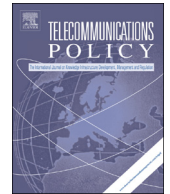


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Mobile and fixed broadband access services substitution in Japan considering new broadband features

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ABSTRACT

The new generation of mobile broadband services, such as WiMax/LTE, is now incrementally diffusing throughout Japan. If they were substitutable for a fixed broadband network, Nippon Telegraph and Telephone (NTT) would no longer dominate the last mile access market. Therefore, substitutability between mobile internet access services and fixed broadband access services might be one of the most important empirical questions in the discussion on broadband access market regulations. This study empirically investigates substitutability between mobile and fixed broadband access services by using the original stated preference survey data and simulating the market shares with declining fees of mobile broadband access services. This study considers quality of service (QoS) and security factors realized under next-generation networks (NGNs) or 3.9 G mobile internet access. The result reveals that if tethering, QoS, and security became available via mobile internet access, then mobile and fixed broadband access services would become highly competitive.

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1. Introduction

Telecommunications services are one of the fastest growing technological development fields. Therefore, its regulatory framework must often be reconsidered, especially since the Internet has become a very popular communication tool. The number of internet users reached 100 million in 2013. In addition, its shares of access lines in homes were as follows: fiber to the home (FTTH)=54.8%, cable modem=17.2%, digital subscriber line (DSL)=9.6%, mobile=14.6%, and dial-up=19.6% (multiple answers, Source: "Tsushinriyodoko-Chosa 2012 (FY)" [Ministry of Internal Affairs and Communications \(MIC\) \(2013\)](#)). These figures indicate that a large volume of consumers access the Internet via fixed line services at home.

In Japan, the last mile access line market, which is the landline from telephone offices to homes or offices, is dominated by the formerly state-owned monopoly Nippon Telegraph and Telephone (NTT). Although cable TV companies have their own broadband network infrastructures as a last mile access line, their market share is small in Japan, as is the case with that of mobile broadband internet access services. Before DSL services were launched, Japanese internet users used dial-up internet access, where the local call charge is a time-sensitive-metered rate. At the time, DSL services started on a flat rate basis, and this difference of price structure accelerated the migration from dial-up internet access to DSL services. Undoubtedly, the price level of DSL services also figured strongly in the beginning of Japan's broadband market. Although the share of NTT East and NTT West in the ownership of regional access lines was 83.7% in 2014,¹ the establishment of

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collocation and unbundling rules for DSL service providers using access networks of the dominant regional carriers (NTT East and NTT West) has made the DSL service market in Japan competitive from the outset. Thus, the last mile regulation strongly affects Japan's broadband market.

However, if the near future broadband markets are examined, the new generation of mobile broadband services such as WiMax/LTE has become more popular in Japan. These new mobile technologies provide faster mobile internet access. The National Broadband Plan in the United States ([Federal Communications Commission \(FCC\), 2010](#)) also mentioned the wide possibilities of mobile broadband access. If the new technologies became substitutable for the fixed broadband network, the last mile access market would no longer be dominated by NTT, changing the regulatory framework. In exploring the broadband access market regulatory framework in Japan and other countries where last mile players comprise only fixed broadband carriers, substitutability between mobile internet access and fixed broadband access can be one of the most important empirical questions in the future discussion on broadband access market regulations. In fact, in the United States, where cable TV operators have a certain share of the last mile broadband access market, the regulatory arguments apply to the middle mile market, not in the last mile market ([Federal Communications Commission \(FCC\), 2010](#)). Cost structures and certain other aspects of middle mile and last mile markets differ; therefore, different discussions are needed not only for achieving efficient and competitive broadband access services but also for determining cost shares in universal access.

Another topic in the near future broadband market is the next-generation network (NGN). In November 2004, NTT Group announced the "NTT Group Medium-Term Management Strategy." To implement this strategy, they devised a roadmap for building NGNs. The major features of NGN services include speed guarantee, security against wiretapping, and higher speed. The smooth migration from ordinary broadband to NGN is another important topic for regulatory policy and business factors in the internet access markets.

To explore the abovementioned future broadband access market competition, this study empirically examines the relationship between ordinary fixed line or NGN broadband access service and mobile broadband access service by using stated preference (SP) survey data.

In reviewing previous studies in this field, [Ida and Kuroda \(2006\)](#) explored the relationship between the DSL and the FTTH markets. [Flamm and Chauhuri \(2007\)](#), [Rappoport, Kridel, Taylor, and Alleman \(2003\)](#), and [Yanelis, Christopoulos, and Kalantzis \(2009\)](#) also discussed substitutability within fixed broadband access markets. For fixed and mobile substitution, [Vogelsang \(2010\)](#) reviewed the literature largely on phone demands from both theoretical and empirical perspectives; he then noted that further empirical and theoretical research is needed on this topic. In the internet service area, few papers discussed fixed and mobile substitution. [Cardona, Schwarz, Yurtoglu, and Zulehner \(2009\)](#) analyzed Austria's broadband access market taking into account mobile broadband access. They employ various nested logit models with real subscription data; however, as they highlighted, the mobile broadband penetration ratio during their 2006 survey was very small. [Srinuan, Srinuan, and Bohlin \(2012\)](#) analyzed the Swedish broadband access market by also using nested logit models with real subscription data. They noted that mobile broadband service had a market share greater than 33% in 2010, providing sufficient data for analyzing fixed and mobile substitution. For NGN features, [Jitsuzumi \(2013\)](#) empirically examined consumer willingness to pay (WTP) for fixed and mobile internet access quality of service (QoS) from network neutrality perspectives.

To the best of the author's knowledge, no empirical evaluation simultaneously analyzes fixed broadband and mobile broadband access services considering future broadband features, such as QoS and security; this study focuses on this prominent feature. This study's empirical results suggest the strong substitutability between mobile and fixed broadband access services. It also indicates that the mean WTP for the QoS and security of mobile internet access services is higher than those of fixed internet access services.

This paper is organized as follows: [Section 2](#) describes the design of this study's SP experimental method. [Section 3](#) presents the econometric model framework and estimation procedure. [Section 4](#) presents and discusses results for the estimation parameters. [Section 5](#) reports and discusses the results for market share simulation and price elasticity estimations. [Section 6](#) concludes with a summary of the findings and a review of this study's limitations with suggestions for future research.

2. Stated preference experiments

This section briefly explains the data used in this study. In January 2010, an SP survey was conducted in collaboration with the Information Communications Research Institute of Japan to analyze substitutability between mobile internet access and fixed broadband access. Consumers' choice behavior regarding broadband access services can be examined by analyzing data such as revealed preference (RP); however, this study used an SP survey to capture consumer preferences. This is because, in practice, a mobile broadband access service, with the exception of direct internet usage on mobile phones, has not yet become widespread in Japan. The subscription rate for this service was so low so that stable estimation results would not be obtainable by RP data. Moreover, this study incorporated NGN features such as speed guarantee and security against wiretapping as attributes. NGN services launched in Japan, however, have not yet become familiar for general consumers. [Ida, Kinoshita, and Sato \(2008\)](#) used SP data to analyze demand for IP telephony service in Japan and highlighted the difficulty of collecting sufficient data in an emerging market.

By designing a choice experiment, researchers could assure the variability of attribute levels, including price, and avoid collinearity among attributes. These are advantages that SP data offer over RP data. This study's SP survey uses a conjoint

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