Does Net Neutrality help a network upgrade?: the lesson from Japan's experiences.

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Introduction

In Japan, there is a rapid proceeding of broadband migration from ADSL to FTTH. According to OECD Broadband Statistics to June 2007, 36% of Japan's broadband subscriber use a fiber connections and Japan's diffusion of a fiber connection is most proceeding in the world. Gandal(2002) pointed out importance of compatibility, standardization, and network effect to analyze a network goods like broadband. Particularly, Indirect network effects have important role in a demand analysis of broadband.

There were some econometric analyses of demand for broadband. But, there is no econometric analysis of network effect to demand for broadband access.

Since 2006, Japanese broadband user is migrating from ADSL to FTTH, even thought there is no declining of price nor increase of speed change. This migration is caused by indirect network effects from service diversification. In Japan, telecommunication operators are obliged not to intercept access to arbitrary contents nor discrimination of arbitrary services. We show net neutrality has a possibility to contribute to a network upgrade.

Estimation

Network subscription equation

Following a formulation of Clements and Ohashi (2006) that derive from Berry (1994) to estimate a indirect network effects by pooled data, we estimate a below network subscription equation by two stage least square.

$$\ln(s_j) - \ln(s_0) = x_j\beta - \alpha p_j + N\omega_j + \sigma \ln(s_{j|BB}) + \xi_j$$

s_j is the share of alternative j, s_0 is the share of not using broadband, $s_{j|BB}$ is a share of alternative j within broadband using alternatives.

x_j is a observable attribute of alternative j, ξ_j is an unobservable attribute of alternative j, p_j is a price of alternative j.

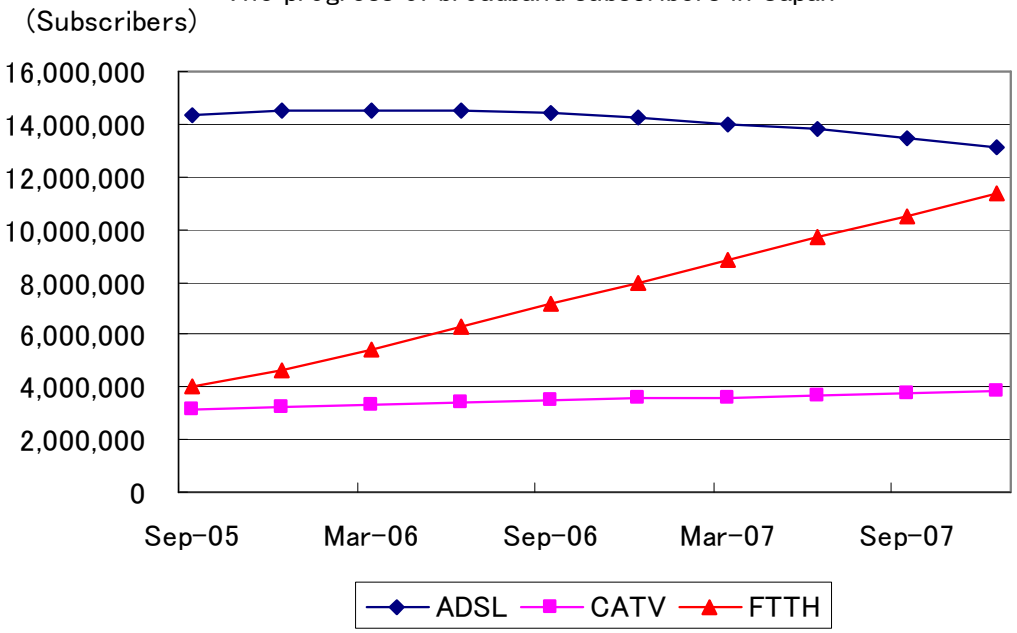
N represents **a indirect network effects** that is captured by number of **music** distribution films, number of **motion picture sharing** services, and number of **online game** titles.Becatuse of compatibility of internet access services, N is same for each alternatives and the parameter of network effects is differ for alternatives.

Endogeneity

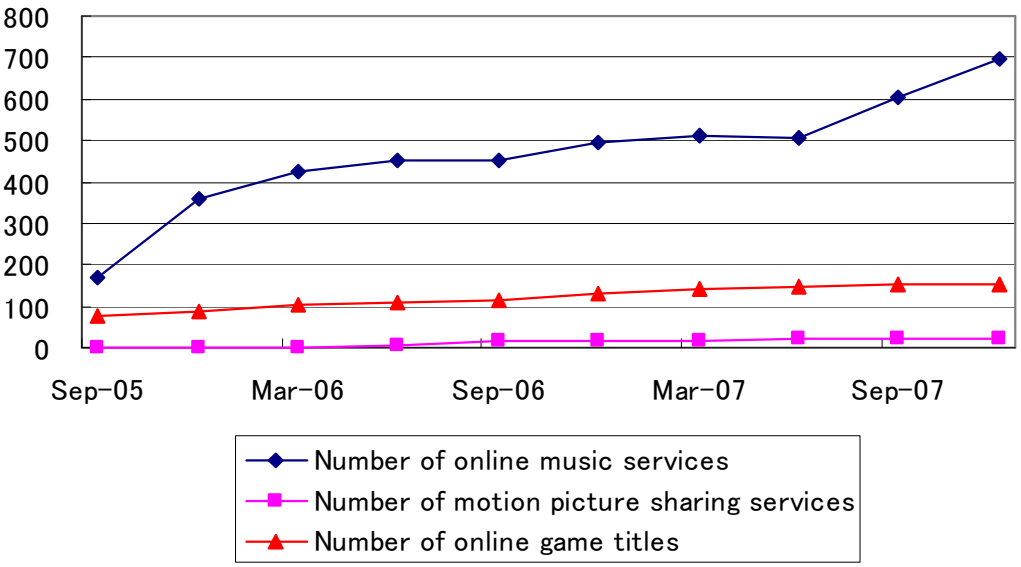
The network subscription equation contains five endogenous variables, price, within share of access service, number of music distribution films, number of motion picture sharing services, and number of online game titles.We get two instruments from access charge set by Ministry of Internal Affairs and Communications (MIC) and three instruments from offline delivered contents.

Data

The progress of broadband subscribers in Japan



Progress of the broadband contents services in Japan



	Price(Real/yen)			Speed(Mbps)			Price per bit (yen/Mbps)		
	ADSL	CATV	FTTH	ADSL	CATV	FTTH	ADSL	CATV	FTTH
Sep-05	3,153	5,227	4,722	50	39	199	62.47	134.68	23.74
Dec-05	3,154	5,227	4,725	50	39	197	62.48	134.96	23.93
Mar-06	3,160	5,239	4,726	50	39	195	62.60	135.48	24.27
Jun-06	3,145	5,192	4,688	50	39	193	62.30	134.41	24.27
Sep-06	3,137	5,177	4,675	50	39	191	62.15	133.72	24.46
Dec-06	3,145	5,190	4,690	50	39	190	62.31	134.06	24.67
Mar-07	3,162	5,232	4,720	50	41	189	62.65	126.73	24.91
Jun-07	3,147	5,202	4,698	50	41	188	62.36	125.85	24.94
Sep-07	3,141	5,196	4,694	50	51	188	62.24	102.79	24.92
Dec-07	3,130	5,267	4,683	50	56	188	62.01	93.82	24.89

Estimation results

	OLS		2SLS without network effects		2SLS with network effects	
N	1410		1410		1410	
R-squared	0.9971					
Adjusted R-squared	0.9968					
Price (thousand yes)	−0.0586**	0.0180	−4.6178	2.9417	**−0.8631****	**0.3936**
Speed (Mbps)	0.0006*	0.0002	0.0896**	0.0126	**0.0070****	**0.0031**
Music (ADSL)	0.0001	0.0000			−0.0001	0.0002
Music (CATV)	0.0002**	0.0000			0.0002	0.0002
Music (FTTH)	0.0006**	0.0000			0.0001	0.0002
Motion picture sharing (ADSL)	0.0020	0.0012			−0.0034	0.0027
Motion picture sharing (CATV)	0.0056**	0.0012			0.0009	0.0033
Motion picture sharing (FTTH)	0.0201**	0.0012			**0.0126****	**0.0117**
Online game (ADSL)	0.0017**	0.0005			**0.0042****	**0.0013**
Online game (CATV)	0.0022**	0.0005			**0.0027***	**0.0012**
Online game (FTTH)	0.0084**	0.0005			**0.0109****	**0.0085**
σ					0.1173	1.1256

* Significance at the 95-percent confidence level.
** Significance at the 99-percent confidence level.

Price and Speed Elasticities (computed by all sample's average using parameters of 2SLS with network effects)

Price elasticities	ADSL	CATV	FTTH	No subscribe
ADSL	−2.6411	1.1104	1.2565	0.8942
CATV	0.3049	−3.7409	0.3815	0.2689
FTTH	0.4706	0.5326	−3.9787	0.5279

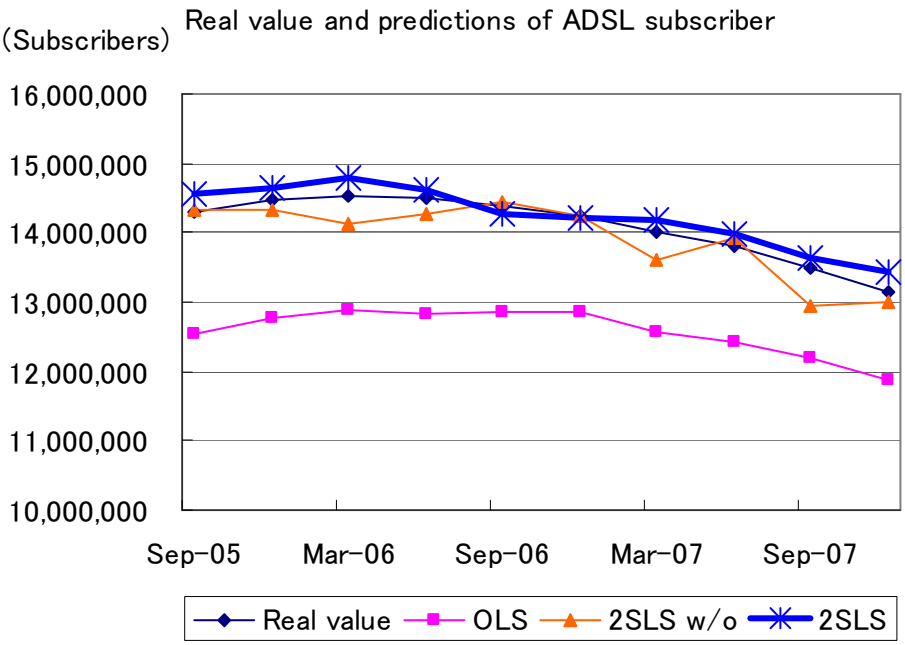
Speed elasticities	ADSL	CATV	FTTH	No subscribe
ADSL	0.2734	−0.0613	−0.3509	−0.0927
CATV	−0.0315	0.2025	−0.0986	−0.0157
FTTH	−0.0488	−0.0326	1.0592	−0.1704

Network effects Elasticities (computed by all sample's average using parameters of 2SLS with network effects)

Contents elasticities		Within	Between	Total
ADSL	Music	−0.0379	−0.0058	−0.0437
	Motion picture	−0.0397	−0.0138	−0.0535
	Online game	0.5175	−0.3486	0.1689
CATV	Music	0.1012	−0.0058	0.0954
	Motion picture	0.0097	−0.0138	−0.0040
	Online game	0.3357	−0.3476	−0.0119
FTTH	Music	0.0671	−0.0058	0.0613
	Motion picture	0.1658	−0.0138	0.1520
	Online game	1.3935	−0.3496	1.0439
No subscribe	Music			−0.0058
	Motion picture			−0.0138
	Online game			−0.3496

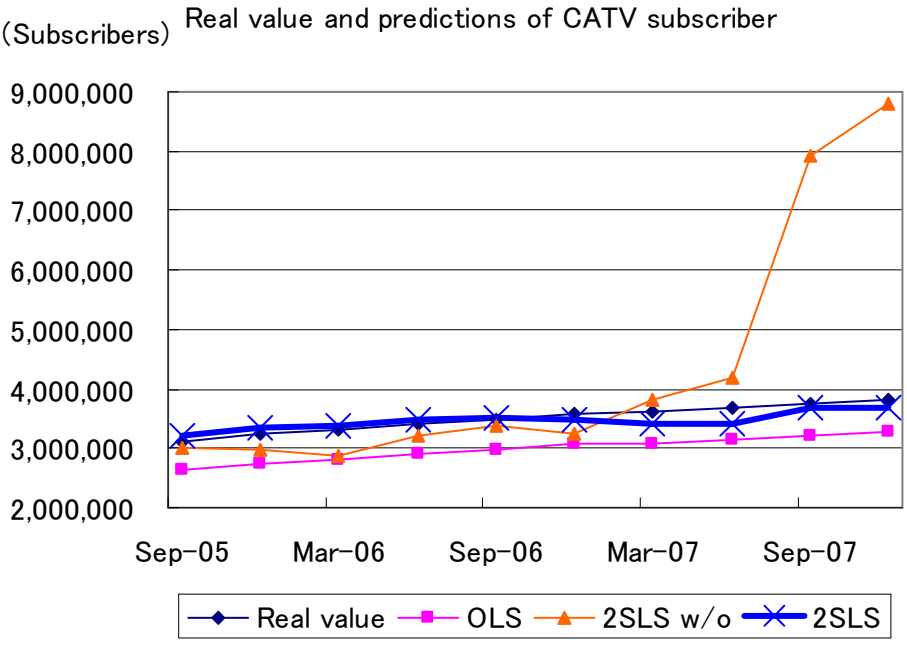
Model fit and bias

ADSL



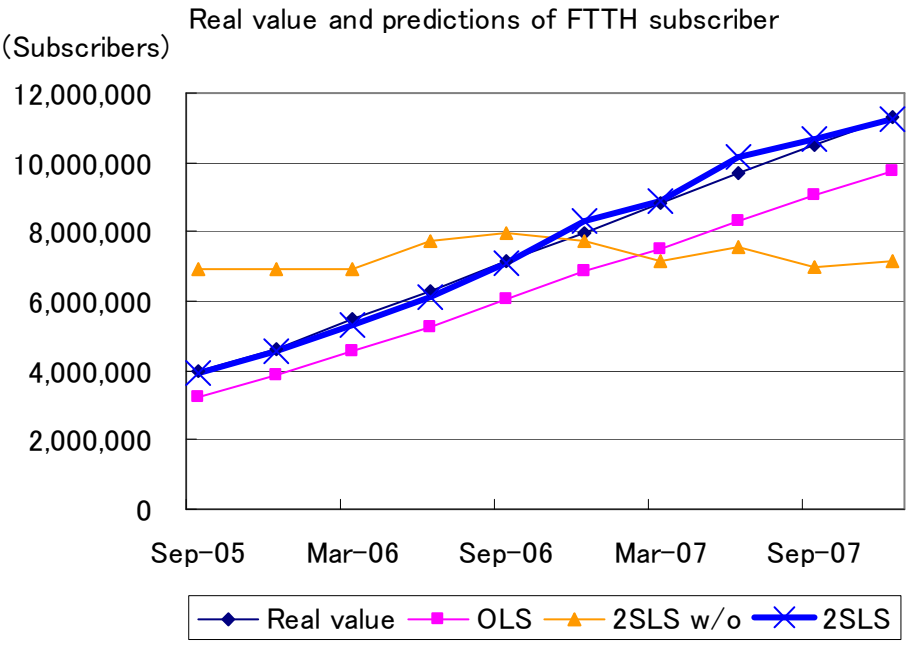
OLS has large downward bias. 2SLS without network effects had a redundant fluctuation. 2SLS shows good fit.

CATV



OLS has large downward bias. 2SLS without network effects has large over estimation that derive from estimation bias of price and speed coefficient. 2SLS shows good fit.

FTTH (Subscribers)



OLS has large downward bias. 2SLS without network effects can not catch a growth of FTTH subscriber. 2SLS shows good fit.

Estimaton bias of elasticities and PCM/MC

There are many techniques for the competition policy that use a price elasticities.A bias of price elasticities leads a wrong policy analysis. Below table shows a estimation bias of price elasticities that calculated from 2SLS without indirect network effects.In case of estimating monopoly films parket power, ignoring network effects underestimates a market power.

Excess ratios	ADSL	CATV	FTTH	No subscribe
ADSL	450.2%	337.3%	383.7%	463.6%
CATV	473.2%	358.5%	436.4%	549.4%
FTTH	373.2%	304.8%	418.4%	430.9%

		ADSL	CATV	FTTH
Price		3147.286	5214.878	4702.126
MC	2SLS w/o	2930.685	4910.865	4474.14
	2SLS	1955.632	3820.86	3520.288
PCM	2SLS w/o	0.068822	0.058297	0.048486
	2SLS	0.378629	0.267316	0.251341

Net neutrality and network upgrade

Incentives for conduits discrimination

Rubinfeld and Singer (2002) pointed out two access provider's incentives to foreclose. Conduit discrimination is insulating its own conduit from competition by limiting rival platform distribution of its affiliated contents and services, and content discrimination insulation it's own affiliated contents from competition by blocking or degrading the quality of outside contents.

In Japan, telecommunication act oblige a telecommunication company to guarantee the secrecy of communication, and it is interpreted to prohibit a contents discrimination.But, there are no regulation for a conduit discrimination.

Below table is a simulated profit of conduit discrimination by foreclosing one contents services film(or title), assuming each access service is provided by a virtual monopolists.

Profit of conduit discrimination

	Music			Movie sharing			Online game		
	ADSL	CATV	FTTH	ADSL	CATV	FTTH	ADSL	CATV	FTTH
2005Q3	534	−59	−50	24,614	617	−4,569	24,127	10,765	7,354
2005Q4	577	−53	−56	27,944	1,465	−5,341	27,087	11,984	8,650
2006Q1	631	−43	−68	32,733	2,526	−6,474	31,271	13,115	10,482
2006Q2	672	−30	−74	36,619	3,943	−7,512	34,621	14,577	12,258
2006Q3	710	−12	−82	40,919	5,463	−8,686	38,270	15,615	14,254
2006Q4	769	6	−99	46,960	7,033	−10,343	43,441	16,702	16,957
2007Q1	774	15	−109	48,696	7,718	−11,146	44,807	17,097	18,209
2007Q2	820	35	−125	53,768	9,560	−13,008	49,110	18,595	21,299
2007Q3	841	51	−104	54,761	11,392	−13,407	50,085	20,600	22,450
2007Q4	869	62	−103	57,266	12,353	−14,125	52,258	21,288	23,776

(thousand yen)

The ADSL monopolist has an largest incentive of conduit discrimination and it is possible to compensate a lost revenue of contents. If the ADSL monopolist execute a conduit discrimination, the consumer welfare loss amounts to ¥2.5M by a music , ¥173M by a movie sharing, ¥158M by an online games.

Conclusion

1. From the results of estimation, we show the migration to **FTTH services in Japan are stimulated by the indirect network effects from the contents services.**
2. **Therea are a large upward bias in estimates of price elasticities that ignore the indirect network effects.** This suggests that policy analysis based on elasticity estimates that ignore the indirect network effects will underestimate price–cost margins.
3. ADSL service provider has the largest incentives to foreclose a broadband contents service film. If there are no network neutrality, ADSL provider foreclose a contents provider to lock in their customer. It make hinder a diffusion of FTTH services. **Net neutrality helps ADSL user's migration to FTTH services.**

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