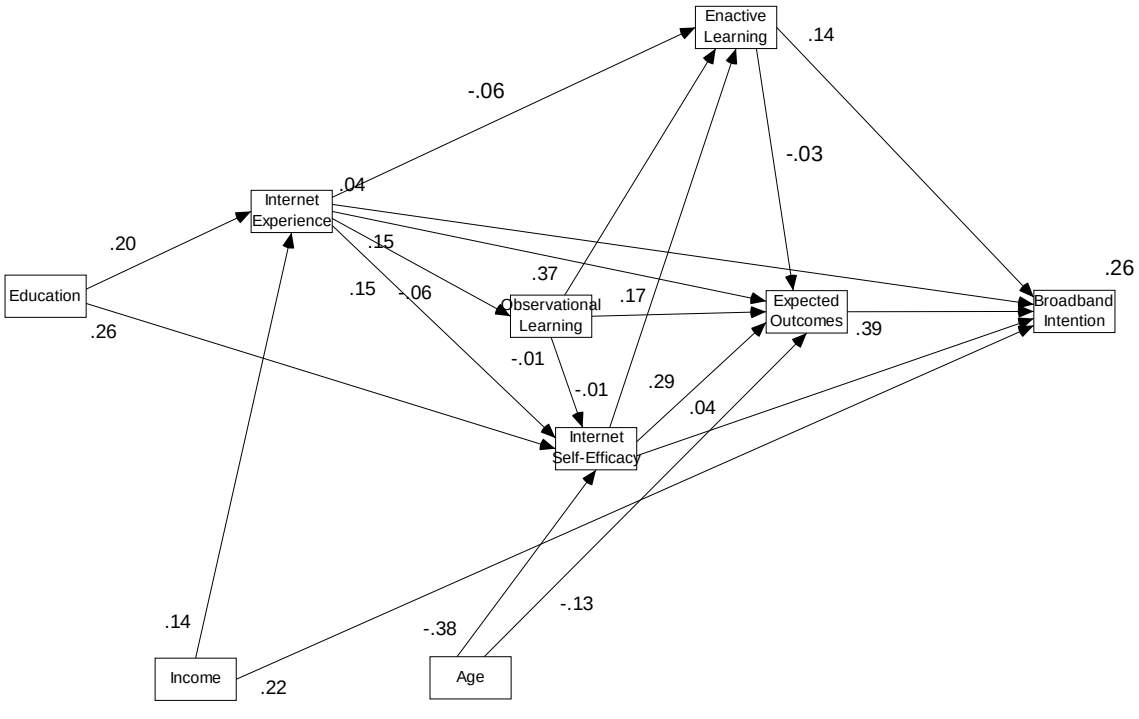
Final Path Model of Broadband Adoption
Socio-cognitive and Demographic Variables
Pike County, 2008



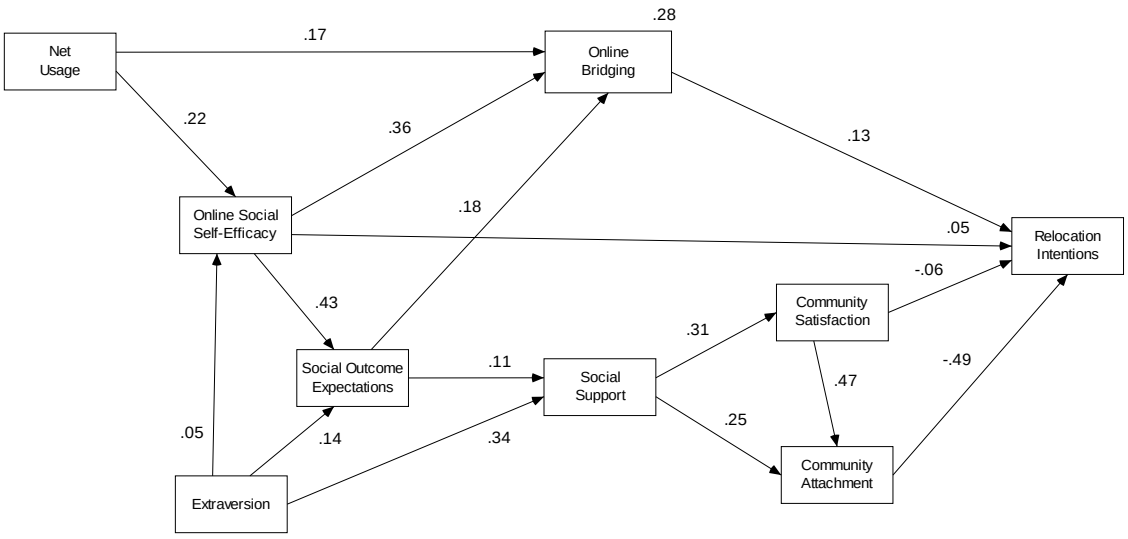
Final Path Model of Broadband Adoption
Socio-cognitive and Demographic Variables
Zapata County, 2008



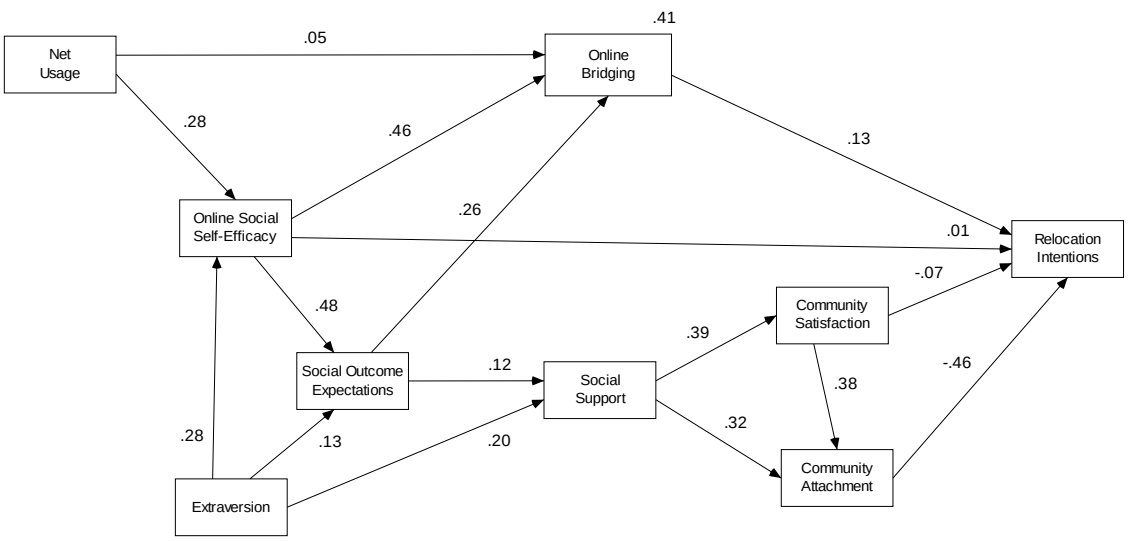
Final Path Model of Broadband Adoption
Socio-cognitive and Demographic Variables
Zavala County, 2008



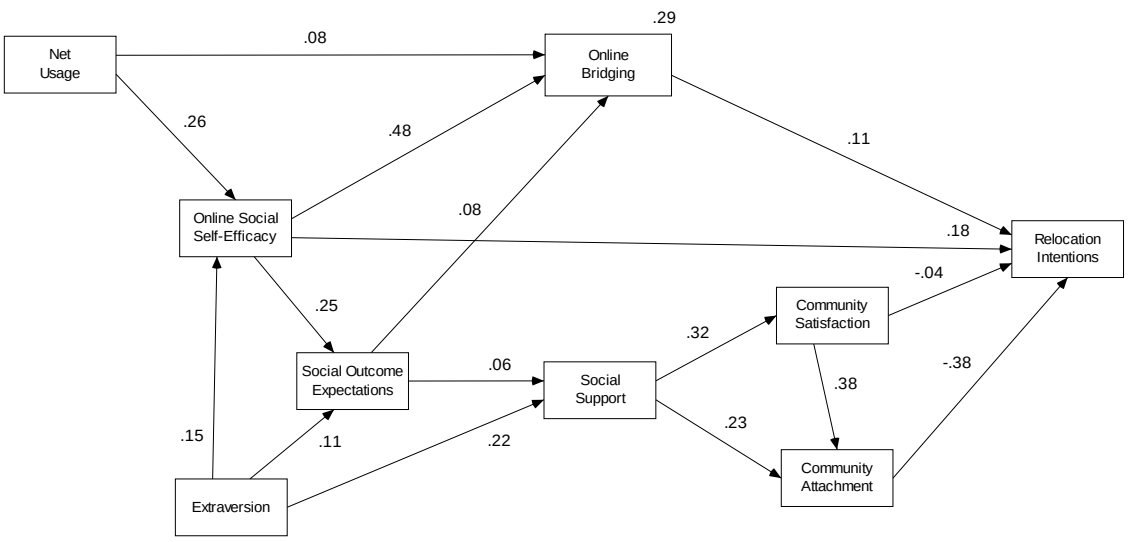
Final Path Model for Relocation Intentions
Huron County



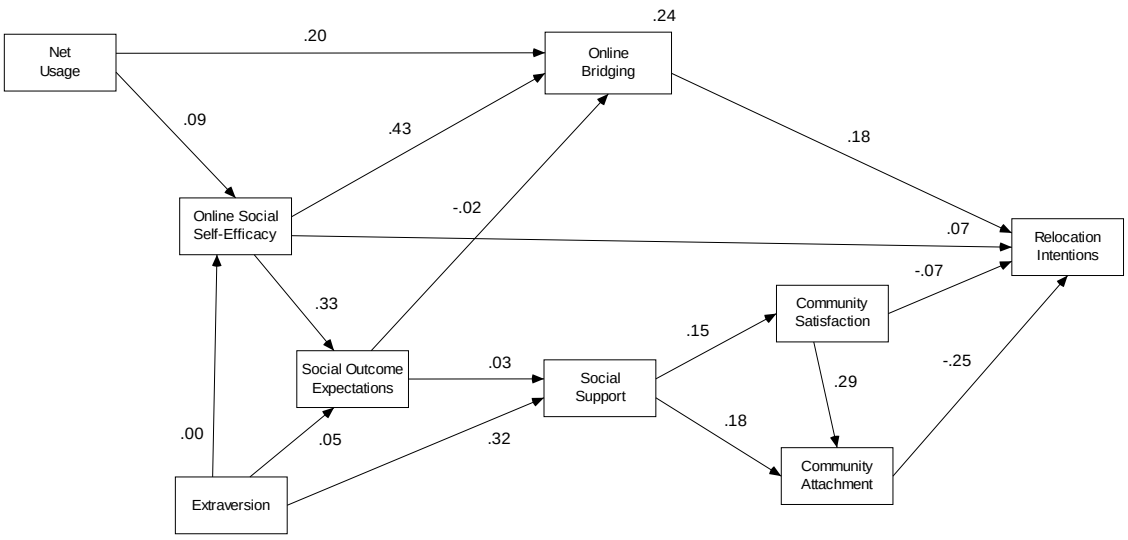
Final Path Model for Relocation Intentions
Pike County



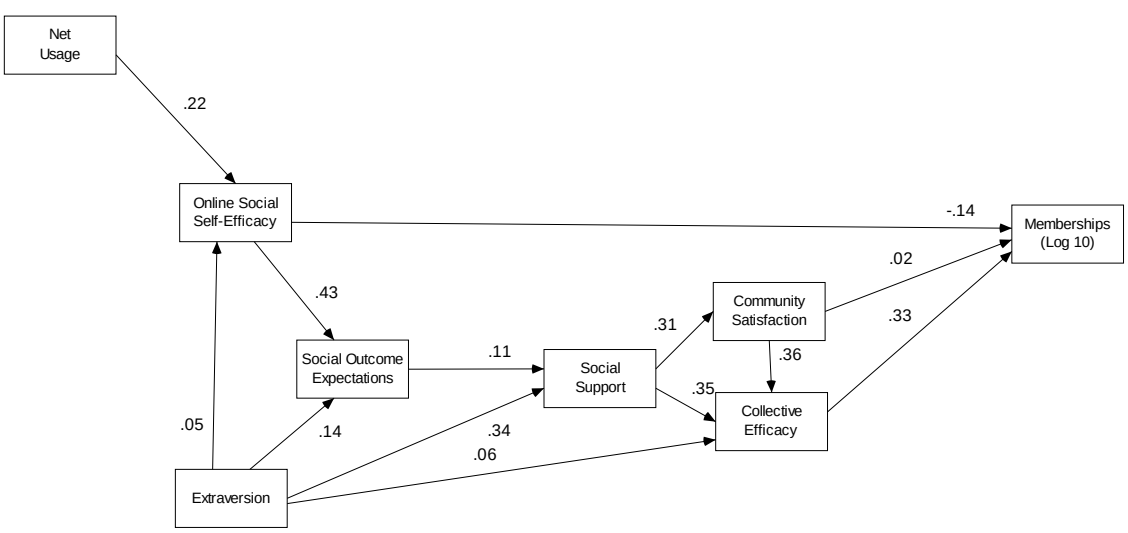
Final Path Model for Relocation Intentions
Zapata County



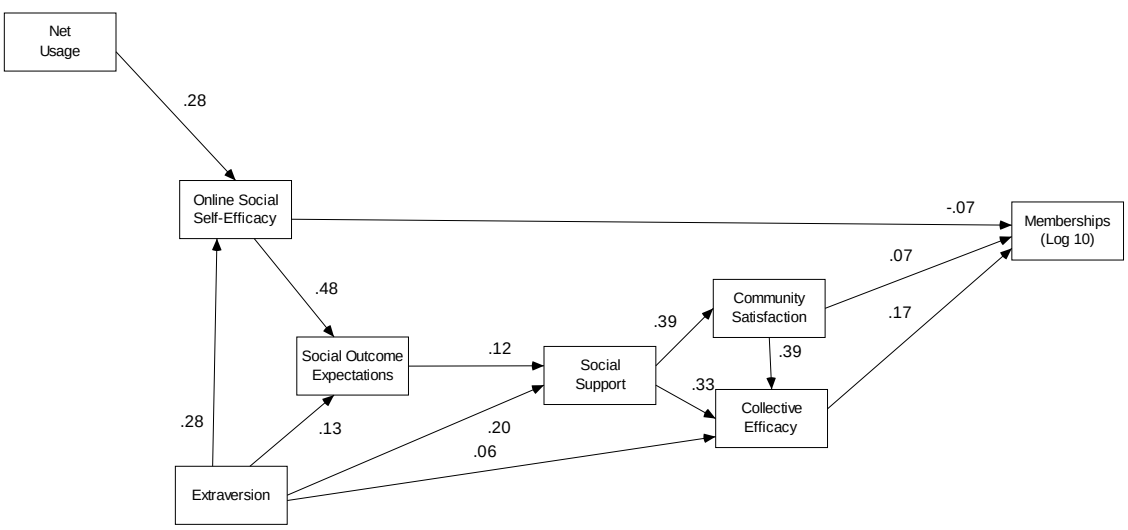
Final Path Model for Relocation Intentions
Zavala County



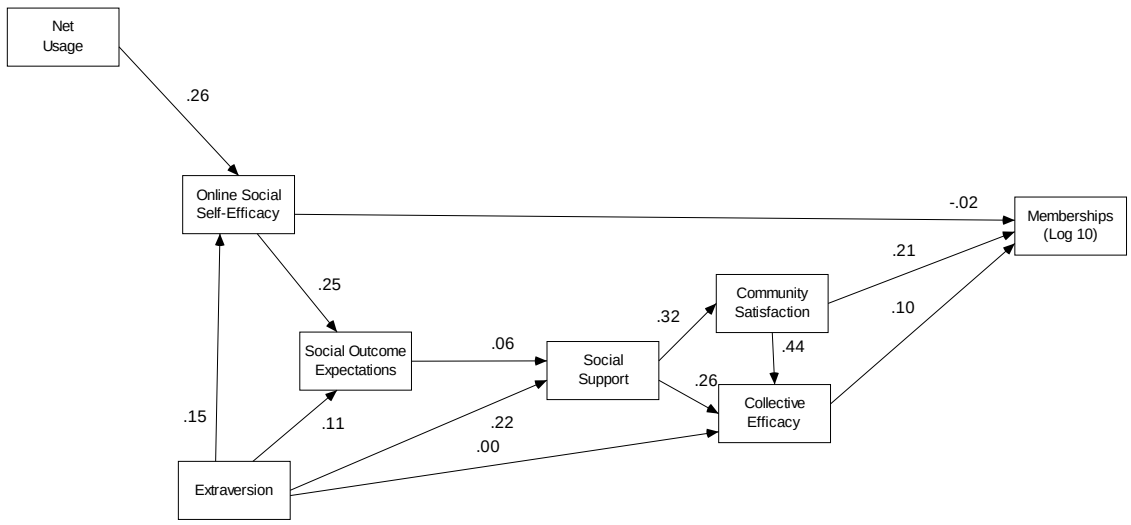
Final Path Model for Community Participation
Huron County



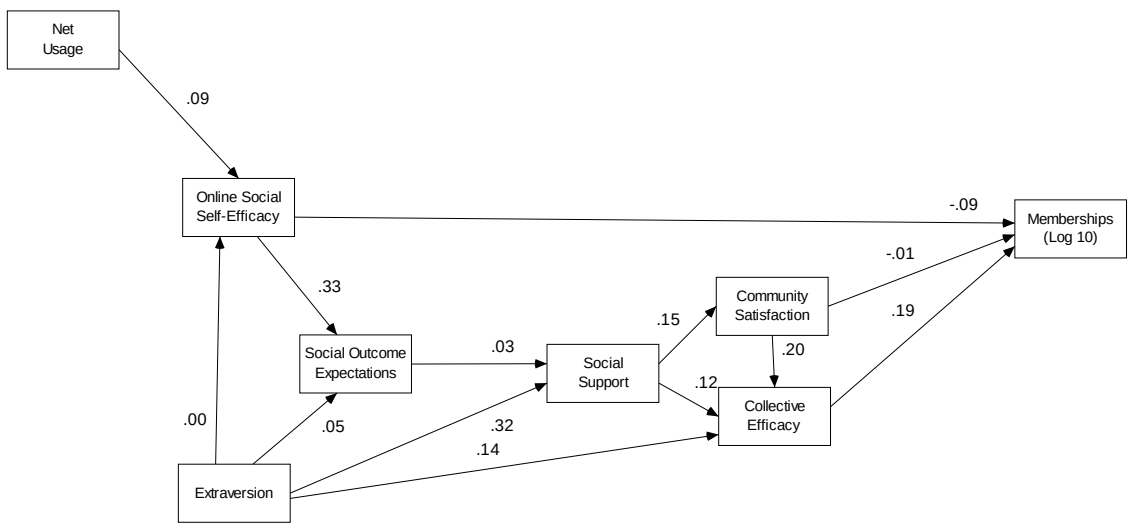
Final Path Model for Community Participation
Pike County



Final Path Model for Community Participation
Zapata County



Final Path Model for Community Participation
Zavalal County



[1]
Working from data provided by Pew/Internet (Horrigan & Murray, 2006, p. 3), 27% of rural homes and 11.5% of non-rural homes have no broadband access available. Assuming that broadband coverage is equal for Internet and non-Internet homes, the estimate penetration of broadband in rural homes with broadband access available is 33%, compared to 45% in urban and suburban homes with broadband access available.
[2]
In the next year I will…place phone calls from the Internet from my home, have high speed Internet at home, use a high speed Internet connection outside my home, install a wireless computer network at home.

[3]
From what you may have heard about high-speed Internet service, how much do you agree or disagree. It is not worth the cost (reflected), I can share pictures with my family and friends, I can download music and movies more quickly, I can listen to near-CD quality radio stations on the Internet, it would improve my life, there is nothing I need it for (reflected), I could take online courses more easily, I could start a home business, it could improve my health care options, I could work at a job in the city while still living here, I could play multi-user games over the Internet, I could use it to make phone calls.

[4]
I feel confident…Using the Internet to gather data, I know how to learn advanced skills related to the Internet, understanding terms/words relating to Internet software, I know how to learn advanced skills relating to Internet software, and if I had problems using the Internet I know I could eventually work them out.

[5]
I haven't heard good things about it from the people I know (reflected).

[6]
I haven't seen for myself what it can do (reflected).

[7]
I would never consider leaving here; I would really like to leave this community if I had the opportunity (reflected); I feel very much at home in this community; If I had to move away from this community for some reason, I would be very sorry to leave.

[8]
How many voluntary associations, such as clubs, churches, youth programs, and any other community associations are you a member of?
[9]
In the next year I will…Start a small business; Work from home using the Internet; Run a business from my home.
[10]
My friends really try to help me; I can count on my friends when things go wrong; I have friends with whom I can share my joys and sorrows; I can talk about my problems with my friends.
[11]
I know how to make new friends on the Internet, I know how to get help with my personal problems through the Internet, I am confident I can find social support on the Internet.
[12]
The longer I live in this town, the more I feel that I belong. If I was in trouble, most people in this community would go out of their way to help me. My neighbors would be helpful in the event of a personal emergency or crisis.
[13]
Source: US Census Quick Facts.
[14]
Source: Bureau of economic analysis, http://www.bea.gov/regional/reis/action.cfm
[15]
Source: County Business Patterns
[16]
Source: Michigan Department of Labor and Economic Growth, http://www.michigan.gov/dleg/0,1607,7-154--202294--,00.html
[17]
Top 10 Local Stories of 2007, Huron Daily Tribune, December 28, 2007, http://www.michigansthumb.com/articles/2007/12/28/import/20071228-archive5.txt
[18]
Crampton, "The 100 Best Small Towns in America"
[19]
http://www.cityofpikeville.com/visitors.cfm
[20]
Source: US Census Quick Facts.
[21]
http://ukcc.uky.edu/census/21195.txt
[22]
Source: US Census Quick Facts.
[23]
http://www.usda.gov/rus/telecom/commconnect/pdfs/ky-update.pdf
[24]
http://www.connectkentucky.org/what_we_do/
[25]
http://www.connectkentucky.org/NR/rdonlyres/D529ADCF-F459-4FEE-8517-4BCDA8C6FB11/0/1_PIKE_STRATEGIC_TECHNOLOGY_PLAN.pdf
[26]
http://www.connectkentucky.org/NR/rdonlyres/D529ADCF-F459-4FEE-8517-4BCDA8C6FB11/0/1_PIKE_STRATEGIC_TECHNOLOGY_PLAN.pdf
[27]
Decision and Order, U.S. Department of Agriculture, DNS-RUS Docket 06-0001, June 20, 2006.
[28]
I feel confident… Using the Internet to gather data, I know how to learn advanced skills related to the Internet, understanding terms/words relating to Internet software, I know how to learn advanced skills relating to Internet software, and if I had problems using the Internet I know I could eventually work them out
[29]
I use the Internet so much it interferes with other activities, I get strong urges to be on the Internet, I have a hard time keeping my Internet use under control, web surfing is a habit I have gotten into, I have to struggle with myself to limit my time online, I have to keep using the Internet more and more to get my thrill, I spend much

longer on the Internet than I intend, the Internet is part of my usual routine, web surfing is a habit I have gotten into.