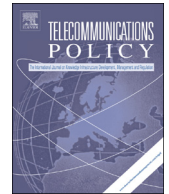


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The impact of tariff diversity on broadband penetration—An empirical analysis



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ABSTRACT

This paper provides an empirical analysis how tariff diversity affects fixed broadband penetration. To measure tariff diversity on a country-level a detailed data set comprising over 1000 fixed-line broadband tariffs is used. An instrumental variable approach is applied to estimate demand, controlling for various industry and socio-economic factors. Our results indicate that service-related and socio-economic factors affect broadband demand the most. An increase in tariff diversity provides a significant impetus to broadband adoption. A positive relationship is indicative of the importance of innovative pricing schemes in expediting the ascent of broadband internet access.

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1. Introduction

Around the globe, policy makers see broadband penetration as a key driver for economic prosperity (OECD, 2008). Ever since the by now seminal study of Röller and Waverman (2001), many other studies provided evidence that broadband has positive effects on growth by directly or indirectly spurring innovation, productivity, and, thereby, a country's national competitiveness.¹ Consequently, a timely deployment and adoption has become a major policy objective for many governments (ITU & UNESCO, 2013).

Given the differences in telecommunications infrastructure, the variety in access technologies and penetration rates across countries, there has been considerable interest in understanding the key factors that drive broadband diffusion. A growing body of empirical literature has analyzed what affects broadband uptake either at a single-country level (Aron & Burnstein, 2003; Denni & Gruber, 2007) or at a cross-country level (e.g., Galperin & Ruzzier, 2013; Gruber & Koutroumpis, 2013; Kongaut & Bohlin, 2014; Lin & Wu, 2013). A large majority of these studies stresses the importance of low prices at an aggregate level in order to promote broadband demand (Galperin & Ruzzier, 2013; Lee et al., 2011; Lin & Wu, 2013). Besides emphasizing the importance of a low price level the International Telecommunication Union (ITU) stated already in 2003 that innovative pricing schemes are needed to attract a wide variety of customers (ITU, 2003, p. 20). However, price dispersion within a country has been neglected entirely in the empirical literature. To the best of our knowledge, our analysis is

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¹ Koutroumpis (2009) and Czernich, Falck, Kretschmer, and Woessmann (2011), for example, have found a positive impact of broadband penetration on countries' GDP for OECD member states. For non-OECD members, Sassi and Goaid (2013) recently confirm a similar effect for the MENA countries and Chavula (2013) for African countries. Other studies that demonstrate how broadband penetration positively affects economic growth include Jung, Na, and Yoon (2013), Lee, Levendis, and Gutierrez (2012), Gruber and Koutroumpis (2011), Thompson and Garbacz (2011) and Lam and Shiu (2010).

the first to account for the degree of tariff diversity within a country. This focus is new and hence the main novelty of our paper.

While it is rather clear that the price level impacts on broadband uptake, it is from a theoretical perspective less clear how the price variety, i.e., tariff diversity, should affect broadband penetration. On the one hand, classical industrial economics theory suggests that price discrimination in final consumer markets should lead to an expansion of output (that is increased broadband penetration in the case at hand), as it allows suppliers to serve low-value customers without lowering the price for high-value customers. On the other hand, accounting for recent theories of boundedly rational consumer behavior the prediction becomes less clear. In fact, there has been a burgeoning literature which demonstrates that consumer decisions are prone to mistakes in telecommunications markets (see, e.g., Bolle & Heimele, 2005; Haucap & Heimeshoff, 2011; Lambrecht & Skiera, 2006). Based on these findings, Eliaz and Spiegler (2006), Brown, Hossain, and Morgan (2010), Piccione and Spiegler (2012) and Herweg and Mierendorff (2013) have developed models which suggest that firms may sometimes deliberately choose to obfuscate consumers in order to increase their profits. Consequently, as Spiegler (2006) has argued, consumers may become confused over “too much variety” or “too many tariffs” and finally reluctant to sign a contract. Actually, the success of flat-rate tariffs in telecommunications markets, associated with a rather modest price variety between offerings, may suggest that simple tariffs might be more helpful in fostering penetration than more diverse and complicated offerings. From a theoretical perspective it is, therefore, not clear how tariff diversity affects broadband uptake: while classical industrial economic theory would suggest a positive relationship between tariff diversity (as a measure for price discrimination) and broadband uptake, the more recently advanced behavioral economics view may suggest a negative one (seeing tariff diversity as a measure for customer obfuscation strategies).

At the same time, many consumer advocates and public interest groups have reacted with skepticism against tendencies to move away from flat rates and introduce greater tariff diversity (see, e.g., Lyons, 2013, p. 4; Rebaï & Flacher, 2013; Xavier, 2008; Xavier & Ypsilanti, 2010). Moreover, universal service obligations sometimes even outrightly prohibit price discrimination. For example, the International Telecommunication Union states that “in many instances, in addition to the requirement for affordable prices, regulators have imposed the requirement of uniform pricing on the operator with the obligation to provide universal service. Under the uniform pricing policy, the operator is not allowed to differentiate its prices geographically and/or between consumer types.”² Hence, it is useful to empirically analyze how price variety affects penetration rates. While it is true that many developed countries have saturated broadband markets, this is not the case for less developed countries. Furthermore, there is no reason to assume that consumer behavior would follow completely different patterns with respect to NGN penetration or networks with even higher bandwidth in the future.

The purpose of this paper is to provide an empirical assessment for how tariff diversity influences fixed broadband demand, while accounting for other factors that affect broadband penetration.³ Ensuring reliability of our empirical results, tariff diversity is calculated in various ways based on a newly available data set that originally encompasses more than 1000 broadband-only-offers for 82 countries.⁴ Thus, the second major novelty of this paper is, apart from its research focus on tariff diversity, the use of an entirely new data set.

The empirical analysis reveals that increased income and enhanced offerings, such as lower prices and improved quality of service, foster broadband uptake. Besides, an increase in tariff diversity provides a further impetus to broadband adoption, supporting the classical perspective that price discrimination induces output expansion. This finding is of crucial importance because it underlines the necessity for diverse and innovative pricing schemes in order to bridge the digital divide.

The remainder of the paper is organized as follows: In Section 2 we summarize the relevant literature. Section 3 outlines the empirical strategy and provides a description of our data set. Results are discussed in Section 4 and Section 5 concludes.

2. Literature

There is a steadily growing body of literature on the drivers of broadband penetration as an aggregate measure (e.g., Distaso, Lupi, & Manenti, 2006; Galperin & Ruzzier, 2013; Gulati & Yates, 2012; Lee, Marcu, & Lee, 2011; Lin & Wu, 2013; Kongaut & Bohlin, 2014) and on the determinants of a subcategory of fiber-based broadband (see Briglauer, 2014). These studies have examined various rather invariable endowment factors, e.g., economic prosperity, demographics and geography as well as influenceable regulatory factors, which may plausibly explain cross-country differences. Given that conventional and fiber-based broadband mainly differ with respect to down- and upload speeds from the demand side's point of view, the obtained results seem to be applicable for both quantifications of internet access technologies. A literature overview is provided in Table A2 in Appendix A.

Price: Several studies have accentuated the importance of a low(er) price level in determining broadband demand. Among these studies are Bouckaert, van Dijk, and Verboven (2010), Lee et al. (2011), Galperin and Ruzzier (2013), Lin and Wu (2013) and Briglauer (2014) to name just a few. Lin and Wu (2013), for example, have shown in their diffusion model of

² Emphasis added; <http://www.itu-coe.ofca.gov.hk/vtm/universal/faq/q1.htm>.

³ Under fixed broadband internet various DSL, cable, fiber, satellite, broadband over power lines and other fixed broadband technologies are subsumed.

⁴ All countries included in this study are listed in Table A1 in Appendix A.

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