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## Conference Paper

# Understanding broadband under-utilization in Japan

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# Understanding broadband under-utilization in Japan

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## Abstract

Improved internet connectivity has been a consistent aim of Japanese telecommunications policy in the past decades, however, despite the high availability of high speed and ultra-high speed broadband services, actual use has yet to match network capacity. This study hopes to explore this paradox by looking at the factors that affect demand for broadband services.

To achieve this, the relationship between overall broadband adoption and two basic demand factors, namely price of internet services and presence of a competitor in the form of wireless broadband, was examined over a 12-year period. The findings suggest that the lag in adoption can be attributed to both a higher demand for wireless connectivity and high broadband contract prices, while network effects may play a positive role in diffusion.

Given that Japanese broadband policy has tended to focus more on the role of price as a mechanism for improving penetration, this study ultimately contributes to the discussion of policy efficiency by providing some empirical basis for the consideration of alternative demand-side incentives.

Keywords: broadband adoption, Japan, mobile internet

## **I. Introduction**

It is often taken for granted that broadband internet access is something consumers want. This at least appears to be the assumption behind Japanese broadband policy, which in the past years has consistently featured goals for more, faster, and cheaper internet<sup>1</sup>. This policy focus has resulted in dense network coverage,<sup>2</sup> however, despite the ubiquitous availability of broadband, diffusion of high-speed internet among end users has been generally described as slow (Ota 2009).

This study attempts to shed some light on the reasons behind this apparent lag by looking at the demand side of the market. Is Japan dealing with low demand for broadband connectivity or is there another good that competes with broadband and which has not been taken into account? To answer this question this study tests the hypothesis that the uptake of broadband, in the form of subscription rates, is influenced by two factors, namely the price of internet access, and the competing good of mobile internet access.

This matter is salient for policy makers to the extent that it helps to better understand how internet use patterns change over time. By furthering knowledge on the workings of the demand side, the study can moreover provide some more background to the ongoing discussion on the effectiveness of policy measures in boosting adoption of broadband services.

This paper will set out to provide this information by first explaining how this particular research was designed in terms of the model, method, and data. Following the results, the discussion will interpret the findings within the Japanese internet environment, concluding with more general policy implications.

## **II. Research design**

The aim of this study is to identify the reasons behind the apparent under-utilization of Japanese broadband networks. While Japanese broadband expansion has been significantly investigated, the focus has mostly been on the technical aspects of the development of the backbone network (such as in Fukuda et al. 2005 and Takachi & Mitomo 2005), and the effect of unbundling regulation (Ota 2009). This approach, however, has left the demand side

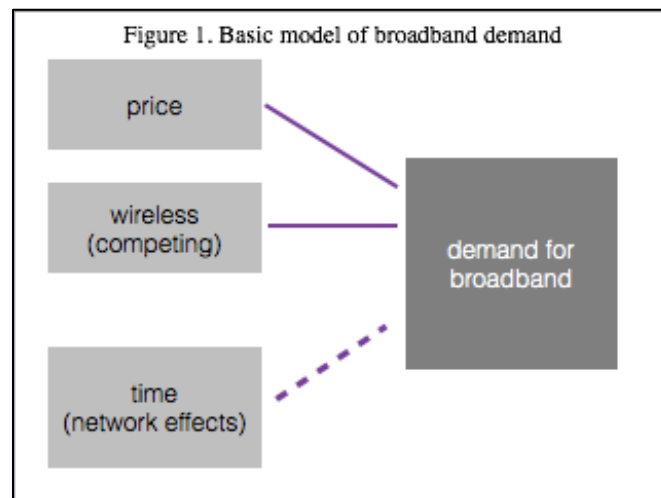
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<sup>1</sup> Starting in 2000, with the Basic Act on the Formation of an Advanced Information and Telecommunications Network Society (IT Basic Act) (Act No. 144 of 2000)

<sup>2</sup> As of March 2014, broadband coverage was 100% and ultra-high speed coverage 99.9% (MIC 2014, [http://www.soumu.go.jp/soutsu/okinawa/denki/buro\\_map.html](http://www.soumu.go.jp/soutsu/okinawa/denki/buro_map.html))

of the equation somewhat underrepresented. To cover this gap, this research looks at the factors influencing consumer incentives for the adoption of broadband technologies.

The study thus hypothesizes that the cause underlying the paradox of the high availability of broadband but low use is that the demand quantity of the good in question - broadband access - is affected not only by the pricing mechanism, but also by the presence of a competing good. To put it in model terms, broadband penetration is influenced not only by the price of broadband, but also the presence of mobile internet access - as opposed to wired broadband, which until recently was the primary focus of broadband policy<sup>3</sup>.



Before continuing with details on the research setting and data however, it may be necessary to justify the description of mobile broadband as a competing good to wired broadband. This distinction can be justified by two reasons, one being the official Japanese definition of broadband and policy implications of said definition. The second pertains to the different experiences each medium represents for the consumer.

While the ITU (ITU-T Recommendation I.113) defines broadband as a transmission capacity that is faster than primary rate ISDN, at 1.5 or 2.0 Mbps., in Japan the cut-off point of broadband was defined at higher speeds, so that only FTTH, DSL, CATV, FWA, BWA, and LTE/3.5G are defined as high speed broadband internet<sup>4</sup> technologies (MIC 2014). This is significant in that mobile internet (in particular 3G) did not originally qualify as broadband in Japan, and therefore was understood by policy makers as a qualitatively different good.

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<sup>3</sup> Evidence of this focus can be seen from policies such as the New Broadband Super Highway (Hikari-no-michi) policy which explicitly tied broadband to fibre connectivity, not only with respect to the backbone network, but for the end user as well. (MIC Information and Communications in Japan White Paper 2010, chapter 5, p. 49)

<sup>4</sup> Connections within those technologies exceeding 30Mbps are defined as ultra-high speed broadband.

Aside from matters of definition, in practical terms it can be argued that wired and wireless internet in the past presented divergent experiences for the consumer. While both types of broadband provide access to internet content, this content and the way in which the content is delivered have not always been the same (an argument also made by Kim and Sugai, 2008). Both in terms of the content presented and the physical experience related to screen size and input methods (keyboard, touch screen etc), mobile internet access can be constructed as a distinct form of internet use. While the two types of content and delivery are seen as being in the process of merging (Kim, Lee & Koh 2005), for the time period reviewed this process has not been completed and mobile and wired internet can be understood as different, and therefore competing, goods.

In this study, in order to capture the relationship between broadband adoption and the two demand factors, a linear regression was run. The measures used were the total number of broadband subscriptions, wireless broadband subscriptions<sup>5</sup>, and price of internet connectivity. A time factor was also included in the regression, partially to stand as a proxy for network effects that are known to make their appearance over time. This is justified by the fact that a large amount of internet activity pertains in one way or another to interpersonal networks, so that the network effects spill over from the actual networking platforms to the media pipes used to access said content (i.e. broadband expands as social networks expand).

For this test, quarterly<sup>6</sup> data were sourced over a 12-year period, from June 2002 to June 2014, looking at the entire country. Subscription information and network expansion were retrieved from the Ministry of Internal Affairs and Communications (MIC) database for data after 2008, and the MIC web archives for data 2002-2008. Data on pricing were pooled from the Consumer Price Index (CPI) over the same period, and in particular the category 'Internet connection charges' (45 observations, section D of CPI). All data were transformed to logarithmic values to represent growth.

### **III. Results**

Before looking at the regression findings, it is worthwhile to discuss the results at a preliminary level, starting with the dependent variable, overall broadband penetration.

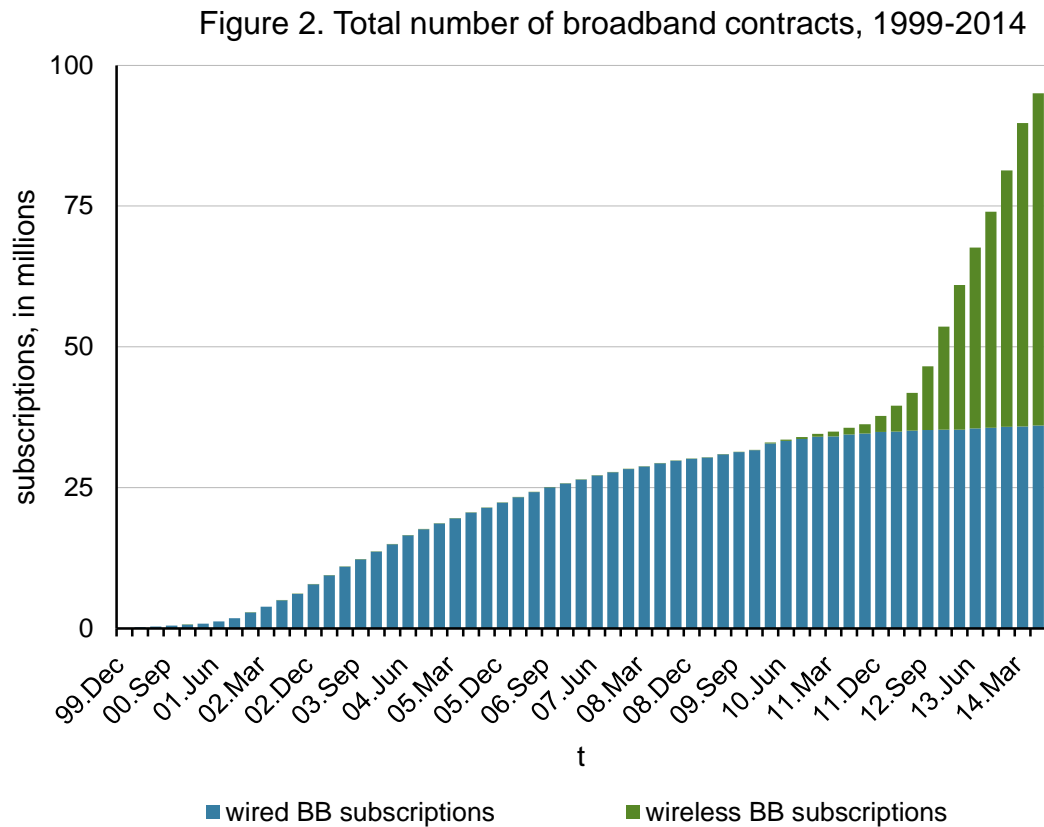
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<sup>5</sup> Mobile internet and wireless internet are not the same, however, the data used here concern FWA, BWA and 3.5/LTE contracts, so that in this study they have been used interchangeably.

<sup>6</sup> Note that the Japanese fiscal year begins in April, making 1st quarter April-June, 2nd July-September, etc.

Despite the discussion on lagging acceptance of broadband, the subscription data show a sharp increase in penetration, as can be seen in the graph below<sup>7</sup>.

There are two main points to be made concerning the above graph. One is that of the two types of broadband, wireless connectivity has experienced the greatest growth in the shortest time (September 2010 to June 2014). The second is that after 2012 increases in the overall penetration rate are almost entirely attributable to new mobile broadband contracts.



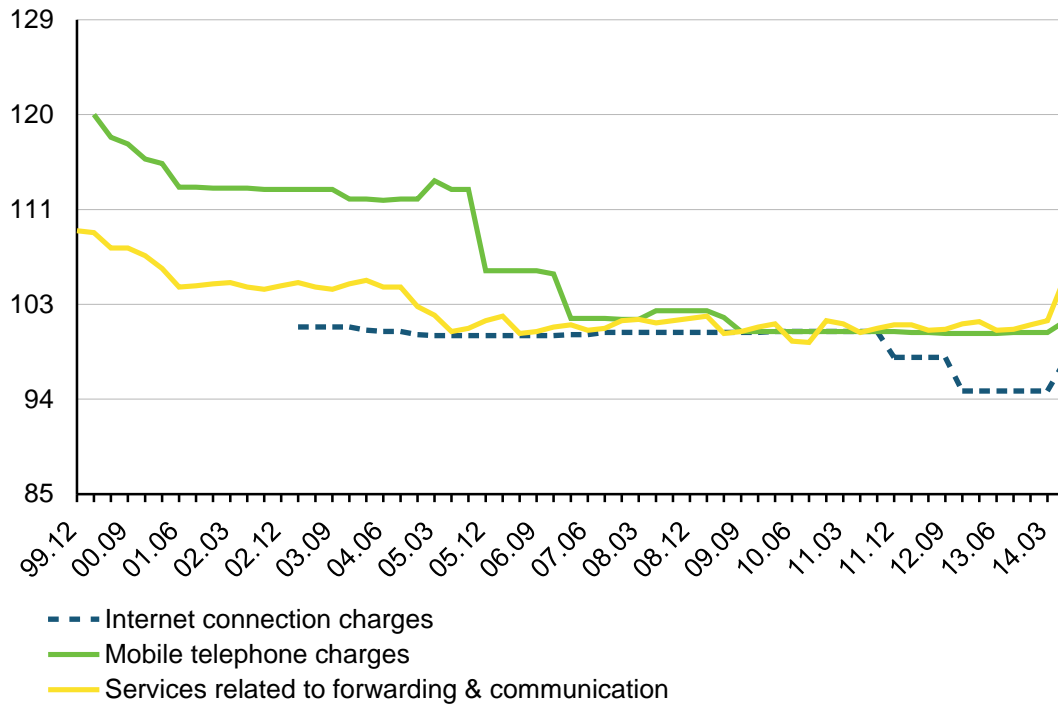
Interestingly, this increase in wireless internet does not match the pricing of communications services over the same period, as can be seen from the next graph. The cost items illustrated here represent categories from the Consumer Price Index relating to communications and connectivity. The prices are in Japanese yen (¥) out of a 10,000JPY<sup>8</sup> total representing the entire CPI basket. This value was chosen because it represents the overall weight of telecommunications expenses for the average consumer, and is also more consistently measured compared to other price indicators.

<sup>7</sup> For the sake of brevity, the term ‘broadband’ in graphs has been abbreviated to BB

<sup>8</sup> At the time of writing, this equaled roughly 90USD or 75EUR.

Thus, in terms of the prices consumers face, a gradual decrease in the cost of telecommunication services can be observed over the 14 year period. Mobile charges experienced the greatest overall decrease, while internet charges have been generally stable.

Figure 3. Price of communications as part of CPI, 1999-2014



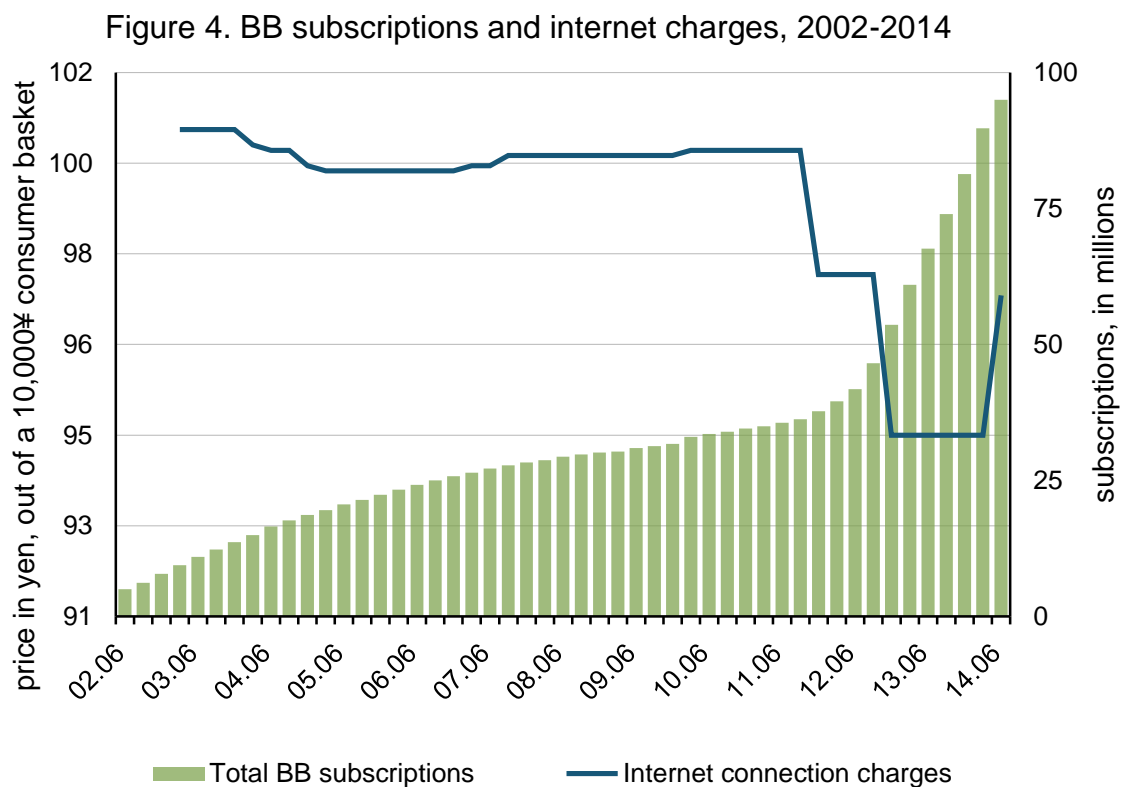
It is worth noticing however, that at the same time that the rapid growth of wireless broadband starts taking place (in 2010, view previous graph), volatility in internet connection charges also begins to appear.

### II.b. Regression results

The previous observation is further supported by the regression findings, which show a significant negative relationship between broadband penetration and the price of internet connectivity (table 1). The competing effect of wireless internet on penetration can also be seen, as can the fact that time imparts a positive trend on the adoption of broadband.

Table 1: Regression Results for broadband penetration, 2002-2014	
Price of internet connection	-0.0599*** (0.0147)
Wireless Broadband subscriptions	-9.8203*** (1.7065)
Time	0.0375*** (0.0025)
Constant	62.0478*** (7.9552)
R-squared	0.9507
no. of observations	46
***p<.01 standard errors in parentheses	

The negative relationship between broadband adoption and pricing is quite intuitive. Figure 4 below presents a more visual representation of the effect of pricing on penetration. With sharp drops in connection charges, broadband penetration increased, however, it would be remiss to assume that the causal effects stop here.





The results also imply a significant turning point in penetration rate growth with the introduction of mobile broadband. The negative impact of wireless access on broadband acceptance solidifies the role of the former over the period studied as a competing good.

The implication here is that when consumers were faced with a choice between wireless and broadband, they chose wireless. Knowing that in terms of overall spending as a CPI ratio, mobile expenses are higher than internet expenses, it can be inferred that the choice of mobile over broadband was not related to contract price, or at least not exclusively. The reasons should be sought instead in more general consumption patterns that favour mobility, which the literature suggests may be attributable to lower barriers to the adoption of mobile in general (Akiyoshi & Ono 2008).

The negative relationship observed between wired and wireless broadband can also be credited to a possible substitution effect. Given that the two types of connectivity function as competing goods, with the appearance of mobile broadband, it can be inferred that some subscribers switched from wired to wireless contracts, choosing to keep only one connection instead of two. It is worth noting however, that the growth of wireless broadband contracts far exceeds the drop in growth of wired broadband, so that even if such an effect is in place it is at this point relatively mild.

#### **IV. Discussion and conclusion**

To return to the question posed in the beginning, it would appear that Japan is not really facing low demand for broadband. The results instead imply that, first, when factoring in mobile broadband (from 2010 onwards), the demand for broadband internet is not as low as is sometimes presented. While subscription rates may still be lower than those originally predicted (see Ida et al. 2008), the actual rate of increase is now higher.

Second, as can be inferred from the negative relationship between total broadband subscriptions and wireless subscriptions, it is perhaps better to frame the under-utilization of broadband networks as a preference for wireless accessibility, or, in other terms, under-supply of mobility. This means that the Japanese broadband market didn't really take off until after wireless internet achieved higher speeds. Some authors have theorised that the preference for mobile internet is the result of particularities of usage in Japan (Ishii 2004), however, more recent studies suggest that this is more likely an international trend (Barth & Heimeshoff 2014).

These two findings combined imply that in the case of Japan, a policy misalignment may have taken place in the matter of broadband internet. While Japanese broadband strategy originally seemed to follow the logic that broadband adoption will catch up once the infrastructure is in place, this was primarily framed within the FTTH system. While systemic focus on the infrastructure layer was undoubtedly relevant for the creation of the backbone network, it seems that policy makers underestimated the importance of mobility for internet users and the eventual impact that would have on the market. It could be argued as a conclusion then, that Japanese broadband policy did not factor in the paradigm shift in internet consumption patterns change, at least not during the first wave of broadband policies.

While this is a lesson that could be of relevance in other countries, it would be remiss not to acknowledge that the Japanese case is in some ways unique. For one, Japan is a wealthy country, so the effect of pricing on mobile broadband penetration would differ depending on whether broadband and mobility are regular or luxury commodities in the context of other economies. Therefore, if we wish to discuss the generalisability of these results, we need to first consider the elasticity of demand for these goods across countries. Nonetheless, some evidence suggests (such as in the aforementioned Barth and Heimeshoff study) that the study results can be of use in providing a better understanding of consumer incentives in a more general context.

In conclusion, the present study tried to capture the effect that changes in internet use patterns impart on technology acceptance, or in this case, the role that the shift to greater mobility played in the diffusion of broadband. The results will hopefully provide policy makers with alternative considerations in addition to pricing when tackling the challenges behind broadband strategy formulation, besides contributing to the academic discussion on demand for internet services.

This was a short-scale study intended as a preliminary step to understand policy management of the demand side in Japan. To determine whether there was a policy effect in place interfering with the market and whether this environment could be observed or duplicated elsewhere, more studies need to be conducted.

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