



## **AN EMPIRICAL ANALYSIS ON THE EFFECTS OF THE “MOBILE TERMINAL DISTRIBUTION ACT” FOR THE CHANGE IN THE WELFARE OF USERS AND MOBILE**

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### **Abstract**

This study analyzes the effects of the Mobile Terminal Distribution Act for the change in welfare of users and three mobile service carriers through panel regression analysis methodology. It is believed that three mobile service carriers' subsidy has an effect on own company's revenue and ARPU since the enactment of the Mobile Terminal Distribution Act. The empirical results show that handset subsidy and revenue have a positive coefficient, and statistically significant relationship with higher sensitivity. In addition, communication charge and handset subsidy for households have a weak effect each other, but statistically significant between them. This seems to be the result of higher telecom service fee contracts to receive more handset subsidies. In addition, we believe that the increase in sales of service under the current act is due to the increase in sales through adherence rather than competition. Overall, the dummy variables that related the effect of the

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act influence the value of the entire model, and secure statistical significance. Therefore, in order to improve the current law, there should be no restriction on price competition, and it is necessary to make transparent the subsidy of the carrier as well as the subsidy of the manufacturer. In addition, by supplying various terminals, it is necessary to create a fair competition environment so that users can conveniently select them.

### **1. Introduction**

The “Act on the Improvement of Distribution Structure of Mobile Terminal Equipment” (hereinafter referred to as the “Terminal Distribution Act”) established for the purpose of establishing a fair and transparent distribution order of mobile communication terminal apparatuses was implemented on October 1, 2014. The purpose of the original measure was to consider the fact that it would not be unfair to return to all users who want to purchase, rather than being given only to a few customers. In other words, the act has been initiated in order to eliminate the irrationality that only some customers receive the service of the company as a subsidy<sup>1</sup>. The main content of the Terminal Distribution Act is to set the upper limit of the information and handset subsidy for the handset sales, and legally limit the payment according to the agreement. In the early stage of the law, however, the information on the subsidies paid by the manufacturer to distributors and final sellers was included in the price of the handset makers, but the law was withdrawn. In addition, we applied the sunset type so that it would be applied only for three years from October 2014.

However, it is argued that it should not be underestimated that the policy of the terminal sale, rather than the communication goods itself, is disturbing the market by the government rather than the company. According to this,

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<sup>1</sup>In the case of handset distribution, a certain level or a small number of handsets are subsidized by telecommunication companies and manufacturers to eliminate the unfairness of transferring the costs to a large number of users who are not generally provided with the related information.

the use of subsidies by companies should be determined by the market in terms of consumer demand and supply. In addition, if competition through subsidy does not appear, the competition of the handset price should occur, but it is because it is difficult for the manufacturer and the communication company to cooperate and lower the settled price determined once due to the price rigidity. As such, there are various opinions on the positive and negative aspects of the policy due to the emergence of the Terminal Distribution Act. In addition, since the problems caused by the Terminal Distribution Act (competition restrictions, guarantee of minority profits, etc.) have appeared at a time when it has not been less than two years, there is a need to analyze them from various angles.

Previous studies have attempted to examine various aspects of the need or regulation of handset subsidies, and quantitative analysis is limited to analyzing social welfare effects. However, the study of the effects of the adoption of the Terminal Distribution Act is still insignificant. In particular, there is no study that analyzes the changes in sales of three mobile telecommunication companies and their effects on the welfare of the users after the adoption of the Terminal Distribution Act.

Therefore, this study aims to analyze the effect of the introduction of related policies on the mobile communication market under the background of the implementation of the act. In other words, we will examine the effects of handset subsidies on the sales of three telecommunication companies and the effect on user average cost (ARPU). We will again look into the effect of handset subsidy on telecommunication rates by income group by household income class (distinguished by 7 quartiles). In order to examine the effects of the transfer of the Act, we analyzed the effects of the introduction period of smartphones from the 4th quarter of 2009 to the first quarter of 2016 through the panel regression<sup>2</sup>. By analyzing the effects of the current law and

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<sup>2</sup>It is from the time when the smartphone is re-introduced that the data began to be used in earnest communication. (The release date of iPhone 3gs is June 2009, and domestic launches began from November 28, 2009, and the analysis period started in the fourth quarter of 2009.)

presenting the results, it can be used as basic data for future policy direction of the telecommunication market.

This study examines previous studies in Section 2, and hypotheses and variables and model settings in Section 3. Section 4 presents the results of the analysis and Section 5 presents conclusions and implications.

## **2. Literature Review**

The existing domestic research on handset subsidy suggests that the theoretical studies are conflicting with the effect of handset subsidy. Kwon [4] focused on the effect of mobile subsidy on mobile communication industry. Most studies, however, are diagnosing the problem of handset subsidies and suggesting a shift to price competition. That is, handset subsidy is a means of price discrimination by telecom operators and it was consistently argued that subsidy regulation should shift from competition for subscriber to service competition. (Park and Ahn [3]; Kim [2]). On the other hand, [10, 11] analyzed that subsidy regulation has no effect as a means of promoting and reducing price competition and that the strength of subsidy regulation results in discrimination against subscriber users. Byun and Hyo [5] calculated the subsidy rate to maximize social welfare when consumers are discounting hyperbolic discounts on future value or cost, and suggested a relation with hyperbolic discount rate.

Empirical studies on handset subsidies analyzed the abolition effect of handset subsidies by estimating demand for handsets and mobile communication services. (Kim and Kang [1], Lee et al. [8], Choi and Kim [12], KDI [13]). The results of empirical studies on the quantitative effects of subsidies for handsets are also not uniform. KDI [13] argued for the increase of social welfare of handset subsidy. In particular, the Korea Development Institute (KDI) indirectly suggests the social welfare effect of the handset subsidy by emphasizing the reduction of consumer surplus through the implementation of the main law regulating subsidy support. Other studies

address the social welfare of handset subsidies. Lee et al. [8] emphasized the necessity of regulating subsidies by indirectly suggesting that the size of domestic handset subsidies is excessive through evaluating the network externality of the mobile communication service sector. Choi and Kim [12] estimated the price reduction effect when the handset subsidy is abolished through the empirical model. Byun et al. [5] pointed out that the price of high-priced handsets was due to the distribution structure of terminals through the case study. “In Korea, competition for sales price is not actively developed due to distribution of handsets mainly in mobile communication companies, the price that consumers have to pay can be kept high”. It is predicted that if the price of handsets is reduced due to the improved distribution structure of handsets, the effect of subsidies will be weakened and competition for subsidies will be eased.

In addition, the representative studies analyzing the effects of the short-term law at various angles after the empirical method is implemented show that the effectiveness of the short-term law is not in conformity with the original purpose by using the empirical and theoretical approaches [6, 8]. Analyzed the effects of the implementation of the terminal self-sufficiency system, which is discussed as a short-circuit law and follow-up, on the mobile industry and consumer welfare. In his paper, he analyzes the impact of the full-self-service implementation of the short-term law on competitive means through the theoretical model. Implementation of the short-term law weakens competition instead of reducing consumer conversion, and terminal full self-supply makes it possible to sell low-priced terminals in the market, but weakens competition more. As a result, consumer prices and consumer welfare are sequentially reduced. However, in the case of social welfare, it was the case that only the short-term law was implemented due to the decrease of the conversion cost. It should be noted, however, that this does not take into account the likelihood of subscriber collapse in the model. Lee et al. 2011 and [6] analyzed the effects of the short-term law on the mobile terminal market and the mobile telecom market. In order to analyze the

change of the plan choice in the mobile communication market, the effect of the short-term law was estimated through the ordered probit model after dividing the plan selected by the consumer into 6 steps according to the monthly payment amount. In order to analyze the change of the terminal dispatch price by model, panel data was formed and the effect of the Terminal Circulation law was estimated by the fixed effect model. As a result, consumers have been choosing a fare system that is one step lower, or about 15,000 won lower, after the implementation of the law. However, there was no evidence that the Terminal Circulation law had lowered the shipment price on the terminal shipment price by model. In other words, the results of this study show that it is not completely achieving the purpose of its implementation.

Previous studies have quantitatively or qualitatively analyzed the net effect or adverse effect of the subsidy on social welfare, suggesting the need for subsidies or regulatory legitimacy. However, this study is different from the previous studies in that there are no studies analyzing the effects on the welfare of the three mobile communication companies and users.

### **3. Competition and Status of Mobile Communication Market in Korea**

#### **1. Domestic market competition structure**

In the mobile telecom market, the 5: 3: 2 competitive landscape has remained stable since SKT acquired Shinsegi Telecom in 1999 and secured a market share of 57%. SKT occupies an overwhelming position as the No. 1 operator due to the first mover's advantage and 800MHz band low-frequency monopoly. SKT was established as a privatized 'Korea Mobile Communications', a public company in the mobile communication market, and became a starter in the mobile communication market. Market share has remained at 5: 3: 2 in the past 10 years, with only a slight change between the 2nd and 3rd place.

**Table 1.** Mobile subscriber market share by year (unit:%)

Division	'02	'03	'04	'05	'06	'07	'08	'09	'10	'11	'12	'13	'14.5
SKT	53.2	54.5	51.3	50.9	50.4	50.5	50.5	50.6	50.6	50.6	50.3	50.02	50.10
KT	31.9	31.1	32.1	32.1	32.1	31.5	31.5	31.3	31.6	31.5	30.8	30.09	30.13
LGU+	14.8	14.4	16.6	17.0	17.4	18.0	18.0	18.1	17.8	17.9	19.0	19.89	19.77

Source: Ministry of the Future Creation Science Statistics (2014)

In terms of market concentration, Korea's market share and HHI are still the highest among OECD countries. In other words, SKT's market share continues to exceed 50%, and HHI as of 2013 is 3,919, the highest level in OECD countries.

**Table 2.** Market share of major carriers in 2011 (unit:%)

Division	Korea	Japan	Germany	England	USA	OECD Average
M/S	50.6%	45.3%	33.0%	32.9%	37.4%	42.1%

Source: OECD Statistics (2014)

**Table 3.** Mobile market concentration of major countries in 2013 (unit:%)

Division	Korea	Japan	Germany	England	USA	Major European countries average
HHI	3,919	3,751	2,827	2,818	2,924	3,062

Note: Major European countries: Germany, France, UK, Italy, Spain

Source: Merrill Lynch (2013)

## 2. Evaluation of market power of mobile communication

The Korea Institute of Information and Communications Policy (KISDI) estimates that the domestic mobile telecom market is a 'less competitive market' and SKT has 'market dominance'. In the mobile communication market, competition has improved after LTE adoption, but it is concluded that competition is not actively considering market share, market concentration, and profitability gap. That is, SKT possesses market dominance (KISDI, Market Research Group, 2013).

**Table 4.** Industrial vitalization index of major countries in 2014

Division	Industrial vitality index (x 10,000)	Domestic relative size
France	156	30.7
Germany	82	16.1
Italia	48	9.5
Japan	43	8.4
Spain	71	13.9
England	57	11.2
Comparative country average	76	15.0
Korea	5	1.0

Source: Merrill Lynch wireless matrix (2014)

The Korea Electronics and Telecommunications Research Institute (ETRI) is diagnosing that the domestic mobile communication market has a low level of industry vitality and monopoly power. In the case of the index of industrial vitality, France is the highest with 156, while Korea is the lowest with only 5 (for reference, the second lowest in Japan is 43). The industry vitalization index is the index of the sum of annual market share fluctuation. The bigger and smaller the vitality of the industry, the less vigorous the vitality is. Next, in the case of the monopoly power fixing index, Korea is higher than the comparative country by 2.2 to 13.2 times. The monopoly power fixation index is an index that reverses the portion of the fluctuation of the first place in the total annual market share fluctuation. The larger the monopoly power, the smaller the monopoly power.

**Table 5.** Securing monopoly power of major countries in 2014

Division	Industrial vitality index ( x 1,000)	Domestic relative size	HHI	1st place average M/S
France	113	2.2	3237	42.51%
Germany	26	9.6	2814	34.36%
Italia	19	13.2	2956	36.57%
Japan	26	9.6	3524	48.36%
Spain	32	7.8	3237	42.41%

England	41	6.0	2231	27.38%
Comparative country average	31	8.1	3123	42.44%
Korea	246	1.0	3860	50.45%

Note: Utilize the average value of 2006~2013 data

### 3. Current status of mobile communication market after the terminal distribution act

In the case of household monthly average communication costs, it has decreased by about 5,000 won from 151,278 won in 2013 to 147,725 won in 2015 after the adoption of the law. And the average subscription fee gradually dropped from 42,565 won in 2013 to 38,695 won. In addition, the proportion of high-priced (over 60,000 won) subscribers sharply dropped from 66.9% in 2013 to 6.3% in 2015. Also, the proportion of subscription service additions at the time of opening was also drastically lowered from half (43.2%) in 2013 to 12.4% in 2015. This can be an indicator of the decline in household telecom costs after the implementation of the law.

Subscriber net additions were mainly through number portability before enforcement, while subscriber adherence increased gradually as the number portability decreased and device changes occurred after the enforcement of the Terminal Distribution Act. In addition, the number of retail stores in retail stores declined gradually from 20,000 in December 2014 to 18,000 in 2015, while the number of retail stores increased from 8,424 to 9,900 in 2015. This can be seen as a retailer's direct selling point as the number of retail stores decreases and that of direct stores increases. Meanwhile, the operating profit of the company has increased by 87% from about 2 trillion won in 2014 to 3,600 trillion won in 2015, and the marketing cost has decreased from 9 trillion won to 8 trillion won appear.

However, we can consider the following points that cannot be expressed by these quantitative indicators. It has made subscribers in a situation where they cannot afford to use pre-owned or mid-priced phones after the Terminal Distribution Act. And, the number portability without merit of subsidy payment no longer appeared, and it seems that the change of the equipment

has caused the contraction of the competition among each business. In the telecom market, which shows a typical monopoly market, the contraction of competition can lead to a greater social surplus loss, as the consumer leads to lower options, price restrictions, and supply levels. In addition, overall low usage rates and limited data usage can be a factor in avoiding the development of high-capacity, high-quality communications environments. In addition, there is a possibility that the low consumption of goods cannot be viewed positively because the overall telecommunication industry can be affected.

**Table 6.** Mobile telecommunication market after the terminal distribution act

Division	2013	2014	2015	2016(1~3)
Communication cost	152,791	150,350	147,725	-
Average subscription fee	42,565	45,155	38,695	39,142
Share of high-priced service subscriptions (net worth more than 60,000 won)	66.9%	33.9% (7~9)	6.3%	3.5%
Proportion of additional service subscription at the time of opening	43.2%	37.6% (1~9)	12.4%	6.2%
terminal	2,095mil.	1,823mil.	1,908mil.	435mil.
Sales portion of mid to low end sales (less than 500,000 won)	16.2%	21.5%	33.4%	38.4%
Operating profit		19,000Bil.	35,980Bil. (87% increase from the previous year)	-
Marketing expenses		88,220Bil.	78,669Bil. (11% decrease from the previous year)	-
Store	-	20,168	18,674 (As of June) 18,300 (As of Dec.)	-
Retail store	-	8,424	9,014 (As of June) 9,900 (As of Dec.)	-

Source: Future Telecommunication Department

National Mobile Communications Distribution Association Data (2016)

#### **4. An Empirical Analysis of the Effect of the Terminal Distribution Act**

##### **1. Hypothesis and variable setting**

###### **(1) Hypothesis**

In order to conduct the analysis, it is necessary to select the appropriate independent variables and dependent variables to ensure the relationship. It is necessary to empirically analyze the forms applied to the mobile communication industry based on general users and corporate theory. First of all, it is necessary to identify the factors affecting sales or operating profits. First, companies are engaged in activities that increase their profits through various commercial activities and increase their profits by excluding the expenses. Companies that provide telecommunication services continue to maintain and attract subscribers of telecommunication services, thereby continuing to link subscription and service costs from users to sales. In this case, how much the subscribers own telecommunication service provider affects sales, and various sales activities are carried out to maintain and attract subscribers. Therefore, sales of telecom service providers are affected by sales activities such as subscriber level, advertising, subsidy provision, and facility investment.

Second, the process of choosing a service of a specific business operator takes into consideration service and subscription cost, terminal type (smart device), type of plan, various promotions, and quality of call and data communication. When there are various service providers in the market, consumers can make various choices through price and service competition, and can provide cheaper services through search activities. Meanwhile, the government imposes restrictions<sup>3</sup> on the provision of telecommunication services through policies. This restriction is due to the monopoly nature of commodities, so it is unreasonable to involve a large number of operators in competition. Therefore, it is necessary to obtain permission to provide

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<sup>3</sup>This regulation may be restricted or enforced for activation.

communication service. In addition, according to the previous studies, there has been no evidence that the terminal price has declined after the Terminal Distribution Act. Also, the Korea Development Institute [13] argues that the surplus of consumers is reduced by the implementation of the shortcut law that regulates the subsidy. Therefore, we try to construct hypotheses and models to measure the effects of the Terminal Distribution Act using the components of the enterprise, user, and policy. The independent variables affecting this are capital investment, mutual access costs, disposable income in telecommunication sector, and handset subsidy. First, the hypotheses set out in relation to the sales of mobile carriers are as follows.

*Hypothesis (1) The effect of handset subsidies on sales of three telecom carriers increased before and after the adoption of the ACT, and the effect on ARPU would have decreased.*

It was started to prevent the bleeding competition by restricting the handset subsidy and to prevent the excessive payment to a large number of subscribers by transferring the damage caused by the bleeding competition to the user. Therefore, they will have a positive effect on corporate sales by reducing handset subsidies, and the ARPU of users will decline. The handset subsidy generally has a commission paid by the carrier to the carrier or dealer, and the manufacturer has a form of commission (subsidy) paid to the carrier or dealer. However, the manufacturer or the retailer does not provide accurate data, but most of them appear to be in the category of payment or sales commission<sup>4</sup>. Meanwhile, the subsidy of such a handset can induce fair price competition, thereby contributing to the overall sales of the handset. However, if too many subsidies cause competition for bleeding, the sales will

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<sup>4</sup>In the IR data of telcos, there is usually a sales or payment commission, which is a subsidy given by the telecom company as a commission fee when a cell phone dealer or retailer sells the terminal to the customer. The subsidy depends on the policy, and there is variety of sales techniques by which the retailer or agency chooses whether to take all or only part of the grant, or both.

not increase and the subsidy will be wasted. As such, we may see a drop in sales due to continued losses in the long-term.

*Hypothesis (2) User disposable income and communication cost will have positive (+) relationship.*

The second hypothesis is generally a part of the income effect, and an increase in disposable income can increase consumption in many items. Communication methods exist for each household, and consumption of premium services or high-priced terminals may increase, and thus disposable income growth and positive relationship with sales of communication service providers will be shown. However, in the case of communication expenses such as essential goods (rice, water, electricity, etc.) rather than general goods, an increase in disposable income may not be related to the increase in communication costs.

## (2) Setting variables and models

The variables needed for the hypothesis analysis are IR data from three Korean telecommunication carriers and data based on the National Statistical Office. First, we used total sales, advertising costs, depreciation related to facility investment, access costs, payment and sales commission (handset subsidy) from the three companies. The prices used to actualize the level variables are data limited to the telecommunication service and data published by the National Statistical Office. Disposable income was also used as data for analysis based on the data of the National Statistical Office. Lastly, the data are from 4Q09 to 1Q06. This is due to the period when smartphones were used in earnest, and the period of time in which terminal selection methods are consistent is needed. The above variables are mostly level variables and the following CPI data are used for realizing them. Therefore, all variables are real variables.

**Table 7.** Variable description

Variable name	Actual data	Data explanation	Source
TR	Total revenue	Total sales	Telecom 3 IR data (2009Q4~2016Q1)
Ad	Advertisement	Advertising cost	
CAPEX	Capital expenditure	Facility investment cost	
Inco-fees	Interconnection fees	Interconnection cost	
Sub	subside	Handset subsidy	
Subscribe	Subscribe	Subscribers	
ARPU	Average revenue per user	Average cost per subscriber	Telecom 3 IR data (2009Q4~2016Q1)
CPI	Consumer price index (telecommunications)	Price (communication service)	Statistical office
Income	Disposable income	Annual disposable income (by income level)	
Teles	Telecommunication service fees in each of income level	Communication rates by income level	

We made panel data using data from three telecommunication companies and conducted panel analysis. The panel model is shown in the following equation (1):

$$\ln(Y_{i,i,t}) = \alpha + \sum \beta \ln(X_{i,i,t}) + \varepsilon_{i,i,t}. \quad (1)$$

In equation (1),  $Y$  is a dependent variable and is defined as a variable representing the enterprise and households by setting the total sales revenue (TR) for each company and the average communication cost per subscriber (ARPU). The purpose of this analysis is to analyze the direct effects of advertising, capital investment, interconnection costs, handset subsidies, and disposable income as dependent variables, which are dependent variables, on sales and telecommunication costs. The panel analysis model is limited to

perform random effects considering the situation of three operators and the limitation of data selection<sup>5</sup>. Therefore, a fixed effect model is constructed when constant time is considered constant even though time and subject are changed. However, telecommunication carriers added SUR (seemingly unrelated regression) assumption as their sales, interconnection fees, and ARPU could have an organic relationship with each other due to their similarities.

In detail, we examine the influence of each variable on the analysis period from 2009Q4 to 2016Q1 for companies and households. In addition, we will add a variable consisting of dummy variable value 1 from 2014Q4 to 2016Q, which is the period of the Terminal Distribution Act, to see if there is an actual influence relationship. Second, we analyze the period from 2009Q4 to 2014Q3 and from 2014Q4 to 2016Q1, excluding dummy variables, and try to understand how changes in the sign and sensitivity change occur. In addition, in the household model, we try to compare the results with different disposable income variables by income quintiles<sup>6</sup>. Therefore, the model can be classified as follows.

**Table 8.** Detailed analysis model

Object	Division	Equations	Periods
Company	Model 1	$\ln(TR_{i,t}) = \alpha + \beta_1 \ln(Subscribe_{i,t})$ $+ \beta_2 \ln(AD_{i,t}) + \beta_3 \ln(CAPEX_{i,t})$ $+ \beta_4 \ln(SUB_{i,t}) + \beta_5 \ln(InCo - Fees_{i,t})$ $+ \beta_6 \ln(Income_{i,t}) + \beta_7 \ln(dum_{i,t}) + \varepsilon_{i,t}$	2009Q4 ~2016Q1(1)
			2009Q4 ~2014Q3(a)
			2014Q4 ~2016Q1(b)

<sup>5</sup>In order to analyze the probabilistic effect for each operator, the number of cross sections should be larger than the number of estimated coefficients, which is a limit to multivariate analysis.

<sup>6</sup>In Model 2, the income  $X$  of the dependent variable is applied differently from 1 to 7 for each income quintile.

Household	Model 2	$\ln(ARPU_{i,t}) = \alpha + \beta_1 \ln(AD_{i,t})$ $+ \beta_2 \ln(CAPEX_{i,t}) + \beta_3 \ln(SUB_{i,t})$ $+ \beta_4 \ln(InCo - Fee_{i,t}) + \beta_5 \ln(Inomme_{i,t})$ $+ \beta_6 \ln(dum_{i,t}) + \varepsilon_{i,t}$	2009Q4~2016Q1(2)
			2009Q4~2014Q3(a)
			2014Q4~2016Q1(b)
Income quartile effect (monthly average)	Model 3	$\ln(ARPU_{i,t}) = \alpha + \beta_1 \ln(AD_{i,t})$ $+ \beta_2 \ln(CAPEX_{i,t}) + \beta_3 \ln(SUB_{i,t})$ $+ \beta_4 \ln(InCo - Fee_{i,t}) + \beta_5 \ln(Inomme_{i,t})$ $+ \beta_6 \ln(dum_{i,t}) + \varepsilon_{i,t}$	Less than 1 million won (a, a(1))
			100~2 million won (b, b(1))
			200~300million won (c, c(1))
			300~400million won (d, d(1))
			400~500million won (e, e(1))
			500~600million won (f, f(1))
			More than 600 million won (g, g(1))

## 2. Analysis results

(1) Analysis of the impact of the adoption of the Terminal Distribution Act on the sales of three mobile telecom companies

Table 1 summarizes the analytical results of Model 1, 1-a and 1-b on the firm side. First, in Model 1, the variables except facility investment, interconnection fee, and dummy variables for statistical significance were found to be statistically significant when coefficients were rejected at a significance level of 1 to 10%. Of these, disposable income was the most influential factor in telecom sales. That is, one unit increase in disposable income is 1.1749 in sales. The second most influential factor is the subscriber level variable, which shows that the sales increase by 0.4856 units as the number of subscribers increases. In addition, handset subsidy shows the same direction as sales, and 1 unit increase of handset subsidy increases by 0.2273 units of sales. Finally, advertising also has a positive effect on sales.

In Model 1-a, statistical significance is shown as the coefficients of advertising, disposable income, and subsidy have significance within 1%, 1% and 10%, respectively. Similar to Model 1, disposable income has the most positive effect on sales. Second, subsidies are highly effective, followed by advertising. It is effective from 4Q09 to 3Q03, before the implementation of the short-term act compared to the whole period. During this period, the effect of subsidy on sales was lower than the whole period. On the other hand, the results of Model 1-b show that there is no statistical significance on the effect of handset subsidy on sales since the implementation of the pedagogy method.

**Table 9.** Analysis of Model 1

	Dependent var.: ln (TR)		
	Model 1 (2009Q4~2016Q1)	Model 1-a (2009Q4~2014Q3)	Model 1-b (2014Q4~2016Q1)
Constant	-10.9555*** (-2.9453)	-9.8785** (-2.1258)	-60.7608** (-3.1026)
ln(subscribe)	0.4856*** (2.6904)	0.3098 (0.7862)	2.1059*** (4.1288)
ln(AD)	0.0725* (4.0716)	0.0979*** (2.9976)	0.0915** (3.1851)
ln(CAPEX)	-0.0889 (-0.7312)	-0.0358 (-0.3446)	-0.4308* (-2.1219)
ln(Inco-Fees)	0.0610 (1.2213)	0.0716 (1.3364)	0.2654*** (3.6340)
ln(Income)	1.1749*** (4.7960)	1.3595*** (4.4355)	2.8632*** (3.2926)
ln(SUB)	0.2273** (2.4119)	0.1824* (1.9337)	0.1047 (0.8113)
DUM	-0.0263 (-0.7495)		
Adjusted R-squared	0.9641	0.9592	0.9960
S.E. of regression	0.0561	0.0714	0.0234
F-statistic	222.28	165.69	539.12

Note:  $p$ -value 1% > \*\*\*, 5% > \*\*, 10% > \*

(2) The effect of the adoption of the Terminal Distribution Act on the average communication cost of users and households

The following table summarizes the results of the analysis of the models 2, 2-a and 2-b from the household side. Dependent variable is service fee (ARPU), which is directly paid by the subscriber instead of the previous sales amount. The difference between model 1, 1-a and 1-b is that incentives to reduce ARPU increases as disposable income increases. In other words, telecommunication goods are not a form of ascending concurrently even if disposable incomes rise, but they can be regarded as goods with a steady state. Other variables were found to have almost the same directionality. The increase of advertising expenditure showed a tendency to increase the ARPU, and the increase of the capital investment cost increased the household communication cost. This means that there is a tendency that the enterprise has to transfer the price to the service as much as the portion of the facility investment. In general, development and investment in new communication technologies ultimately serve to create new profits. The increase of the interconnection fee was not enough to increase the telecommunication cost, but it did not have a great effect because the size of the coefficient was small. Finally, the relationship between handset subsidy and ARPU is positive but statistically insignificant.

The dummy variables due to the adoption of the Terminal Distribution Act were statistically significant as the coefficients were rejected within the 5% significance level. And, as the dummy variable has a positive value, the ARPU after the Terminal Distribution Act is increasing as a result of raising the communication cost of the consumer in a fixed multiple form. In other words, the dummy variable affects the constant part and assumes a higher value when assuming that it increases by 1 unit for each variable. In the case of models 2-a and 2-b, it is meaningless to interpret the meaning because most of them have a high probability of error because they have statistical significance in some parts such as facility investment, interconnection fee and disposable income. However, since a certain (sign) relation is shown, it can be said that the model is consistent.

**Table 10.** Analysis of Model 2

	Dependent Var. : ln(ARPU)		
	Model 2 (2009Q4~2016Q1)	Model 2-a (2009Q4~2014Q3)	Model 2-b (2014Q4~2016Q1)
Constant	9.0019***	8.6128***	22.3693***
	(5.9850)	(4.9880)	(5.6232)
ln(AD)	0.0257	0.0019	0.0411**
	(1.1846)	(0.0869)	(2.5322)
ln(CAPEX)	0.3000***	0.4474***	0.0953
	(4.9282)	(5.4111)	(1.5510)
ln(Inco-fees)	0.0537*	0.0908**	0.0951***
	(1.8080)	(2.4591)	(4.2233)
ln(income)	-0.0913	-0.1363	-1.0884***
	(-0.6506)	(-0.8468)	(-3.3916)
ln(SUB)	0.0503	0.0367	0.0275
	(0.9824)	(0.6838)	(0.8877)
DUM	0.0547**		
	(2.3900)		
Adjusted R-squared	0.9070	0.9299	0.9888
S.E. of regression	1.0229	1.0304	1.1940
F-statistic	94.902	112.72	164.84

Note:  $p$ -value 1% > \*\*\*, 5% > \*\*, 10% > \*

(3) The effect of the adoption of the Terminal Distribution Act on the communication charges by the household income bracket

In households, income is divided into 7 quartiles, and the analysis of the household side is expanded by using these variables. We use the ARPU, which is the average cost directly paid by the subscriber, as the dependent variable and determine the effect of each income level on the average cost of ARPU. First, advertising, facility investment, interconnection fees, and dummy variables are similar to those of the previous results. Overall, the coefficients have statistical significance. However, in the case of the handset subsidy, most of the income level showed a positive relationship with the

ARPU during the period of the mandatory period, and it was statistically significant. This is interpreted as a result of implementing a high level telecommunication fee arrangement to receive more subsidies.

Second, the effect of the Terminal Distribution Act on the disposable income quintiles, which were originally reported, shows that the coefficients analyzed in the period after the short-term method have statistical significance in the income class below 1 million won<sup>7</sup>. As the disposable income increases, the telecommunication charges tend to decrease. In the case of monthly income between 1 million won and 2 million won, as in the case of less than 1 million won, the coefficients analyzed during the Terminal Distribution Act have statistical significance but the sign is opposite. This seems to be due to the fact that the consumer group, which has a relatively higher disposable income, has a pattern of inefficiently consuming telecommunication charges even if the subsidy is lowered due to the adoption of the short cut. In other words, it is possible to receive a subsidy for a mobile subscriber by making a contract with a higher communication fee, thereby increasing the overall communication fee. On the other hand, coefficients between 2~3 million won, between 3~4 million won, between 400~5 million won and between 500~6 million won have no statistical significance. However, when the average monthly income is over 600 million won, the relation between disposable income and ARPU and negative (-) relationship is shown for the whole period. Even if there is an increase in disposable income, the highest income group is tied up by the agreement and is likely to use an unlimited plan. In addition, since the communication fee will decrease as the form of long-term contract and family bundle progresses, there appears to be a negative relationship between the communication charge and the disposition. Finally, the dummy variable due to the adoption of the short-run method was statistically significant from the monthly

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<sup>7</sup>Sales and payment commissions in the first quarter of 2015 will decrease 26.3% (960.7 billion won) compared to the same period last year (The CEO Score Daily, May 5, 2015).

incomes of more than 2 million won. Therefore, it can be said that the effect of raising the reference point describing the communication charge as a whole can be said to be effective.

**Table 11.** Model 2' analysis results (1)

	Dependent Var. : ln(ARPU)							
	Model2'-a	Model2'-a(1)	Model2'-b	Model2'-b(1)	Model2'-c	Model2'-c(1)	Model2'-d	Model2'-d(1)
	(09Q4~16Q1)	(14Q4~16Q1)	(09Q4~16Q1)	(14Q4~16Q1)	(09Q4~16Q1)	(14Q4~16Q1)	(09Q4~16Q1)	(14Q4~16Q1)
Constant	6.878***	7.256***	-1.855	13.765***	-1.047	8.410**	23.654	7.125**
	(4.440)	(6.730)	(-0.296)	(10.104)	(-0.097)	(3.186)	(1.606)	(2.244)
ln(AD)	0.047**	0.043***	0.044**	0.069***	0.043**	0.030*	0.055***	0.034*
	(2.369)	(3.501)	(2.246)	(3.430)	(2.121)	(1.853)	(2.703)	(2.121)
ln(CAPEX)	0.270***	-0.011	0.281***	-0.067	0.274***	-0.064	0.277***	-0.090
	(4.892)	(-0.307)	(5.183)	(-1.267)	(5.008)	(-1.434)	(4.994)	(-1.774)
ln(Inco-fees)	0.054*	0.071***	0.056**	0.048***	0.052**	0.036**	0.043	0.030**
	(1.966)	(4.242)	(2.104)	(3.782)	(1.911)	(2.852)	(1.501)	(2.465)
ln(Income1)	0.085	0.153***						
	(0.717)	(3.259)						
ln(Income2)			0.695	-0.255*				
			(1.565)	(-2.137)				
ln(Income3)					0.624	0.135		
					(0.840)	(0.793)		
ln(Income4)							-1.061	0.239
							(-1.064)	(1.066)
ln(SUB)	0.053	0.127***	0.055	0.045**	0.045	0.047***	0.066	0.027
	(1.206)	(4.941)	(1.254)	(2.976)	(1.014)	(3.563)	(1.460)	(1.244)
DUM	0.034		0.033		0.037*		0.044**	
	(1.454)		(1.489)		(1.745)		(2.043)	
Adjusted R-squared	0.922	0.992	0.921	0.987	0.923	0.994	0.923	0.994
S.E. of regression	1.0323	1.2116	1.0333	1.2043	1.0270	1.0446	1.0322	0.9776
F-statistic	110.62	296.53	108.35	187.51	111.31	406.27	112.12	388.07

Note:  $p$ -value 1% > \*\*\*, 5% > \*\*, 10% > \*

**Table 12.** Model 2' analysis result (2)

	Dependent Var.: ln(ARPU)					
	Model2'-e (09Q4~16Q1)	Model2'-e(1) (14Q4~16Q1)	Model2'-f (09Q4~16Q1)	Model2'-f(1) (14Q4~16Q1)	Model2'-g (09Q4~16Q1)	Model2'-g(1) (14Q4~16Q1)
Constant	-3.554	5.715	5.294	6.289	16.247***	12.529***
	(-0.277)	(0.371)	(0.358)	(1.068)	(5.294)	(7.917)
ln(AD)	0.039	0.053*	0.050**	0.029	0.028	0.023
	(1.670)	(2.031)	(2.557)	(1.609)	(1.471)	(1.203)
ln(CAPEX)	0.283***	0.010	0.264***	-0.079	0.338***	-0.073
	(4.717)	(0.108)	(4.517)	(-1.571)	(6.140)	(-1.347)
ln(Inco-fees)	0.098	0.031	0.053*	0.032**	0.041	0.034**
	(2.905)	(1.270)	(1.866)	(2.643)	(1.560)	(2.731)
ln(Income5)	0.743	0.279				
	(0.871)	(0.268)				
ln(Income6)			0.178	0.276		
			(0.183)	(0.714)		
ln(Income7)					-0.544***	-0.135
					(-2.732)	(-1.356)
ln(SUB)	0.058	0.033	0.053	0.043**	0.052	0.056**
	(1.002)	(0.631)	(1.183)	(2.928)	(1.192)	(2.930)
DUM	0.043**		0.041*		0.043**	
	(2.068)		(1.890)		(2.256)	
Adjusted R-squared	0.820	0.979	0.923	0.993	0.921	0.985
S.E. of regression	1.0283	1.0961	1.0309	1.0190	1.0339	0.9309
F-statistic	110.85	201.81	111.86	347.39	108.67	357.32

Note: *p*-value 1% > \*\*\*, 5% > \*\*, 10% > \*

## 5. Conclusion and Implications

This study attempted to quantitatively analyze the effects of the adoption of the Terminal Distribution Act on the telecommunication service providers and households by using the data of the IR and the National Statistical Office. The fixed effect model was derived using the panel data of three telecom companies. The period was from the 4th quarter of 2009, when the 4th generation mobile communication service appeared. In order to measure the regulatory effect, the dummy variable was added to the dummy value 1 from the 4th quarter of 2014 to the first quarter of 2016. We analyzed the effect of the actual handset subsidy by analyzing the period from 4Q 2009 to 3Q 2014 and from 4Q 2014 to 1Q 2016.

As a result of the study, it is analyzed that the influence of the sales increase through subscribers is expanded for the companies after the Terminal Distribution Act, and the increase of telecommunication costs is on the rise. As a result, the effect of the subscriber's adherence increased as the subscriber's movement slowed down and the long-term contract (contract) was tied to the process. In addition, when introducing a new LTE technology and joining a high-priced subscription, it is likely that household ARPU has gradually increased due to high handset subsidies. In the model based on household income, there was a positive (+) relationship between handset subsidy and ARPU during the short-term period. This seems to be the result of higher telecom fee commitments to receive more handset subsidies. Thus, the current Terminal Distribution Act suggests that there is a problem in that the sales of several telcos are being enhanced by the strengthening of the sticking effect rather than the competition.

This seems to be the result of higher telecom service fee contracts to receive more handset subsidies. In addition, we believe that the increase in sales of service under the current act is due to the increase in sales through adherence rather than competition.

Based on the above analysis results, the following considerations should be considered in order to improve the current method. First, restricting subsidies and price competition, which are the inherent authority of enterprises, helps to prevent artificial price fixing, which is a form of transferring burden to the public. Therefore, it would be desirable to enforce the Act for early terminal distribution improvement according to the original bill so that not only the subsidy of telecommunication companies but also the subsidies of the manufacturers are transparentized. Second, it is necessary to create a fair competitive environment for the people to use and deliver various terminals. There are few types of smartphones that are used domestically, and companies that provide them have a high price negotiating power. As a result, if monopolistic and oligopolistic effects are fixed, the people will naturally pay high prices and use goods.

Therefore, in order to improve the current law, there should be no restriction on price competition, and it is necessary to make transparent the subsidy of the carrier as well as the subsidy of the manufacturer. In addition, by supplying various terminals, it is necessary to create a fair competition environment so that users can conveniently select them.

This study has significance as a study to analyze what kind of effect it has on the enterprise and the household after the censorship, but it is limited in the following point. First, since the diversity of variables is insufficient, there is a limitation that it cannot be analyzed from a comprehensive viewpoint, that is, a manufacturer or a national level. This is due to the fact that it is difficult to obtain relevant data even though it is necessary to approach the major manufacturers' sales volume due to the Terminal Distribution Act, or how the production of telecommunication equipment has changed due to it. Second, the amount of data is absolutely small and has an ecological limit that cannot be closer to the population. If this is complemented, you will be able to look at the censorship as a more effective analysis.

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