EMPIRICAL CONSIDERATION OF THE EFFECTS OF BIT/DATA CAP ON TELECOMMUNICATIONS OPERATORS

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Abstract

This article considers a case where a regulatory agency introduces a qualitative incentive into competition. Due to severe competition, telecom operators use charging schemes to increase revenues and introduce differentiated services to meet individual demands. This means that include many factors for differentiation. It is hard to explain or justify the pricing of that services differentiated only by price and quantity. For agency oversight, we use logit and probit model which can set a threshold of Bit/Data cap at standard deviation level and 5GB level derived from sample basic statistics. Basic statistics show that downlink speed under a data cap is about 24Mbits/s, and other variables show that operators tend to set lower than standard deviation level. This implies that customers using data cap plan receive lower quality of service. The estimation at 5GB level suggests that setting the cap at 5GB would be statistically more significant than the case of the cap at standard deviation level, and would be justified even for fixed line data. This implies that the cap of 5GB in the mobile market seems to be calculated, justified, and set by the operators. The irrationality of this implication is that most operators set the same amount of the cap, even though the capacity, density, and quality of their networks are different. A 5GB cap could be justified as long as their services are offered by bundling. This article concludes that the agency could determine to what extent the threshold of the cap seems appropriate. Estimation in this article suggest that the Price-per-Mbit/s price could be an effective indicator and regulatory instrument of bit/data cap because this variable has statistically significant sensitivity.

Key words: Telecommunications, Regulations, Bit/Data Cap, Incentive

JEL Classification: L43, L86, L96

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1. INTRODUCTION

Innovation in telecommunications encourages competitive markets, and contributes to a decline in overall revenue 5.1 percent. The margin of the early 2000's economic bubble plays a role of buffer even in the face of the recent economic crisis in the telecommunications industry¹. A bit/data cap is a conventional way to limit data use and avoid data traffic congestion. A decision on the amount of data is an arbitrary managerial decision. In virtue of competition, business practices are rarely discussed in the name of freedom of management under competition. This article focuses on the effect of the practice.

This article considers the effects of a practice implemented worldwide in the telecommunications industry. The practice sets a "cap", a quantitative limit on data use, and charges additionally when customers use more than the limit set by operators.

This article examines the validity of the cap through analysis of empirical data of fixed telephone services under the models we discuss here, and proposes a bridge over the problem in mobile services. The practice of the cap has been implemented over the years in fixed line telecom services. Therefore, models in this article examine factors that determine the cap. This model considers not only the effect of each factor, but also policy issues so that this practice can be supervised by the agency. In short, how a cap can be set and rationalized is examined.

Recently, telecom operators have implemented or attempted to implement bit/data caps on telecom data services. The practices are implemented in a process covering enough network capacity or geographical area to provide data services. A concern we point out here is one when all operators implement the practice uniformly. We also point out that a certain degree of uniform practice could be rational even though the practice tends to be justified in virtue of freedom of business management.

In section 2, we review the background of some aspects, especially the methodological background. Section 3 examines empirical data and considers basic statistics. Section 4 explores models. Section 5 estimates them to describe characteristics of the practices, and proposes a direction to meet the goal. Section 6 concludes the article and points out some future extensions.

¹ OECD Communications outlook 2011

2. BACKGROUND

To include qualitative aspects in competition, an incentive should have objective(s) and criteria (parameters) to be set. In view of economics,

"(Q)ualitative policy refers, in our terminology, to changing details of social organization rather than foundations... Changes in social organization, even if they refer to less important aspects only, will, as a rule, be less frequent than quantitative changes in the value of existing instruments of economic policy" (Tinbergen, 1964).

In the quantitative world, i.e. in neoclassical economics, discussions are not simply a matter of equality between price and marginal cost in virtue of efficiency. In the telecommunications market, rate-of-return regulation may cause an asymmetric information problem between agency and monopoly operator, though it contributes to minimize total cost. Therefore over-capitalization may occur in order to earn a return on capital and discourage entry by competition (Averch-Johnson, 1962).

To deal with this, a regulatory agency sets a limit on the revenue they earn. A regulation to set such a limit is price cap regulation. The major problem of price cap regulation is the time of the initial setting of the cap. This means that price cap regulation also has an asymmetric information problem where the operator overstates its costs, and it is hard for the agency to track. The price cap itself is derived from an index, CPI. Change in individual behavior has only a small influence on the price cap. Some theoretical discussions consider it quantitatively (Armstrong and Sappington, 2007, Cabral and Riordan, 1989, and Clemenz, 1991).

As historical background, the telecom industry experienced privatization from being a nationalized monopoly to market competition in the mid-1980s. The industry faced a high cost structure which market power reduced. The case in UK was examined their experiences and price cap regulation (Beesley, 1997).

Through these experiences, the telecommunications market introduced competition and become more competitive, and now faces severe competitive circumstances. Due to severe competition, telecom operators devised charging schemes to increase revenues. Furthermore, they introduced differentiated services to meet individual demands. This means that services comprise many factors enabling differentiation. It is hard to explain or justify the pricing of differentiated services by considering only price and quantity. This is why it is necessary to also take quality into consideration. To evaluate these complicated services in broader terms, we need to have a certain standard. This article considers possible options. Therefore, the objective of the agency is to assess competitive circumstances in a qualitatively highly differentiated

market. The following background shows that the standard we expected is statistically testable using empirical data.

The background for the methodology of this article is based heavily on an article (Bouissou, Laffont, and Vuong, BLV, 1986), which considers log-likelihood ratio test for noncausality; noncausality is the abstract or theoretical concept of stochastic process of quality. The definition of noncausality by BLV is as follows,

"(I)f X, Y are two stochastic processes, then Y does not cause X at any instant."

In this definition, X involves an infinite number of random variables, so conditions need to be set to reduce independence properties of a finite set of variables. BLV defined the probability distribution such that Y does not cause X if qualitative data are available. The two stochastic processes in BLV are set in time, past and future, but this article sets it in relation to a certain threshold of the variable we discuss, under or over a bit/data cap. As BLV set the value of X as null when the time is before a certain defined period of time, we set the value of the cap as null when the cap was over a certain defined threshold. The probability model estimates a stationary process, which identifies the independent restriction, the threshold, to be defined. Details of the model are discussed in section 4.

3. THE DATA

To obtain qualitative data, empirical data in this article are based on OECD data which include detailed data on the cap and periodic data as a time series in OECD Communications Outlook. To discuss the characteristics and effects of the cap per se, this article focuses on a static model and data. Modification of X on theoretical assumptions contributes to adjust to static consideration, which would also work as a benchmark to capture the status quo of the market and its validity.

The empirical data cover the most recent data available on the amount of the bit/data cap, downlink and uplink access speed, and minutes to the cap, monthly payments (USDPPP), and price per Mbits/s (USDPPP)². These variables are almost all available from the data source related to the cap. The data used cover all service plans offered in OECD member countries that have a bit/data cap.

This article shows possible empirical contributions to the Incentive using observed data. If competition needs the bit/data cap, the scheme or model should be simple and easy to capture

² All data used are shown in the Appendix. The measure of value is in USDPPP for consistency of the data.

without observing and listing lots of data and variables. To achieve this goal, assumptions and settings should be carefully defined. These normative considerations are referred to in the next section.

Table 1 shows correlations of the variables in the data. Some relationships indicate relatively high numbers as shown; between downlink speed and Monthly payment, between downlink and the cap, and between monthly payment and the cap. This suggests that the bit/data cap practice tends to affect downlink speed and monthly payments.

Table 1: C	Correlation of	Variables
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(obs=168)						
	Downkb~s	Upkbits	Minute~p	USDpri~P	PMbits~P	BitcapMB
Downkbits	1.0000					
Upkbits	0.1925	1.0000				
Minutestor~p	-0.2660	-0.1388	1.0000			
USDpricemo~P	0.4648	-0.0273	-0.0441	1.0000		
PMbitsUSDPPP	-0.3978	-0.1767	0.3531	-0.0287	1.0000	
BitcapMB	0.4995	0.0187	0.2935	0.5649	-0.2042	1.0000
	•					

Source: OECD Communications Outlook 2011 & OECD Broadband Statistics Sep., 2010

Table 2 shows sample statistics of the data used in this article. The statistics show that downlink speed under data cap is about 24Mbits/s, and other variables show that operators in the status quo tend to set lower than standard deviation level. This indicates that customers in status quo using data cap plan use lower level in quality of service. This result shows the need to improve the circumstances of customers using bit/data cap plan.

Variable	Obs	Mean	Std. Dev.	Min	Max
Downkbits	185	23345.14	24617.64	512	102400
Upkbits	170	5442.637	10934.23	128	50000
Minutestor~p	185	875.689	1624.719	8.888889	9333.333
USDpricemo~P	181	48.59519	22.64153	0	145.8096
PMbitsUSDPPP	181	7.183355	11.99387	0	66.36744
BitcapMB	185	73194.59	89970.25	1000	500000

Table 2: Sample Statistics

Source: OECD Communications Outlook 2011 & OECD Broadband Statistics Sep., 2010

4. THE MODEL

4.1. Normative Assumptions and Settings as an Incentive

Based on the theoretical background in section 2, for empirical analyses, not only the data used but also the assumptions and settings are important to describe how we define the characteristics of the cap and market in question.

Actual management in the market is not adjustable in real time. This means that management has "slackness". Discussions of this kind of slackness were treated as an efficiency measure (Selten, 1986, Abel-khalik, 1988, and Berg and Jeong, 1991). These arguments consider the effectiveness of slackness using probit model (Berg and Jeong, 1991), and for setting the target we discuss a threshold (Abel-khalik, 1988).

Implementing a concept of differentiation in empirical analysis suggests that an efficient upstream differentiates downstream, and decisions may differ in preferences (Villas-Boas, 2009). Furthermore, we implement a model setting the mean value as the threshold (Berry, Levinsohn, and Pakes, 1995). Unlike that article, this article introduces the value of the standard deviation, or one derived from basic statistics, as the threshold.

4.2. The Simple OLS Model

To describe bit/data cap in practice, we build a model of how charges and speeds affect the amount of the cap. We consider a simple mechanism to build a regulatory tool to capture the characteristics of the practice, and obtain better network services, that do not restrict operators' behaviors. The simple OLS model is as follows;

$$DC_{i} = \alpha_{0} + \alpha_{1}DL_{i} + \alpha_{2}UP_{i} + \alpha_{3}MIN_{i} + \alpha_{4}MON_{i} + \alpha_{5}PBIT_{i} + u,$$

where

- DC: Data Cap (MB)
- DL: Downlink Speed (kbits/s)
- UP: Uplink Speed (kbits/s)
- MIN: Minutes to reach the bit/data cap (min.)
- MON: Monthly payment (USDPPP)
- PBIT: Price per Mbit/s (USDPPP).

4.3. The Logit and Probit Model

To consider the cap and its incentive, a certain amount of the cap would be determined. In statistical view, we consider the case where the agency sets the amount of the cap level at the standard deviation level, STDDEV, obtained from statistical data.

Following the theoretical background in section 2, we set DC as a latent variable and assume $DC^* = 1$ if DC becomes more than the standard deviation level, and $DC^* = 0$ if DC is less than the level, shown as follows;

$$DC > STDDEV \iff \alpha_0 + \alpha_1 DL + \alpha_2 UP + \alpha_3 MIN + \alpha_4 MON + \alpha_5 PBIT + u > 0$$
$$\iff u > -\alpha_0 - \alpha_1 DL_i - \alpha_2 UP - \alpha_3 MIN_i - \alpha_4 MON_i - \alpha_5 PBIT_i.$$

To obtain DC*=1, we assume its probability, P(DC*=1),

$$P(DC^* = 1) = P(DC > STDDEV) = P(u > -\alpha_0 - \alpha_1 DL - \alpha_2 UP - \alpha_3 MIN - \alpha_4 MON - \alpha_5 PBIT)$$
$$= 1 - F(-\alpha_0 - \alpha_1 DL - \alpha_2 UP - \alpha_3 MIN - \alpha_4 MON - \alpha_5 PBIT)$$

 $P(DC^*=0) = P(DC \le STDDEV) = P(u \le -\alpha_0 - \alpha_1 DL - \alpha_2 UP - \alpha_3 MIN - \alpha_4 MON - \alpha_5 PBIT)$ $= F(-\alpha_0 - \alpha_1 DL - \alpha_2 UP - \alpha_3 MIN - \alpha_4 MON - \alpha_5 PBIT)$

where $F(\cdot)$ is the cumulative distribution function. So 5GB can be set instead of STDDEV in the model.

5. THE RESULTS AND ESTIMATION

The result and estimation of the simple OLS model are shown in table 3. The model shows a certain fit, the rate of adjusted R-squared being 0.5843, and some interesting results.

Coefficients of monthly payment and per Mbits/s price show that the relations between the cap and each of the 2 parts of the charges have the same proportion but opposite direction. This means that charging higher monthly payments tends to set about 1.6GB higher when every USDPPP of the monthly payment increases, in case of charging higher Mbit/s price, and vice versa (if set about 1.6GB lower, every USDPPP increases). The variable MIN shows that the cap increases about 25MB of when it takes one minute more.

Tables 4-1 and 4-2 show the estimation using logit and probit model. As assumptions and settings shown in section 4, we describe the cap when the agency defines the amount of the cap, and examine its validity statistically. As shown in the previous section, we set one of the

thresholds at the level of the standard deviation. Ordinary estimation in logit model sets zero as the threshold of DC in normalization. This methodology is referred to in section 2 above.

All variables observable in the model except uplink speed are statistically significant as this model is following statistical procedures. In the logit model, we obtain better significance and different characteristics than we expect intuitively.

Source	SS	df	MS		Number of obs	= 168
					F(5, 162)	= 47.94
Model	7.6094e+11	5 1.521	9e+11		Prob > F	= 0.0000
Residual	5.1430e+11	162 3.174	17e+09		R-squared	= 0.5967
					Adj R-squared	= 0.5843
Total	1.2752e+12	167 7.636	52e+09		Root MSE	= 56345
BitcapMB	Coef.	Std. Err.	t	P> t	[95% Conf.	Interval]
Downkbits	1.214278	.2261913	5.37	0.000	.7676147	1.660942
Upkbits	0736806	.4102286	-0.18	0.858	8837654	.7364043
Minutestore~p	25.07939	2.809708	8.93	0.000	19.53101	30.62776
USDpricemon~P	1607.965	221.7996	7.25	0.000	1169.973	2045.956
PMbitsUSDPPP	-1607.329	407.8008	-3.94	0.000	-2412.62	-802.0388
cons	-44601.59	11405.24	-3.91	0.000	-67123.7	-22079.47

 Table 3: Estimation of the Simple OLS Model

Table 4-1: Estimation of the Logit Model under the Cap at Standard Deviation Level
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Logistic regres	ssion			Number	of obs	=	168
				LR chi	2(5)	=	155.02
				Prob >	chi2	=	0.0000
Log likelihood	= -26.432545			Pseudo	R2	=	0.7457
dum_cap	Coef.	Std. Err.	Z	P> z	[95%	Conf.	Interval]
Downkbits	.0000362	.0000162	2.24	0.025	4.476	e-06	.000068
Upkbits	.0000386	.0000245	1.57	0.115	-9.446	e-06	.0000867
Minutestore~p	.0096622	.0021671	4.46	0.000	.0054	4148	.0139097
USDpricemon~P	.0973612	.0268512	3.63	0.000	.0447	7338	.1499887
PMbitsUSDPPP	-1.092491	.2791981	-3.91	0.000	-1.639	9709	5452728
_cons	-9.572502	2.148389	-4.46	0.000	-13.78	3327	-5.361738
Note: 14 failur	res and 10 suc	ccesses comp	letely de	etermined	•		

Average margina	al effects			Number	of obs =	168
Model VCE :	OIM					
Expression : dy/dx w.r.t. :		-	storeach	bitcap US	Dpricemonthl	уРРР
	dy/dx	Delta-method Std. Err.	Z	P> z	[95% Conf	. Interval]
Downkbits	1.74e-06	6.95e-07	2.51	0.012	3.83e-07	3.11e-06
Upkbits	1.86e-06	1.13e-06	1.65	0.099	-3.50e-07	4.07e-06
Minutestore~p	.0004649	.0000465	9.99	0.000	.0003737	.0005562
		0000100	5.11	0.000	.002888	.0064817
USDpricemon~P	.0046848	.0009168	0.II	0.000	.002000	.000401/

 Table 4-2: Estimation of the Probit Model under the Cap at STD Dev. Level

Probit regressi	on			Number	of obs	=	168
				LR chi2(5) =			156.02
				Prob >	chi2	=	0.0000
Log likelihood	= -25.934349			Pseudo	R2	=	0.7505
dum_cap	Coef.	Std. Err.	Z	P> z	[95%	Conf.	Interval]
Downkbits	.0000221	9.18e-06	2.40	0.016	4.06	e-06	.0000401
Upkbits	.0000257	.0000132	1.95	0.051	-1.310	e-07	.0000515
Minutestore~p	.0055607	.001169	4.76	0.000	.0032	2695	.0078518
USDpricemon~P	.0572013	.0151497	3.78	0.000	.0275	5085	.0868941
PMbitsUSDPPP	6222723	.1414881	-4.40	0.000	8995	5839	3449607
cons	-5.661604	1.202083	-4.71	0.000	-8.017	7644	-3.305565

Note: 27 failures and 14 successes completely determined.

Average margina	al effects			Number	of obs	=	168
Model VCE :	OIM						
Expression : dy/dx w.r.t. :		-	storeach	bitcap USI	Opricemont	chly	PPP
		Delta-method					
	dy/dx	Std. Err.	Z	₽> z	[95% Co	onf.	Interval]
Downkbits	1.84e-06	6.70e-07	2.74	0.006	5.23e-0)7	3.15e-06
Upkbits	2.13e-06	9.97e-07	2.14	0.032	1.81e-0	7	4.09e-06
Minutestore~p	.0004626	.0000457	10.12	0.000	.00037	73	.0005523
USDpricemon~P	.004759	.0008864	5.37	0.000	.003021	16	.0064963
PMbitsUSDPPP	0517712	.0070007	-7.40	0.000	065492	23	0380502

Taking a recent trend in the mobile data market into consideration, some mobile operators implement a 5GB cap to limit explosive demand for data use, and avoid congestion of their network. Recent lively demand for mobile data use is not a phenomenon that arose suddenly. Operators have emerged to bundle their services in the name of fixed and mobile convergence. This business strategy benefits both operators and customers, but operators underestimate the demand for data use. Customers take the bundled service as a seamless service and expect seamless access without limits on the place of access. Lower charges on each service caused by bundling seems to give an excuse for lower quality of each service. It seems this bundling trend makes this article relevant even for data on fixed line services.

As shown in the tables, the marginal effect of the PBIT shows that this variable fee causes about 2.5% or 5.2% decline of the probability of setting the cap at each level. The estimation at 5GB level shown in table 5-1 and 5-2 suggests that setting the cap at 5GB would be statistically more significant than the case of the cap at standard deviation level, and be justified even under fixed line data. This implies that the cap of 5GB in mobile market seems to be calculated, justified, and set by the operators. The irrationality of this implication is that most operators set the same amount of the cap even though the capacity, density, and quality of their networks are different. A 5GB cap could be justified as long as their services are offered by bundling, and the PBIT would have the same level and conditions as those of fixed line services.

Logistic regres	sion			Number	of obs	=	168
				LR chi2(5) =			135.39
				Prob >	chi2	=	0.0000
Log likelihood	= -6.3673264			Pseudo	R2	=	0.9140
dum_cap5GB	Coef.	Std. Err.	Z	₽> z	[95%	Conf.	Interval]
Downkbits	0000502	.0001047	-0.48	0.632	0002	2555	.0001551
Upkbits	.0003572	.0003443	1.04	0.300	0003	3177	.0010321
Minutestore~p	.0831697	.0427457	1.95	0.052	0006	5104	.1669498
	.4408606	.2465946	1.79	0.074	0424	1559	.9241772
USDpricemon~P							
USDpricemon~P PMbitsUSDPPP	-2.133419	1.072962	-1.99	0.047	-4.236	5386	0304527

 Table 5-1: Estimation of the Logit Model under the Cap at 5GB Level

Average margina	al effects			Number	of obs =	168		
Model VCE :	OIM							
<pre>Expression : Pr(dum_cap5GB), predict() dy/dx w.r.t. : Downkbits Upkbits Minutestoreachbitcap USDpricemonthlyPPP</pre>								
		Delta-method Std. Err.	Z	₽> z	[95% Conf.	Interval]		
Downkbits	-5.78e-07	1.18e-06	-0.49	0.624	-2.89e-06	1.74e-06		
Upkbits	4.12e-06	3.64e-06	1.13	0.258	-3.02e-06	.0000112		
Minutestore~p	.0009583	.0003112	3.08	0.002	.0003484	.0015682		
USDpricemon~P	.0050798	.0020004	2.54	0.011	.0011592	.0090004		
PMbitsUSDPPP	0245821	.0075576	-3.25	0.001	0393948	0097694		

Table 5-2: Estimation of the Probit Model under the Cap at 5GB Level

Probit regressi	ion			Number	of obs	=	168
				LR chi	2(5)	=	135.63
				Prob >	chi2	=	0.0000
Log likelihood	= -6.2495927			Pseudo	R2	=	0.9156
_							
	r						
dum cap5GB	Coef.	Std. Err.	Z	P> z	[95%	Conf.	Interval]
Downkbits	0000285	.0000577	-0.49	0.621	0001	417	.0000846
Upkbits	.0001967	.0001972	1.00	0.319	0001	L898	.0005832
Minutestore~p	.0476209	.0241081	1.98	0.048	.0003	3699	.0948718
USDpricemon~P	.2439697	.1343844	1.82	0.069	0194	1189	.5073583
PMbitsUSDPPP	-1.222599	.6043495	-2.02	0.043	-2.407	7102	0380956
cons	-7.902153	4.138259	-1.91	0.056	-16.01	L299	.2086854

Note: 11 failures and 121 successes completely determined.

Average marginal effects Number of obs =										
Model VCE :	MIO									
<pre>Expression : Pr(dum_cap5GB), predict() dy/dx w.r.t. : Downkbits Upkbits Minutestoreachbitcap USDpricemonthlyPPP</pre>										
	Г	Delta-method								
			Z	₽> z	[95% Conf.	Interval]				
Downkbits	-5.72e-07	1.14e-06	-0.50	0.614	-2.80e-06	1.65e-06				
Upkbits	3.94e-06	3.70e-06	1.07	0.287	-3.31e-06	.0000112				
Minutestore~p	.0009546	.0003252	2.94	0.003	.0003172	.001592				
USDpricemon~P	.0048906	.0020712	2.36	0.018	.0008312	.00895				
PMbitsUSDPPP	0245082	.0079078	-3.10	0.002	0400072	0090092				
	<u> </u>									

6. CONCLUSION

This article considers a case where a regulatory agency takes a qualitative incentive into consideration for competition. By way of oversight, a regulatory agency could use logit and probit model which could set a threshold of Bit/Data cap at the standard deviation level and 5GB level derived from sample basic statistics.

Unlike earlier studies, we apply logit and probit models to the telecommunications market, and modify its setting of a stochastic process to a 5GB threshold set by statistical result, standard deviation, and practical market observation. To do this, we organize empirical data available worldwide and consider qualitative factors. This article substitutes the cap-setting process taking qualitative factors into consideration for the neoclassical price setting process in a view of quantitative adjustment. With this view, we use empirical methodology to justify thresholds actually set by operators. The result and estimation of this article would contribute not only to capturing relationships in the market with the cap we actually face, but would also give the regulatory agency a regulatory instrument to benchmark. The contribution also shows that this analysis gives some reasons for operators to rationalize thresholds they actually set.

Through our estimation, threshold settings of monthly and per Mbit/s are more likely to be set by the capacity that could be accessed without congestion or other concerns on quality of service, as one of the factors "minutes to the limit" represents a certain usability of the service. Estimation of section 5 suggests that the Price-per-Mbit/s could be an effective indicator of bit/data cap, because this variable is statistically significant.

In this analysis, we tried to implement an interaction term, but we could not get statistically significant results in our logit and probit model. We should point out that the empirical data on the cap used are for fixed line services, so the result and estimation could be difficult to explain the mobile market. However applying our contributions to the mobile market, we found some rationality in the threshold settings of the market. In other words, the cap could be justified as long as services are offered by bundling; we could think the mobile market is similar to a state of fixed line service. Considering trends in the mobile market, we need to collect detailed data worldwide on mobile data usage. Future analysis should build a more persuasive model as a regulatory instrument. Further analysis needs to consider more detail on market circumstances in a single country.

We should also make deeper observation on the existence of slackness in the threshold, i.e. when operators offer a lower level of threshold than the optimal level at a given price as we discussed here. Furthermore, not only implementing a concept of differentiation in empirical analysis, but use of empirical data of the mobile market is necessary for deeper understanding of telecommunications industry.

Australia	Company Bigpond/Telstra Bigpond/Telstra Bigpond/Telstra	Plan BigPond Elite 2GB BigPond Elite 2GB BigPond Turbo 2GB	Downkbits 30720 20480	Upkbits 1000 1000		Minutestorea chbitcap 8.8888889	USDprice monthlyP PP 32.68979	PMbitsUS DPPP 1.63449	dum_cap 0	dum_cap5 GB 0	
Australia Australia Australia Australia Australia	Bigpond/Telstra Bigpond/Telstra	BigPond Elite 2GB				8.8888889	32.68979	1 63449	0	0	
Australia Australia Australia Australia	Bigpond/Telstra		20480	1000				1.00110			
Australia Australia Australia		BigPond Turbo 2GB				13.333333	32.68979	1.08966	0	0	
Australia Australia	Bignond/Telstra		8192	256		33.333333	26.14529	3.268161	0	0	
Australia		BigPond Turbo 2GB	1536	128		177.77778	26.14529	17.43019	0	0	
	Internode	Home-512-Starter	512	128		1333.3333	26.14529		0	0	
Australia	Internode	Home-NakedExtreme-10	24576	1000		55.555556	32.68979	1.362075	0	1	
	Internode	Home-UltraBundle-10	20480	820		66.666667	39.20157	1.960079	0	1	
	Internode	Home-NakedUltra-10	20480	820		66.666667	32.68979	1.63449	0	1	
	Internode	Home-FibreHigh-15	102400	2000		20	52.3233		0	1	
	Internode	Home-FibreMid-15	51200	8000		40	39.23429		0	1	
	Internode	Home-FibreEntry-15 (standard plan)	25600	4000		80	32.68979	1.307592	0	1	
Australia	Internode	Home-Fast-25	24576	1000		138.88889	65.37958		0	1	
Australia	Internode	Home-Standard-25	1536	256		2222.2222	52.29058		0	1	
	Internode	Home-FibreHigh-30	102400		30000	40	58.8678		0	1	
	Internode	Home-FibreMid-30	51200	1000		80	45.7788	0.915576	0	1	
	Internode	Home-FibreEntry-30	25600	2000		160	39.23429	1.569372	0	1	
	Internode	Home-Extreme-30	24576	8000		166.66667	45.74607	1.906086	0	1	
Australia	Optus	30GB Broadband + Home Phone	20480	4000		200	45.74607		0	1	
Australia	Bigpond/Telstra	BigPond Turbo 50GB	30720	1000		222.22222	52.3233	1.74411	0	1	
Australia	Internode	Easy Broadband	24576	1000		277.77778	52.29058		0	1	
Australia	Internode	Home-Fast-50	24576	1000		277.77778	85.01309		0	1	
	Bigpond/Telstra	BigPond Turbo 50GB	20480	1000		333.33333	85.01309		0	1	
Australia	Internode	Home-Standard-50	1536	256		4444.4444	58.83508		0	1	
Australia	Internode	Home-FibreHigh-60	102400	2000		80	65.4123		0	1	
	Internode	Home-FibreMid-60	51200	8000		160	52.3233	1.046466	0	1	
Australia	Internode	Home-FibreEntry-60	25600	4000		320	45.7788	1.831152	0	1	
Australia	Internode	Home-NakedExtreme-60	24576	1000		333.33333	45.7788	1.90745	0	1	
	Internode	Home-UltraBundle-60	20480	820		400	52.29058		0	1	
	Internode	Home-NakedUltra-60	20480	820		400	45.7788	2.28894	0	1	
Australia	Internode	Home-FibreHigh-100	102400	1000		133.33333	78.50131		1	1	
	Internode	Home-FibreMid-100	51200	2000		266.66667	65.4123	1.308246	1	1	
	Internode	Home-FibreEntry-100	25600	8000		533.33333	58.8678		1	1	
Australia	Internode	Home-NakedExtreme-100	24576	4000		555.55556	58.8678		1	1	
	Internode	Home-Fast-100	24576	1000		555.55556	111.1911	4.632963	1	1	
Australia	Internode	Home-UltraBundle-60	20480	820		666.66667	65.37958	3.268979		1	
	Internode	Home-NakedUltra-100	20480	256		666.66667	58.8678	2.94339	1	1	
Australia	Internode	Home-Standard-100	1536	820		8888.8889	85.01309		1	1	
Australia	Optus	Naked (Standalone) Broadband 14 GB	20480		120000	800	39.26047	1.963024 2.290249	1	1	
Australia	Optus	Naked (Standalone) Broadband 30 GB Naked (Standalone) Broadband 60 GB	20480 20480		170000	1000	45.80497 52.34948		1	1	
Australia	Optus Internode			1000		1133.3333			1	1	
Australia	Internode	Home-Fibrehigh-200 Home-FibreMid-200	102400 51200	1000		266.66667 533.33333	104.6793 87.00916	1.740183	1	1	
Australia Australia				2000					1	1	
	Bigpond/Telstra Internode	BigPond Elite 200GB Home-FibreEntry-200	30720 25600	8000		888.88889 1066.6667	65.4123 85.04581	3.270615 3.401833	1	1	
Australia		BigPond Elite 200GB		4000		1333.3333	65.4123	3.401833	1	1	
Australia	Bigpond/Telstra Internode	Home-NakedExtreme-240	20480 24576	1000		1333.3333	71.95681	2.9982	1	1	
Belgium	Base	home internet 1	1024	256		133.33333	27.68549		0	0	
Belgium	Telenet	BasicNet	4096	400		500	20.93023		0	1	
	Belgacom	Internet Start	3072	2115.6		666.66667	35.09136		0	1	
Belgium	Telenet	ComfortNet	15360	1000		444.44444	33.93134	2.262089	0	1	
	Belgacom	Internet Comfort	12288	1500		555.55556	31.95367	2.662806	0	1	
Belgium	Telenet	ExpressNet	30720	1250		355.55556	47.51938	1.583979	0	1	
	Belgacom	Internet Favorite	25600	3500		533.33333	41.07143		1	i	
Canada	Bell Canada	Essential Plus	2048	800		133.33333	30.70952	15.35476	0	0	
Canada	Rogers	Ultra-lite	512	256		533.33333	28.49365	56.98731	0	0	
Canada	Shaw	High-speed lite	1024	256		1733.3333	28.46705	28.46705	0	1	
Canada	Rogers	Lite	3072	256		666.66667	35.84923	11.94974	0	1	
Canada	Bell Canada	Performance	6144	1000		555.55556	39.90399	6.650665	0	1	
Canada	Bell Canada	Fibe12	12288	1000		555.55556	46.79984	3.899986	0	1	
Canada	Bell Canada	Fibe12 + option 7Mbps upload	12288	7000		555.55556	51.39707	4.283089	0	1	
Canada	Rogers	Express	10240	512		800	45.96314		0	1	
Canada	Bell Canada	Fibe25	25600	1000		400	55.9943		0	1	
Canada	Bell Canada	Fibe16	16384	7000		625		3.786971	0	1	
Canada	Bell Canada	Fibe16 + option 7Mbps upload	16384	7000	75000	625	64.26933		0	1	
Canada	Shaw	High-speed	7680	512	75000	1333.3333	39.7502	5.300027			
Canada	Rogers	Extreme	15360	1000	80000	711.11111	61.59374		0	1	
Canada	Rogers	Extreme Plus	25600	1000		666.66667	70.7882	2.831528		1	
Canada	Shaw	High-Speed Extreme	15360	1000		1111.1111		3.257554			
Canada	Rogers	Ultimate	51200	2000		466.66667	98.3716			1	
Canada	Shaw	Warp	51200	3000		666.66667	97.51017			1	
Canada	Shaw	Nitro	102400	5000		666.66667		1.458096		1	
Hungary	T-Home	Kezdo (DSL Kezdo)	5120	2500		26.666667	28.43697				
	T-Home	Kezdo (Kabelnet Kezdo)	5120	21838		26.666667	28.43697				
	T-Home	Kezdo (Optinet Kezdo)	5120			26.666667		5.687393		0	
	T-Home	Maximum (Kabelnet Maximum)	81920	500		583.33333		0.906233		1	
	T-Home	Super (Kabelnet Super)	51200	5000		933.33333	66.24876	1.324975		1	
	T-Home	Extra (Kabelnet Extra)	25600	5000		1866.6667			1	1	
ο,	T-Home	Csaladi (Kabelnet Csaladi)	15360	400		3111.1111			1	1	
Hungary	T-Home	Alap (Kabelnet Alap)	5120	400		9333.3333		6.999869	1	1	
Iceland	Siminn	Grunnaskrift	12288	12000		11.111111		2.182553			
loolor 1	Vodafone	Huggulega 1GB	12288	12000		11.111111		2.182553			
	TAL	DSL 1GB	12288	12000		11.111111	26.19063	2.182553			
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Iceland Iceland	T 41		51200		10000	26.666667			0	1	*
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Iceland Iceland Iceland Iceland Iceland	Siminn Vodafone	Leid 1 Huggulega 10GB	12288 12288	12000	10000	111.11111	21.51373	0.430275	0	1	*
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Appendix

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Initial Initial <t< td=""><td>Ireland</td><td>Eircom</td><td>Up to 1Mb home broadband</td><td>1024</td><td>1000</td><td>10000</td><td>1333.333</td><td>39.7446</td><td>39.7446</td><td>0</td><td>1</td><td></td></t<>	Ireland	Eircom	Up to 1Mb home broadband	1024	1000	10000	1333.333	39.7446	39.7446	0	1	
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* information are added from telecom operators' websites

Source: OECD Communications Outlook 2011, OECD Broadband Statistics Sep., 2010, and Telecom Operators' Websites

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