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The Consequences of Personal Networks for Internet Use in Rural Areas

Jeffrey Boase

Abstract

Why are there fewer Internet users in rural areas than in urban areas? Researchers addressing this question typically focus on the lack of Internet infrastructure and demographic factors in rural areas. Rural areas often lack affordable Internet connectivity and contain relatively high numbers of people who are unlikely to adopt Internet connections at home—specifically the elderly and those without a postsecondary education. Although infrastructure and demographics are undoubtedly important factors, equalizing Internet adoption in rural and urban areas may require more than simply providing infrastructure that is affordable to a population of the right demographic composition. Drawing on the personal network approach and the concept of direct network externality, the author argues that the composition of personal networks in rural areas may hamper general levels of Internet adoption and high-speed Internet connection at home. To examine the empirical validity of this argument, the author conducted descriptive and multivariate analyses on data collected from a random-digit dial survey of 2,200 American adults.

Keywords

social networks, externality, rural, Internet, digital divide

Internet Use in Rural Areas

The Pew Internet & American Life Project’s 2003 national sample survey of Internet use in rural areas provides some of the most current and comprehensive findings publicly available regarding Internet use in rural America. Findings from this survey show

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that although Internet use is becoming an increasingly popular activity in rural America, it is still less prevalent than in urban and suburban America (Bell, Reddy, & Rainie, 2004). For example, urban and suburban residents have nearly a 15% to 14% lead over rural residents in terms of Internet use. Although broadband is growing in urban, suburban, and rural areas, broadband users make up a larger percentage of urban and suburban users than rural users. This study also finds that rural residents are more likely than urban and suburban residents to depend on having an Internet connection outside of the home. The report in which these results are published points to both lack of Internet infrastructure and demographic factors—especially age and income—to explain these disparities in Internet use.

Using more recent tracking survey data, a data memo published by the Pew Internet & American Life Project in 2006 showed that although high-speed Internet penetration is increasing throughout all parts of America, rural communities continue to lag (Horrigan & Murray, 2006). As of late 2005, 24% of Americans living in rural areas had high-speed Internet connections whereas 39% of urban and suburban residents had high-speed Internet connections. As in the 2003 Pew report, lack of Internet availability and demographic differences between rural and nonrural residents are cited as factors contributing to this gap.

The Influence of Personal Networks

In addition to demographics and Internet infrastructure, personal networks may partially account for the relatively low levels of Internet adoption in rural areas. Broadly defined, a personal network consists of all those relationships deemed significant by a given individual. The personal network approach stems from the social networks paradigm, which posits that social relationships strongly influence behavior, ideas, beliefs, and flows of information.

Those using the personal network approach sometimes explain the significance of personal networks through the use of economic analogies. For example, personal networks yield “social capital” to the extent that they yield information or resources (Lin, 2001). DiMaggio and Cohen (2003) also draw on economic theory to consider the influence of network externalities on the adoption patterns of television and the Internet. They distinguish between direct network externality, whereby the value of adopting the Internet varies directly with the number of people with whom one can interact online (e.g., by way of email, file-sharing programs, or online auction Web sites such as E-Bay), and indirect network externality, whereby greater numbers of people using the Internet increases the availability of services, products, information, and entertainment online. By virtue of having a direct connection to an individual, personal network composition may affect the direct network externality of using the Internet.

In this article I focus on the direct network externality of personal networks and examine if this type of externality further helps to explain the relatively low level of Internet adoption in rural settings. However, unlike DiMaggio and Cohen who consider the direct network externality that includes all potential online interaction partners,
I solely focus on direct network externality that is created through personal networks. This means that I do not consider direct network externality that occurs with those outside of an individual’s personal network, such as strangers on file-sharing networks or anonymous sellers on Amazon.com.

I focus on direct network externality for two reasons. First, following the social networks paradigm, I assume that personal network members are generally more influential than those outside of an individual’s network and will therefore have a greater impact on Internet adoption. Second, using a limited definition of network externality allows for the use of specific personal network measures that can be directly linked to Internet use. Note that examining the influence of direct personal network externality on rural Internet adoption does not dispute the influence of infrastructure and demographics on Internet adoption in rural areas. I consider personal network externality to be a previously unexamined factor that may also contribute to the relatively low level of Internet use in rural areas.

Personal networks may be particularly influential in the decision to adopt the Internet given the popularity of email. This article takes the direct network externality generated by way of email as the main mechanism for explaining differential levels of Internet adoption in rural and urban areas for two reasons. Although other socially oriented Internet activities—for example, the use of Web sites such as Friendster or more recently MySpace—have rapidly gained and lost popularity, email remains the most popular of Internet activities (Pew Internet & American Life Project, 2009). In fact, email’s popularity is explained in large part because it helps people maintain contact with their personal networks (Boase, Horrigan, Wellman, & Rainie, 2006). Although evidence generally suggests that it rarely replaces other forms of communication, it is clear that email serves an important role as a part of a larger personal communication system that individuals use to stay connected to their personal networks (Boase, 2008). Although misunderstandings may occur through email because of a lack of synchronous auditory or visual feedback, individuals find ways of overcoming these issues (Menchik & Tian, 2008). Given its popularity, it is reasonable to infer that email is a significant means through which direct network externality is generated. Moreover, although only a few years old, the data on which this article is based were collected shortly before the rapid adoption of social networking sites and mobile-phone-based email. Therefore, this focus on email is particularly reasonable given the data at hand.

Although I have argued that knowing network members who have Internet connections may be particularly influential for adoption because it allows for communication by way of email, this argument is not particular to email. Rather, in broader terms, it is about how a personal network can influence the adoption of a new technology insofar as that technology allows or “affords” communication with personal network members who themselves have access to the same technology. For this reason, even though new platforms for Internet-based communication will continue to be widely adopted and may eventually dwarf the use of email, that adoption of Internet-based tools by
personal network members will play a significant role in the decision to use the Internet remains an important issue.

Few studies have examined the nature of rural personal networks in America using a nationally representative sample. For this reason it is difficult to say with certainty that rural personal networks differ from nonrural personal networks. Nevertheless, rural populations tend to differ demographically from nonrural populations, and this necessarily affects the demographic traits. Nationally representative surveys have shown that people living in rural areas tend to be somewhat older, less educated, and more often work in lower status occupations than people in nonrural areas (e.g., Bell et al., 2004; Horrigan & Murray, 2006). This implies that rural networks will tend to include larger numbers of people who share these demographic traits. Given that people who are older in age, lack college education, and work in low-status occupations tend to be among the lowest adopters of the Internet, it is likely that rural personal networks have high numbers of people who do not have Internet access.

Given what has been said so far, I pose the following two hypotheses:

**Hypothesis 1:** The negative relationship between rurality and Internet access will decrease when controlling for age, education, and occupation.

**Hypothesis 2:** The negative relationship between rurality and Internet access will further decrease when controlling for the occupational diversity of personal network members.

The age of personal network members is not considered because the data used for this analysis do not contain this information. I also do not consider the impact of Internet infrastructure in rural areas on the negative relationship between rurality and Internet access for the same reason.

As discussed above, people living in rural areas are less likely to have high-speed connections at home than people living elsewhere. For this reason, I further examine the influence that personal networks have on obtaining high-speed Internet access at home. There are mixed reasons to consider the impact of personal networks on obtaining this kind of access, as opposed to Internet access more generally. On one hand, personal networks may act as only a weak network externality for obtaining high-speed Internet access at home because personal networks are most likely to affect email use, which requires minimum bandwidth and can be carried out with only minimal time spent online. Unlike Web surfing, which requires a constant Internet connection, it is possible to compose email offline and connect for only short periods of time online to send and receive email. On the other hand, the burden of sending and receiving email is significantly reduced by using a high-speed Internet connection, and so direct personal network externality may add enough value that an individual feels inclined to adopt a high-speed connection at home. Considering the possible influence of personal networks on obtaining a high-speed Internet connection at home, I hypothesize,
Hypothesis 3: The negative relationship between rurality and having high-speed Internet at home will decrease when controlling for age, education, and occupation.

Hypothesis 4: The negative relationship between rurality and having high-speed Internet at home will further decrease when controlling for the occupational diversity of personal network members.

Data and Method

The findings presented here are based on data collected from the Pew Internet & American Life Project’s Social Ties Survey, a random-digit dial telephone survey of 2,200 adults living in the continental United States. Interviews were conducted from February 17 to March 17, 2004, and lasted an average of 19 minutes per individual. All adults sampled had landline telephones (telephones that use physical outlets connected in one place) in their households, and all interviews were conducted in English. The response rate was 35%, and approximately 96% of those individuals who began the survey completed it in full. A comparison of sex, age, race, employment, and education variables from the Social Ties Survey to the same variables in the U.S. Census Bureau’s 2003 American Communities Survey indicates that the Social Ties sample is similar to the general American population in its demographic composition (Boase et al, 2006).

To measure the occupational diversity of personal networks, the Social Ties Survey used a variation of Lin’s (2001) position generator method. Although Lin’s original method asks respondents if they know anyone in occupations of varying prestige, this variation asks respondents if they know active ties in occupations of varying prestige. Active ties include kin, neighbors, workmates, and other ties that are more than just casual acquaintances. The survey is structured such that respondents are primed with this definition of active ties and are then asked if they know any active ties in 10 occupations of varying prestige. The occupations where chosen at roughly equal intervals from a list of occupations ranked on a prestige scale of 0 to 100 (prestige scores from Ganzeboom & Treiman, 1996).

In this article these data on occupation diversity are analyzed somewhat differently than in Lin (2001). Although Lin adds the results of these questions together to give a single scale indicating network diversity, this analysis adds together the results to give two scales: one indicating the diversity of ties in high-prestige occupations and the other indicating the diversity of ties in low-prestige occupations. This scale is broken into two scales because I have argued that diversity is associated with email use, such that people in high-prestige occupations are more likely to have email access than those in low-prestige occupations. Social diversity can matter for the use of email only if the diverse ties that an individual would like to communicate with have email access. Given that the prestige scale from which the occupations were selected varies from 0 to 100 at roughly equal intervals, network members in occupations with prestige
scores higher than 50 points are considered to be of high prestige and network members with a score of 50 points or less are considered to be working in low-prestige occupations.

In the Social Ties Survey Internet access is measured simply as going online. Having high-speed Internet access at home is measured as having any type of Internet connection at home other than a dial-up connection.

Rurality is coded using the 2003 Rural-Urban Continuum Codes (Beale Codes), which define degree of rurality through a combination of county population and adjacency to metro areas (see U.S. Department of Agriculture, 2009). Although the Rural-Urban Continuum Codes originally used eight categories to indicate degree of rurality, several categories contained less than 5% of respondents. To ensure stronger statistical results, rurality was recoded into five categories, with each category containing at least 10% of the respondents. The “urban fringe” and “city rural fringe” categories were collapsed into a single category, as were the “small urban fringe,” “small city rural fringe,” “rural fringe,” and “rural” categories.

Analysis and Results

This analysis starts with a bivariate correlation to confirm that rurality is negatively associated with Internet access, in general, and high-speed access at home in particular. The existence of these relationships in the Pew Social Ties data is critical to the analysis that follows because they are assumed by all four research hypotheses. The existence of such relationships also indicates external validity of these measures in the Social Ties Survey because such relationships have been found in the surveys discussed in the literature review section of this article. Using Pearson correlations, these relationships in the Pew Social Ties data are confirmed—there is a significant ($p < .001$) correlation of $-0.11$ between rurality and having any type of Internet access and a significant ($p < .001$) correlation of $-0.16$ between rurality and having high-speed Internet access at home (Table 1).

Pearson correlations also confirm the negative association between rurality and having a college education ($-0.12$, $p < .001$) and working in a professional occupation ($-0.09$, $p < .001$). There is also a positive association between rurality and age ($0.06$, $p < .05$). As discussed above, Pearson correlations confirm that rurality is negatively associated with knowing people in high-prestige occupations ($-0.16$, $p < .06$), and positively associated with knowing people in low-prestige occupations ($0.12$, $p < .001$).

The first hypothesis states that the negative relationship between rurality and Internet access will decrease when controlling for age, education, and occupation. Logit regression analysis is used to examine this hypothesis because it implies the use of multivariate analysis and that the dependent variable (Internet access) is dichotomous (Table 2). This analysis supports the hypothesis, showing a marked decrease in the negative relationship between rurality and Internet access when age, education, and occupation type are added to the model. The size of the unstandardized negative coefficient decreases by more than a third, from $-0.17$ to $-0.11$, when controlling for age,
education, and occupation type. However, despite this substantial change in the size of this coefficient, it remains significant at the .001 level.

The second hypothesis states that the negative relationship between rurality and Internet access will further decrease when controlling for occupational diversity of personal network members. This hypothesis is generally confirmed when controlling for the occupational diversity among active, core, and significant ties. When controlling for the occupational diversity of active ties, the size of the negative coefficient for rurality and Internet access decreases from –0.11 to –0.09. Although this is not an extremely large decline in the size of the coefficient, the significance level of this coefficient drops from \( p < .001 \) to \( p < .05 \). This means that the addition of active tie occupational diversity decreases the statistical significance relationship between rurality and Internet access to a threshold that is substantially lower.

The third hypothesis states that the negative relationship between rurality and having high-speed Internet at home will decrease when controlling for age, education,
and occupation. Logit regression analysis shows minor support for this hypothesis, indicating a decrease of approximately 17%, from −0.30 to −0.25, in the unstandardized coefficient for rurality and high-speed Internet access at home when controlling for age, education, and occupation type (Table 3).

The fourth hypothesis states that the negative relationship between rurality and having high-speed Internet access at home will further decrease when controlling for occupational diversity of personal network members. Adding active tie occupational diversity to the analysis shows little support for this hypothesis—the size of the coefficient for rurality and high-speed Internet at home decreases only slightly when controlling for active tie occupational diversity (from −0.25 to −0.23). Moreover, the significance level of the association between rurality and high-speed Internet at home remains at the same threshold ($p < .001$) after adding the occupational diversity control variable.

**Discussion and Conclusion**

The results of this analysis show modest support for the argument that Internet adoption is lower in rural areas than urban areas because of relatively low levels of direct network externality. At least in regard to the adoption of the Internet, considering the occupational prestige of personal networks in addition to demographic characteristics helps to explain why people in rural areas are less likely to have Internet access than people living in more urban areas. This suggests that although improving Internet infrastructure in rural areas will certainly reduce inequality in access, direct network externality may work somewhat against Internet adoption in these areas because the network ties with whom individuals would like to communicate with online may not have Internet access.

Although this analysis indicates that direct network externality helps to explain why general Internet access is relatively low in rural areas, it does not help to explain why...
people living in rural areas are less likely than those living in nonrural areas to have high-speed Internet access at home. There are at least two possible explanations for this finding. First, it is possible that because high-speed Internet infrastructure is generally lacking more in rural areas and urban areas, direct network externality has less opportunity to influence the adoption of these services in rural areas. Nevertheless, this explanation seems less plausible when considering that demographic control variables had a significant role in explaining the relatively low adoption of high-speed Internet at home in rural areas. If these results were completely explained by a lack of high-speed infrastructure in rural areas, these demographic variables should not have had an impact on the relationship between rurality and high-speed Internet access at home.

Second, it is possible that because email is the most popular Internet activity for maintaining personal networks (Boase et al., 2006) and it is less demanding of a high-speed connection than other Internet activities, direct network externality has little influence on the decision to adopt high-speed Internet at home. As argued above, the data that were used as the basis of this analysis were collected before the explosion in the number of users adopting bandwidth intense social media Web sites, such as Flicker and Facebook. It is possible that the direct network externality of these socially oriented Web sites has meant an increase in the value of broadband connections in recent years.

Even though the personal network measures employed here are robust and directly associated with the common and intrinsically social activity of sending and receiving email, future studies would do well to consider the impact of other kinds of personal network properties on a variety Internet activities. The influence of having strong ties with individuals who are highly Internet savvy, or perhaps numerous weak ties with people who use social network Web sites, such as Facebook, might also influence the decision to adopt high-speed Internet at home. Considering these kinds of ties may be particularly important given that they may be less likely to exist in rural communities than in other places. Future researchers would also do well to consider the role of direct network externality on the dis-adoption (vs. continued use) of the Internet in rural areas because it has been shown that significant numbers of people who adopt the Internet eventually stop using it all together (DiMaggio & Celeste, 2004; Katz & Aspen, 1997).

Although direct network externality influences Internet adoption in rural areas, there may be other types of asocial Internet activities that motivate Internet adoption. In this issue Collins and Wellman show that people living in a Canadian rural community value the asocial Web services that provide them with information about health, finances, and shopping. Moreover, they show that direct network externality does not need to be local, as people living in this community were especially interested in connecting with geographically distance friends and kin. Accordingly, future research should consider how both direct network externality and asocial Internet activities influence Internet adoption and continued use in rural areas.

This article has been among the first to examine the influence of personal networks on Internet use in rural areas. It has provided some evidence that direct network
externality may be a previously unexplored factor that contributes to the lower levels of Internet use in rural areas than in urban areas. As argued above, although email was likely the key type of Internet activity that generated direct network externality when the data for this survey were collected, the implications of this study are not limited to this particular type of Internet use or this point in time. More broadly, the findings indicate that personal networks can make a difference in the decision to adopt and use the Internet. This implies that simply making Internet infrastructure more available in rural areas may not completely erase these differences. Nevertheless, although not a sufficient condition, the continued development of Internet infrastructure in rural areas is an necessary condition of greater equality in Internet access.

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**Bio**

**Jeffrey Boase** is an assistant professor in the Department of Communication at Rutgers University. His research focuses on how individuals use the communication technology to maintain and build their personal networks. He has codesigned several large-scale surveys in America, Canada, and Japan. His most recent work examines the social utility of Web-enabled mobile phones in Japan, with a focus on how personal network dynamics shape the extent to which this technology is used to bridge and bond with social ties.