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The faster, the better? The impact of internet speed on employment

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ABSTRACT

Does faster broadband generate more economic benefits than normal-speed broadband? This study examines the differential economic impacts of broadband of different speeds. Utilizing the broadband availability and speed data from the National Broadband Map, a first-differenced regression analysis was conducted to investigate if faster broadband more effectively boosts the employment. The analysis shows a positive relationship between broadband availability and county-level employment. However, compared to normal-speed broadband, faster broadband did not generate greater positive effects on employment.

From the dial-up connection to Fiber-To-The-Home, the Internet, as Firth and Mellor (2005) pointed out, has increasingly referred only to the broadband. Not surprisingly, scholars who investigate the economic impact of ICTs also shift their focus from the general Internet to the broadband, as if the broadband, as if it is one type of technology. Their enthusiasm for the promising future of the broadband is not unfounded. Many empirical studies do show a significantly positive causal relationship between broadband and economic growth (Gillett et al., 2006; Jayakar and Park, 2013; Czernich, 2014). However, the treatment of broadband as one technology may give us a false optimism about the economic gains it can generate. In fact, the broadband Internet is an umbrella term which includes several types of infrastructures. Currently, FCC has recognized six types of broadband technologies: DSL, cable modem, fiber optics, satellite and broadband over power lines. Given that these technologies differ in many aspects such as the difficulty to maintain and upgrade, costs to deploy and use, and the applications enabled, their economic impact may also differ from each other.

However, very few studies have studied the potential existence of such non-uniformity in the economic impact of broadband. The assumption that faster Internet will yield greater economic gains seems to be taken for granted by many national and international policy and business organizations (UNCTAD, 2012; The Executive Office of the President, 2015; FCC, 2015). On the other hand, except for case studies and anecdotal evidence (Ericsson et al., 2013; Haller & Lyons, 2015), few empirical studies exist which shows faster Internet can lead to greater economic gain at the macro level. Such a lack of empirical evidence should not be taken lightly. If the economic benefits produced by faster broadband are in fact not significantly different from what normal broadband can produce, it may be more cost-effective to invest more in the normal-speed broadband.

This study explores the issue of the economic return of Internet speed. The question I seek to answer is: as broadband with increasingly higher speed is deployed, does the economic gain which is supposed to follow rise accordingly? As an exploratory research, this study examines the relationship between the county-level employment rate and broadband availability. Different from many previous studies which treated broadband in general, the current research disaggregates the broadband into three sub-categories: superfast broadband (download speed higher than 1 GB/s), fast broadband (download speed between 100 MB/s and 1 GB/s) and normal broadband (download speed between 3 MB/s and 100 MB/s). This treatment enables the test for any difference in economic impacts of various types of broadband so that a more nuanced picture of the role played by the information super-highway can be drawn.

The article is structured as follows. In the next section, the related literature on the job- creation effect of the Internet and the return of Internet speed are reviewed. Based on the previous literature, two hypotheses are framed. Then, I describe the sampling strategy, data source and methodology used in this study. Thereafter, the analyses and results are presented. A summary of the main findings and the implications of the study are discussed in the last section.

Literature review

Broadband and employment

The impact of Internet or broadband availability on employment has long been recognized in the economic literature. How-

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ever, the increased research on this topic only seems to have deepened the mystery, since evidence for both a significantly positive impact and non- significant, or even negative impact has been found.

A study analyzing the early years of broadband diffusion, i.e., 1998–2002, detected a significant and positive relationship between broadband deployment and growth in employment and the number of new businesses (Gillett et al., 2006). Utilizing the county-level data provided by National Broadband Map, a more recent study by Jayakar and Park (2013) shows a significantly negative relationship between broadband deployment and the unemployment rate at the county level. Instead of analyzing the economic impact of broadband in general, Lapointe (2015) focused exclusively on the employment impact of the fiber Internet at the county level and discovered a positive relationship.

Though many studies have shown a universal, positive effect of broadband on employment, closer examinations have revealed that the effect can be conditional and vary across different regions and industries. Forman et al. (2012) found that investment in broadband led to employment growth only in economically developed regions with ICT-skilled, high-income populations. After analyzing the data on employment in non-urban counties in the U.S., Whitacre et al. (2014) found no relationship between broadband availability and job creation. Scholars have also researched the industry-specific impact of broadband and found that the job-creation effect existed mainly in technology-concentrated industries (Kolko, 2012) and high-end service industries such as finance and insurance,education services and health care services (Crandall et al., 2007). Based on the findings in the previous literature, there is no consensus on the impact of broadband availability on employment. Accordingly, the following hypothesis is proposed:

H1: Broadband availability has no significant effect on county employment rate.

Noticeably, most of the aforementioned studies examine the impact of broadband in general without distinguishing different types of broadband. However, broadband Internet is an umbrella term which covers a variety of technologies. Among a limited number of studies investigating the differential impact of broadband technologies, most support an increasing return of Internet speed: compared to the current-generation broadband, a faster Internet can benefit the economy even more. Singer and West (2013) estimated that, while 40,000 jobs per year would be created if all Americans had access to normal-speed broadband by the end of 2015, 250,000 more jobs per year could be created if the next-generation broadband were made accessible to 80% of American households. Shapiro and Hasset (2012) explored the job-creation effect of mobile broadband. While the transition from 2G to 3G Internet is associated with the creation of 1585,000 jobs from 2004 to 2011, a 10 percent increase in 3G/4G adoption rate could create 231,000 more jobs in less than a year. Though these figures are exciting, one should not forget that faster Internet, while creating new employment in some sectors, can also eliminate job opportunities in others, such as company management and art, recreation and entertainment (Crandall et al., 2007). Therefore, the net and incremental effects of faster Internet on employment still need further investigation.

Diminishing return of internet speed at the individual and firm level

Though broadband is widely believed to facilitate the adoption of various new types of uses and services (Ericsson, Arthur D. Little & Chalmers University of Technology, 2013), studies have shown the adoption and use of different online services are not equally boosted by the increasing speed of broadband. Cho et al. (2003) surveyed 2206 Internet users in South Korea. After comparing the activities the users of dial-up, ADSL, and cable Internet, the researchers found that, although the high-speed Internet users used online media, such as online TV and online music, more often than the low-speed users, they did not differ in online shopping behaviors. This asymmetrical impact of Internet speed is also discovered by Kwak et al. (2004). The researchers examined two models explaining the social consequences of Internet adoption and found that the behavior impact of broadband is not a uniform one. A linear model is found to explain effectively the impact of the transition to faster Internet for soft engagement, such as casual socializing and informal knowledge seeking. However, hard engagement, such as formal knowledge seeking, political discussion and civil engagement, is better explained by a differential gain model: while the introduction of the Internet generated a significant increase in hard engagement activities, such a strong increase halted after people adopted broadband.

In addition to enabling various activities, the high-speed Internet is also regarded as a productivity enhancer for firms (UNCTAD, 2012; Ericsson et al., 2013). However, such a claim is mostly supported by case studies and ethnographies (Haller & Lyons, 2015) or studies failing to distinguish different types of broadband access (Najarzadeh et al., 2014). The non-representative samples studies in ethnographies could potentially lead to biased evaluations, and examining the broadband as a whole may over-generalize the benefits engendered by one type of broadband and the positive effects on one industry or even one firm. In fact, several studies analyzing representative samples of firms have shown a more complex picture. In a longitudinal econometric study examining 790 Italian small and medium enterprises, Colombo et al. (2012) found that, unless the firm invests heavily in employee ICT skill training and adjusts its management and operations, the adoption of applications enabled by fast broadband had extremely trivial, and, in some cases, even negative impact on the firm's productivity. Similarly, Grimes et al. (2009) compared the productivity of 6060 firms in New Zealand. After controlling for the firm's idiosyncratic characteristics, they found that though firms using normal broadband outperformed the ones using dial-up or no Internet by 7%–10% in terms of labor productivity, no significant increase was discovered between firms adopting the fast broadband and the normal broadband.

Though these findings may frustrate fast broadband advocates, Howell and Grimes (2010) pointed out several potential reasons why the scholars failed to find the expected results. First, as Colombo et al. (2012) concluded, the adoption of broadband alone cannot guarantee an increase in productivity. It takes years for the potentials of the technology and proper training to manifest. Second, the benefits may be at some other stages along the production value chain outside the firm and, thus, are not measured by the firm's productivity. Third, the impact of broadband adoption is industry-specific. It is very well possible that the broadband increases the productivity of firms in the knowledge and information intensive sectors while having little impact on others. Such a differentiated impact may not be detected in an analysis using a representative sample including all types of firms. Based on the findings on the incremental effect of Internet speed on employment, the following hypothesis is formulated:

H2: The economic benefit generated by fast broadband is not significantly different from that produced by lower-speed broadband.

Empirical studies on the relationship between broadband diffusion and employment are abundant; however, few consider the possible existence of differential effects of different broadband technologies. Though, at the level of individuals and firms, scholars have discovered evidence of diminishing return of broadband speed, the nature of the micro level analysis may blind us to