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Diversity and digital divide: Using the National Broadband Map to identify the non-adopters of broadband

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ABSTRACT

The Internet has become an integral part of the everyday life for many Americans, yet a sizable gap still exists in household broadband adoption. Previous studies of the digital divide were restricted by the lack of sufficiently granular data on broadband availability and adoption. Recent efforts of NTIA and the FCC have made it possible for scholars to perform an exhaustive analysis of broadband diffusion. This paper examines differences in fixed location broadband adoption rates among households of various demographic and socio-economic characteristics and in different geographic locations utilizing the FCC's census tract level adoption data, demographic data from American Community Survey and the census block level broadband availability data from NTIA. Ordered probit models are estimated and used to conduct simulations in order to analyze the determinants of the broadband adoption rate. The results indicate that, although available in most tracts, the lack of broadband availability can still be a deterrent to its adoption. Furthermore, simulations indicate that, in non-metropolitan areas, policies targeting broadband availability would have a larger impact on adoption than policies targeting income or education, for instance. Additionally, where broadband is available, the census tracts with more educated, wealthy and older people who have more choices of broadband providers have higher fixed broadband subscription rates. The positive impact of older population on adoption rate contradicts the conventional belief that the older generation is left behind. Drawing from the previous literature, the older population may be more likely to have a home broadband subscription through traditional technologies, while their younger counterparts, who adapt to new technologies quicker, may be subscribing to mobile broadband.

1. Introduction

Internet has become an integral part of the everyday life for many Americans, yet a sizable gap still exists in broadband adoption among various demographic and socio-economic groups and in different geographic locations (Prieger & Hu, 2008; Horrigan, 2009a, 2012; Zickuhr & Smith, 2012; Hollifield & Donnermeyer, 2003; Cilan, Bolat, & Coskun, 2009; Grubesic, 2010; McConnaughey, Neogi, Goldberg, & Brocca, 2013). Broadband infrastructure boosts economic growth (see Holt & Jamison, 2009 for a comprehensive literature survey) and induces major advancements socially and politically, so the longer the broadband access, adoption and use are

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halted in communities, the harder it is for those communities to stay competitive (Noce & McKeown, 2008).

Increasing importance of broadband in enhancing economic prosperity, social development and global competitiveness has prompted a series of public policy initiatives in the past decade, which included clearing roadblocks and hurdles and creating targeted financial and non-financial incentives for broadband deployment. These efforts have succeeded in making broadband available to over 92% of households by the end of 2009 (Badasyan, Silva, & Busby, 2011). However, the household broadband adoption rate was only 63% in 2009 (FCC, 2010a) and 69% in 2013 (FCC, 2014).

Recognizing the importance of broadband for continuous economic and social developments, Congress mandated the Federal Communications Commission (FCC) to develop a National Broadband Plan to accelerate affordable high speed broadband deployment and adoption in unserved and underserved areas (FCC, 2010b). Universal broadband access has become a central policy goal for the US. Furthermore, the 2009 American Recovery and Reinvestment Act (ARRA) allocated $7.2 billion to extend broadband access services in the United States (Pub. L. No. 111-5, Sec. 6001, 2009). The Act provided $4.7 billion to NTIA for the Broadband Technology Opportunities Program (BTOP) and $2.5 billion to the Rural Utilities Service of the U.S. Department of Agriculture for the Broadband Initiatives Program (BIP).

As part of the BTOP program NTIA has established the State Broadband Data and Development Program (SBDD) to collect data biannually on broadband availability, speed and location of broadband services, as well as broadband services utilized by community anchor institutions. The main purpose is to create and maintain a complete publicly accessible map of broadband availability by technology and speed at the census block and street level which will provide consumers with information on the broadband service availability as well as assist state and local governments in their efforts to improve broadband availability.

Taking advantage of the granular data on availability and adoption this paper uses a simultaneous, ordered probit model to identify the non-adopters of broadband in various demographic and socio-economic groups and in different geographic locations. It utilizes 2009 census block level fixed location[1] broadband availability data[2] from NTIA (NTIA, 2011) along with the FCC's census tract level fixed location broadband adoption data (FCC, 2010a) and the demographic data from 2005 to 2009 American Community Survey (U.S. Census Bureau, 2011) to examine differences in broadband adoption rates among various demographic and socio-economic groups and in different geographic locations. The model is based on the key characteristics identified by the literature on broadband adoption as the main factors influencing individual/household adoption decisions.

The findings indicate that broadband availability rate, age, educational level, household income, geographic location, ethnicity, race, and the number of providers are statistically significant determinants of the adoption rate. The results with regards to the educational level, household income, race and ethnicity are consistent with previous studies. However, the result that census tracts with higher population age 60 and older are more likely to have higher subscription to fixed broadband is not consistent with previous studies that have indicated that the older generation is left behind. The study also finds that the broadband adoption rate is higher in census tracts with higher number of providers, which is used as proxy for price competition.

While early studies on broadband diffusion were focused on regulatory roadblocks for broadband investments and the broadband availability gap (see Prieger, 2003; Frieden, 2005; Strover, 2003 among others), more recent studies have turned their attention to broadband adoption (Beloc, Nicita, & Rossi, 2009; LaRose, Gregg, Strover, Straubhaar, & Carpenter, 2007; LaRose, Strover, Gregg, & Straubhaar, 2011, Shideler, Badasyan, & Taylor, 2009; McConnaughey et al., 2013). Today the public discourse about broadband has been shifting to focus on supportive demand side policies to boost adoption. However, as the results of this paper indicate, the impact of supply-side policies are still quite significant. Simulations show that the availability of broadband has the strongest impact on adoption, especially in non-metropolitan areas, suggesting that the focus should not be swayed away from supply side policies.

The rest of the paper is organized as follows. Section 2 reviews the literature on broadband adoption. Section 3 presents the research methodology. Section 4 discusses the data, section 5 analyzes the results and section 6 concludes with policy implications.

2. Literature review

The economic literature on broadband adoption has been rooted in early studies of telephone demand (Artle & Averous, 1973; von Rabenau & Stahl, 1974; Squire, 1973; Rohlfs, 1974; Littlechild, 1975). The key points considered in the development of the theoretical structure of telephone demand include (Taylor, 1994):

- distinction between the demand for access to the telephone system and the demand for use of the system once access is obtained;
- the presence of consumption externalities;
- option demand (paying for the option to make a call);
- usage patterns (related to the times and days of the week, distance, and duration).

Artle and Averous (1973) develop a model that incorporates consumption externalities and demand for access, but assumes away the demand for use (by assuming that each individual communicates with everyone else in the network). The model also does not

[1] Fixed location broadband refers to all broadband technologies except mobile wireless. Mobile wireless is excluded in the analysis because mobile wireless adoption data is available only at the state level. Also, the paper evaluates the level of broadband diffusion in the household context and, usually, mobile wireless broadband subscription does not necessarily provide broadband access to all members of the household, while fixed location broadband subscriptions are shared among household members (Beard et al., 2010).

[2] NTIA's census block level broadband availability data presents some limitations which are discussed in Section 4. See Ford (2011) and Grubesic (2012) for extensive analysis of these data limitations.