The Korean Economic Review
Volume 30, Number 2, Winter 2014, 369-384.

Regulation of Program Licensing Fee in Korean CATV Industry: Is it Welfare-Improving?

Yong-Jae Choi*

Financial difficulties of small program networks and poor program quality have led the Korea Communication Commission (KCC) to introduce a regulation mandating cable operators to pay at least 25% of their subscription revenues to cable networks. With this regulation, KCC intended to provide program networks incentives to deliver high quality programs and develop the cable TV industry. However, this regulation was introduced without a formal analysis of the optimality of market equilibrium or the effects of the regulation on the industry or social welfare.

This paper sets up a simple model focusing on the two-sided market nature of CATV industry. It is shown that the market equilibrium is generally suboptimal and program quality is below the socially optimal level. When the market equilibrium is suboptimal, the regulation of the licensing fee can improve program quality and social welfare, but cannot achieve the socially optimal equilibrium.

JEL Classification: L50, L82
Keywords: CATV, Pprogram Licensing Fee, Program Quality, Two-sided Market

I. Introduction

Korean cable television (CATV) industry has achieved a remarkable success with penetration reaching 88.53% (as of 2007[1]) of total households about a decade after the launch of the service. However, industry observers often argue that even with increasing popularity of CATV the weak bargaining power of program networks vis-à-vis cable operators has stunted the profitability of networks and deprived them of the incentive to produce high quality programs (Kwon, 2005; Jung, 2005). It is

Received: May 19, 2014. Revised: Nov. 4, 2014. Accepted: Nov. 25, 2014.

* Professor, Division of International Finance, Hankuk University of Foreign Studies, 81 Oedae-ro, Mohyeon-myeon, Cheoin-gu, Yongin-si, Gyeonggi-do 449-791, Korea. E-mail: yjchoi@hufs.ac.kr C.P. +82-10-2277-0770. This work was supported by Hankuk University of Foreign Studies Research Fund of 2014. I wish to thank two anonymous referees for helpful comments and suggestions. All remaining errors are my own.

[1] It is the year just before the regulation was introduced.

also claimed that the early success of CATV industry is due to the excessively low (subsidized) subscription charges and that the low quality of programs will hinder the industry's future growth (Kim, 2005). Taking this into account, in November 2008 the KCC (Korea Communication Commission) introduced a regulation mandating cable operators to allocate at least 25% of their subscription revenues to networks.

When CATV was first introduced in Korea, 18 program networks were licensed to provide programs to cable operators who were required to transmit all the programs to their subscribers. Program licensing fees were determined by collective bargaining between the operators and the program networks and the latter received 32.5% of the subscription revenues in 1995. In 2001, market entry by program networks was deregulated and program networks simply had to register with the KCC in order to sell their programs.[2] At the same time, the cable operators were no longer subject to mandatory transmission of all the programs; they could negotiate with individual program networks to decide on licensing fees. As a result, the bargaining power of the program networks has substantially weakened and their share of subscription revenues sharply dropped to 13.2% in 2003.

Financial difficulties of small program networks and poor program quality have led to regulation of licensing fee by the KCC. The regulation required cable operators to file quarterly reports on their compensations for program networks, and fulfilling the "25% rule" was set as a prerequisite for cable operators' license renewal. The commission's intention was to encourage program networks to raise program quality, spur the development of the CATV industry, and improve viewers' welfare. Cable operators criticized the regulation, however, arguing that the increased licensing fees will be passed on to subscribers, and impede the industry's expansion.

Introduction of the regulation should be firmly based on an analysis of its effects on social welfare. However, I could not find any academic or policy studies that examined this issue. With this study, I would like to fill this gap and possibly draw some implications for policy makers in other countries.

Cable industry is a typical example of two-sided markets, which have attracted a lot of attention recently. A cable operator (a platform) sells programs or channels to its subscribers and, at the same time, sells "eyeballs" of viewers to networks who in turn sell them to advertisers. There exist positive cross group externalities between subscribers and networks. When there are a larger number of subscribers on a cable system, the networks obtain greater revenues from the sales of airtime for advertising. At the same time, when networks provide higher quality programs, viewers are willing to pay more for subscription to the cable system.[3]

[2] In 2002, the number of program networks registered with the KCC soared to 165.

[3] In existing models of CATV, externality that viewers receive often comes from the number of channels or volume of advertising.

In this setting, it is critically important for a cable operator to strike a balance between the subscription charge and the program licensing fee paid to networks in order to maximize profit. A platform in a two-sided market often obtains most of its revenues from only one side of the market (Haigu, 2004). Previous studies[4] show that a platform levies a lower price for a group of consumers that provides larger positive externalities to the other group or that has a higher price elasticity of demand. In a multi-platform setting, a platform charges a higher price for consumers who are multi-homing[5] than for single-homing consumers (Armstrong, 2006).

According to observations by industry experts in Korea, cable operators also seem to follow this pattern by setting a very low (subsidized) price for subscribers and a very low compensation for networks. This pricing structure may be the result of profit maximization by cable operators; however, it is not clear whether the structure is socially optimal considering its effect on program provision. This paper addresses this issue and provides a basis for evaluating Korea's regulation of licensing fee.

The rest of this paper proceeds as follows. In section II, we present a simple model of CATV industry with endogenous program quality. In section III, as a benchmark, we examine a socially optimal equilibrium. In section IV, we examine market equilibrium with a monopoly cable operator. Section V investigates whether regulation of program licensing fee can improve social welfare. Section VI concludes.

II. A Model with Franchised Local Monopoly

Consider a CATV industry that consists of a cable operator and a program network. Cable operators were franchised as local monopolies when CATV was first introduced in Korea. Later, competitors were licensed in some franchise areas and new media such as satellite broadcasting and IPTV (internet protocol television) entered the pay-TV market. However, as of the end of 2007, CATV remains dominant in the pay-TV market[6] and 59 franchise areas among a total of 77 are serviced by a single cable operator. Thus, for simplicity, it is assumed that a cable operator is a local monopoly in the pay-TV market. On the other hand, there are many program networks competing for a CATV channel. Taking this market structure into consideration and focusing on a single franchise area, we model a

[4] See, for example, Armstrong (2006) and Rochet and Tirole (2004).

[5] A consumer is said to be multi-homing when she has transactions with a multiple number of platforms.

[6] In Korea, the market share of CATV in terms of the number of subscribers is 80.04% as of the end of 2010.

CATV industry as a bilateral monopoly consisting of an operator and a network with all bargaining power residing in the hands of the operator.

The cable operator thus designs a contract in which he procures a program[7] from the network. At the same time, the operator distributes the program to its subscribers in return for a subscription charge, p. The network produces the program and sells its airtime[8] for advertising to an advertiser at a given per viewer[9] price, z.

A viewer's utility, u, can be expressed as follows:

$$u = v - p - \delta . \tag{1}$$

Here $v(>0)$ stands for the quality of a program and δ represents the perceived nuisance cost of advertisement. Viewers are differentiated with respect to their aversion to advertising; we assume that δ is uniformly distributed over the interval, $[0, \overline{\delta}]$, with total mass equal to 1.[10] Noting that the average nuisance cost of all consumers is $\overline{\delta}/2$ we can interpret $\overline{\delta}$ as a measure of viewers' overall aversion to advertising. Assuming that the reservation utility of a consumer who does not subscribe to CATV is 0, the critical level of δ, or $\delta^c (= v - p)$, indicates the level of advertisement's nuisance cost to the viewer who is indifferent to subscribing to the channel.

Some comments are in order about the contract between the operator and the network.[11] If v were contractible, the cable operator could simply make a take-it-or-leave-it offer requiring the network to produce the optimal level of v and extract all surplus. Instead we assume that v is not contractible,[12] so that the operator offers a package of licensing fees, (r, S), where r is a per subscriber licensing fee and S is a lump-sum payment,[13] in order to provide incentives to

[7] Since a single program is transmitted over a channel, a channel and a program are used interchangeably in this paper.

[8] We assume that its amount is fixed, for example, due to regulation.

[9] We use the terms (subscribers and viewers) interchangeably.

[10] Gal-Or and Dukes (2003), Anderson and Coate (2005) and many others introduce the nuisance cost of advertisement in their studies on the media industry. For example, Anderson and Coate (2005) assume that nuisance cost is constant while viewers are heterogeneous with respect to utility from programs. Our assumption of heterogeneous nuisance cost and homogeneous utility is analytically identical to their setup.

[11] We thank an anonymous referee for suggesting that we view this issue as a contracting problem.

[12] In this paper, v is not contractible because it is not verifiable, although the cable operator can indirectly observe program quality via n, the number of subscribers. In the real world, program quality is unlikely to be observable, let alone verifiable.

[13] The network receives licensing fee for its program, but it may also pay the operator for distribution service. Thus S and r are actually licensing fees net of distribution fees that networks pay. If the fee for distribution service dominates the licensing fee, the sum of lump-sum and per subscriber licensing fees is negative and the network pays the operator.

the network. We will show that such a contract is sufficient for the operator to achieve his optimal level of program quality.

Our model thus takes the form of a three-stage game. In the first stage, the cable operator determines a subscription charge, p, and offers a contract to the network by determining a package of licensing fees, (r, S), for its channel. In the second stage, the network determines the quality $v(>0)$ of its program in case it decides to supply a program.[14] In the third stage, viewers decide whether to subscribe to CATV and the operator delivers the program to its subscribers.

We analyze the subgame-perfect Nash equilibrium of this game. Following the convention of backward induction, we examine the last stage first, given possible decisions made in the previous stages, and then move backward to the second and first stages.

In the third stage, consumers subscribe to CATV as long as $u \geq 0$. Therefore the demand for CATV, n, can be expressed as follows:

$$n(p) = \max\left\{0, \min\left\{\frac{v-p}{\overline{\delta}}, 1\right\}\right\}. \tag{2}$$

When $v - p \geq \overline{\delta}$, we say that the market is saturated.

In the second stage, the network chooses v to maximize its profit, $\prod_N$, or solves the following problem:

$$\max_v \prod_N = \begin{cases} \dfrac{1}{\overline{\delta}}(v-p)(z+r) - c(v) + S & if \quad v-p < \overline{\delta} \\ z + r - c(v) + S & if \quad v - p \geq \overline{\delta}. \end{cases} \tag{3}$$

The network obtains revenues from the sales of airtime for advertising and program licensing. It incurs cost $c(v)(>0)$ to produce a program with quality v. It is assumed that

$$c'(v) > 0 \quad \text{and} \quad c''(v) > 0 \quad \text{for all} \quad v > 0 \tag{A.1}$$

$$c'''(v) > 0 \quad \text{for all} \quad v > 0 \quad \text{and} \quad c'(0) < \frac{z}{2\overline{\delta}} \tag{A.2}$$

$c(v)$ is small enough to ensure non-negativity of operator's profit and social welfare. (A.3)

The production cost and the marginal cost (for small increase in quality) are

[14] This timeline also represents the practice that many programs such as a TV series are produced as they run and after they are purchased by the operator.

increasing with quality. (A.2) is not essential but is introduced for the sake of convenience, as will be seen in the following section. Also note that the production cost is independent of the number of viewers. When the network does not produce a program, it obtains a reservation profit which is normalized to 0. Therefore the network provides a program when $\prod_N \geq 0$.

Let $\tilde{v}$ be such that $c'(\tilde{v}) = (z+r)/\overline{\delta}$, which is the first order condition of equation (3) when the market is not saturated. The first order condition implicitly defines $\tilde{v}$ as a function of r, which shows the optimal program quality that the network chooses for each value of r. Other things being equal, the network produces a program with higher quality when per viewer advertising revenue or licensing fee is higher. Quality is also increased when viewers are overall less averse to advertising.

The network's optimal decision and resulting profit can be written as follows;

$$\text{When } \tilde{v} - p < \overline{\delta}, \quad v = \tilde{v} \quad \text{and } \prod_N = \frac{1}{\overline{\delta}}(\tilde{v}-p)(z+r) - c(\tilde{v}) + S \tag{4.1}$$

$$\text{When } \tilde{v} - p \geq \overline{\delta}, \quad v = p + \overline{\delta} \quad \text{and } \prod_N = z + r - c(p+\overline{\delta}) + S. \tag{4.2}$$

For given p, r and S, if $\tilde{v}$ is so large that $\tilde{v} - p > \overline{\delta}$, the network is wasting resources for program production since all consumers subscribe to CATV ($n=1$) at $v = p + \overline{\delta}\,(< \tilde{v})$. Therefore, if $\tilde{v} - p > \overline{\delta}$, the network's optimal strategy is to choose $v = p + \overline{\delta}$. If $\tilde{v} - p < \overline{\delta}$, the network chooses $\tilde{v}$.

In the first stage, given (4.1-2), a cable operator chooses p, r and S to maximize its profit, $\prod_O$:

$$\max_{p,r,S} \prod_O = \begin{cases} \frac{1}{\overline{\delta}}(v-p)(p-r) - S & \text{if } v - p < \overline{\delta} \\ p - r - S & \text{if } v - p \geq \overline{\delta} \end{cases} \quad \text{s.t. } \prod_N \geq 0. \tag{5}$$

Note that the operator does not incur a cost for distributing a program to its subscribers.[15] The first constraint in (5) ensures provision of a program by the network. The reservation profit of the operator is set equal to 0.

III. Social Optimum

Before we solve for market equilibrium of the model in section IV, we find the first-best social optimum as a benchmark. For that purpose, we introduce a

[15] Introduction of the cost would not change the main argument of this paper.

benevolent dictator (a regulator) who can force the cable operator and the program network to make decisions as he wishes.

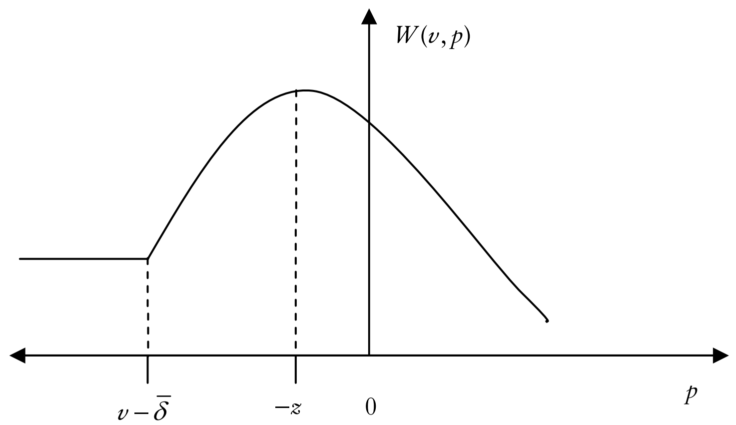
The regulator's goal is to maximize social welfare defined as the unweighted sum of consumer surplus and the profits of the operator and the network (see equation (6) below). Since r and S are just income transfers between the operator and the network, we only need to determine p and v that maximize the social welfare, $W(v,p)$;

$$W(v,p)=\begin{cases}\dfrac{v^2-p^2}{2\overline{\delta}}+z\dfrac{v-p}{\overline{\delta}}-c(v) & \text{if } v-p<\overline{\delta}\\ v-\dfrac{\overline{\delta}}{2}+z-c(v) & \text{if } v-p\geq\overline{\delta}\end{cases}. \tag{6}$$

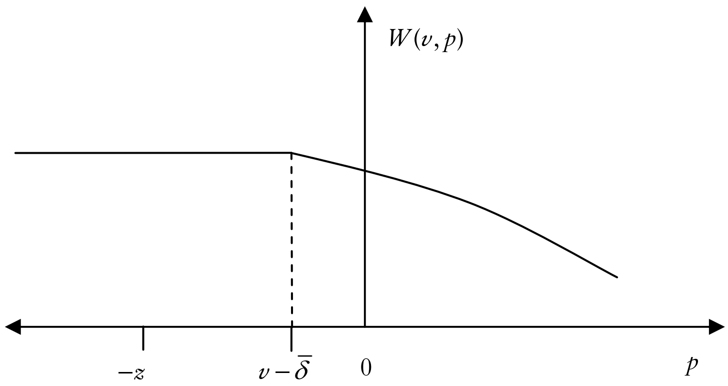
We handle the maximization of this non-differentiable function in the following way. First, for each given v, we determine p that maximizes $W(v,p)$. This gives us the function, $W(v)$, which maps each v to the maximum welfare that can be obtained for that v by changing p. Then we maximize $W(v)$ with respect to v.

From (6), we note that $dW(v,p)/dp=-(p+z)/\overline{\delta}$ when $p>v-\overline{\delta}$ and $dW(v,p)/dp=0$ when $p\leq v-\overline{\delta}$. Also, $-(p+z)/\overline{\delta}(>)0$ when $p\geq(<)-z$, respectively. Considering that $v-\overline{\delta}$ and $-z$ are the two critical values for determining an optimal p, we below examine the regulator's problem by dividing it into two cases: $v<\overline{\delta}-z$ and $v\geq\overline{\delta}-z$.

[Figure 1] $W(v,p)$



(a) $v<\overline{\delta}-z$



(b) $v \geq \overline{\delta} - z$

(i) $v < \overline{\delta} - z$

This means that $v - \overline{\delta} < -z$. As noted above and illustrated in panel (a) of Figure 1, for $p > v - \overline{\delta}$, $W(v,p)$ is maximized when $p = -z$. Since $W(v,p)$ is constant for $p \leq v - \overline{\delta}$, $p = -z$ gives the global maximum, that is, $W(v) = (v+z)^2 / 2\overline{\delta} - c(v)$. Letting $R_0(v) \equiv W(v) + c(v)$, we have $R_0(v) = (v+z)^2 / 2\overline{\delta}$ and $R_0'(v) = (v+z) / \overline{\delta}$.

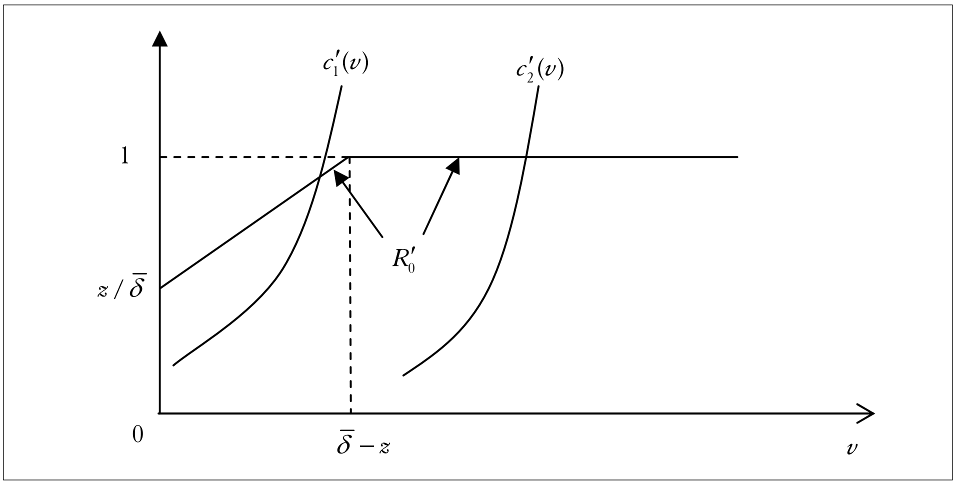
(ii) $v \geq \overline{\delta} - z$

This means that $v - \overline{\delta} \geq -z$. Here $dW(v,p)/dp < 0$ when $p > v - \overline{\delta}$. Hence $W(v,p)$ is maximized when $p \leq v - \overline{\delta}$. Thus we have $W(v) = v - \overline{\delta}/2 + z - c(v)$. In addition, we obtain $R_0(v) = v - \overline{\delta}/2 + z$ and $R_0'(v) = 1$.

Now setting $R_0'(v) = c'(v)$ leads to optimal solution of the regulator's maximization problem (see Figure 2). Assumption (A.2) ensures that $R_0'(v)$ and $c'(v)$ cross only once.[16]

[16] In the absence of (A.2), there may be multiple values of v with $R_0'(v) = c'(v)$. Then we would simply choose a value among them that maximizes welfare as an optimal v. Thus (A.2) can be assumed without loss of generality.

[Figure 2] Social Optimum



Proposition 1.

The socially optimal equilibrium of the game where a regulator chooses v^* [17] *and* p^* *to maximize social welfare is characterized as follows:* v^* *is the solution of* $R_0'(v)$, $= c'(v)$ *where* $R_0'(v) = \begin{cases} (v+z)/\overline{\delta} & \text{if } v < \overline{\delta}-z \\ 1 & \text{if } v \geq \overline{\delta}-z. \end{cases}$ *When* $v^* < \overline{\delta}-z$, $p^* = -z$ *with* $n^* = (v^*+z)/\overline{\delta}$ *and* $W^* = (v^*+z)^2/2\overline{\delta} - c(v^*)$. *When* $v^* \geq \overline{\delta}-z$, $p^* \leq v^* - \overline{\delta}$ *with* $n^* = 1$ *and* $W^* = v^* - \overline{\delta}/2 + z - c(v^*)$. *Assumption (A.3) implies* $W(v^*) \geq 0$.

When the market is not saturated in equilibrium (e.g. $c'(v) = c_1'(v)$ in Figure 2), the marginal subscriber's nuisance cost (δ^c) equals $v^* + z$. That is, the social benefit of an additional subscription (utility from watching, v^*, plus per viewer advertisement revenue, z) equals the social cost (nuisance cost of advertisement). Because an additional subscriber provides positive externality (z), it is socially optimal to set $p = -z$ to subsidize subscribers. When the market is saturated in equilibrium at a price higher than $p = -z$ (e.g. $c'(v) = c_2'(v)$ in Figure 2) p can take any value less than or equal to $v^* - \overline{\delta}$ because once everyone subscribes, a further price cut simply acts as a transfer from the cable operator to the viewers.

[17] Superscript * represents the equilibrium where the regulator maximizes social welfare.

IV. Market Equilibrium

In this section, we examine the equilibrium of the model where the cable operator maximizes its profit as described in section II. Note that the cable operator can collect the entire surplus of the network using r and S. Therefore, the solution of the cable operator's optimization problem (5) can be alternatively obtained by the following steps; (i) find v^{**} [18] and p^{**} that maximize the total profits of the operator and the network, $\prod_{NO}(=\prod_N+\prod_O)$ given in equation (7) below, (ii) obtain r^{**} that supports v^{**} given p^{**}, and (iii) set S^{**} to make the network break even:

$$\prod_{NO}=\begin{cases}\frac{1}{\overline{\delta}}(v-p)(z+p)-c(v) & if\ v-p<\overline{\delta}\\ z+p-c(v) & if\ v-p\geq\overline{\delta}\end{cases} \tag{7}$$

(i) Finding v^{**} and p^{**}

As in the previous section, we first determine the optimal p for each given v, and then solve for v that maximizes $\prod_{NO}$.

Because $\frac{\partial}{\partial p}((v-p)(z+p)/\overline{\delta})=(-2p+v-z)/\overline{\delta}$, it is easy to see that for given v, $p=(v-z)/2$ maximizes $\prod_{NO}$ as long as the market is not saturated ($v-p<\overline{\delta}$). This is the case when $v<2\overline{\delta}-z$. Then we have $p^{**}=(v-z)/2$ and $\prod_{NO}(v,p^{**})=(v+z)^2/4\overline{\delta}-c(v)$. Letting $R_1(v)\equiv\prod_{NO}(v)+c(v)$, we have $R_1(v)=(v+z)^2/4\overline{\delta}$ and $R_1'=(v+z)/2\overline{\delta}$.[19]

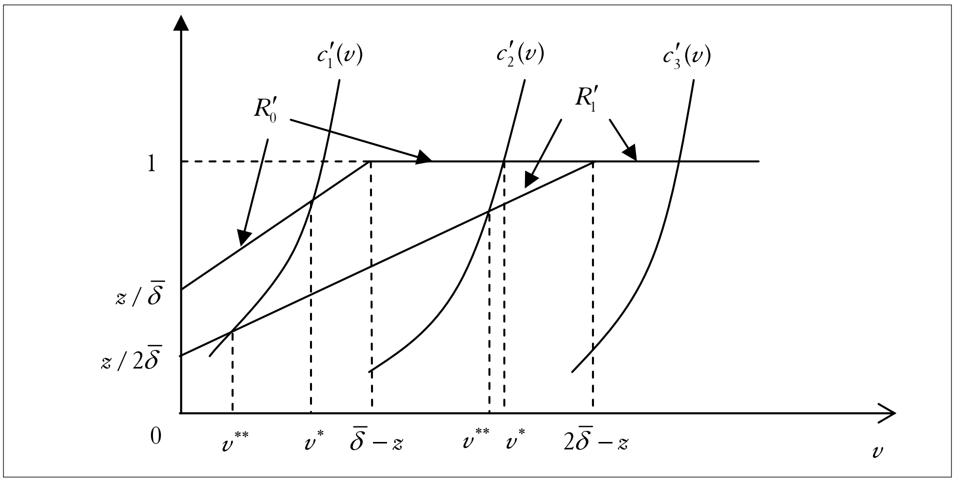
On the other hand, when $v\geq 2\overline{\delta}-z$, the market is saturated at a higher price than $p=(v-z)/2$. Lowering price below $p=v-\overline{\delta}$ decreases $\prod_{NO}(=z+p-c(v))$ because per viewer revenue is reduced without increasing subscription. Increasing price above $p=v-\overline{\delta}$ also does not increase $\prod_{NO}$ since $\frac{\partial}{\partial p}((v-p)(z+p)/\overline{\delta})$ is non-positive when $p\geq v-\overline{\delta}\geq(v-z)/2$. As a result, $p^{**}=v-\overline{\delta}$. In this case, we have $\prod_{NO}=z+v-\overline{\delta}-c(v)$ and $R_1=z+v-\overline{\delta}$ with $R_1'=1$.

Now that we have obtained R_1', we can find v^{**} that satisfies $R_1'=c'(v)$. Adding this result to Figure 2 gives us Figure 3.

[18] Superscript ** represents the market equilibrium where the cable operator maximizes its profit.

[19] For brevity, we omit the arguments of functions when it is clear from the context.

[Figure 3] Market Equilibrium



(ii) Finding r^{**} supporting v^{**}

With the knowledge of the program network's profit maximizing strategy represented by equations (4.1-2), the cable operator can set an appropriate level of licensing fee to induce the optimal level of program quality. When the market is not saturated in equilibrium, r^{**} satisfying $c'(v^{**})=(z+r^{**})/\bar{\delta}$, or $r^{**}=\bar{\delta}c'(v^{**})-z$, leads the network to choose v^{**}. When the market is saturated in equilibrium, setting r^{**} so that v satisfying $c'(v)=(z+r^{**})/\bar{\delta}$ is greater than or equal to v^{**} suffices. Because $c'(v)>0$ we have $r^{**}\in[\bar{\delta}-z,\propto)$. As a result, the operator can induce his desired program quality by setting an appropriate level of the program licensing fee.

(iii) Finding S^{**}

As mentioned before, an optimal lump-sum licensing fee is set at a level to extract all the profit from the network. That is, $S^{**}=c(v^{**})-(v^{**}-p^{**})(z+r^{**})/\bar{\delta}$.

Discussions above lead to the following proposition.

Proposition 2.

The market equilibrium of the game where a monopoly cable operator chooses p^{**}, r^{**} *and* S^{**} *(and thereby* v^{**}*) to maximize its profit is characterized as follows:* v^{**} *is the solution of* $R_1'=c'(v)$, *where* $R_1'=\begin{cases}(v+z)/2\bar{\delta} & \text{if } v<2\bar{\delta}-z\\ 1 & \text{if } v\geq 2\bar{\delta}-z.\end{cases}$ *When*

$v^{**} < 2\overline{\delta} - z$, $p^{**} = (v^{**} - z)/2$, $r^{**} = \overline{\delta} c'(v^{**}) - z$, *and* $S^{**} = c(v^{**}) - (v^{**} - p^{**})(z + r^{**})/\overline{\delta}$ *with* $n^{**} = (v^{**} + z)/2\overline{\delta}$ *and* $\Pi_O^{**} = (v^{**} + z)^2 / 4\overline{\delta} - c(v^{**})$. *When* $v^{**} \geq 2\overline{\delta} - z$, $p^{**} = v^{**} - \overline{\delta}$, $r^{**} \in [\overline{\delta} - z, \infty)$, *and* $S^{**} = c(v^{**}) - (v^{**} - p^{**})(z + r^{**})/\overline{\delta}$ *with* $n^{**} = 1$ *and* $\Pi_O^{**} = z + v^{**} - \overline{\delta} - c(v^{**})$. *Even though* v *is not contractible the cable operator is able to achieve his optimal level of* v^{**}*, and assumption (A.3) implies* $\Pi_O^{**} \geq 0$.

Looking at Figure 3, we notice that $R_0' > R_1'$ when the market equilibrium is not saturated. A marginal increase (say Δv) in program quality gives rise to a larger increase in social welfare than that in the operator's profit. This can be attributed to the fact that the monopoly operator faces a decreasing demand function (in p) and is thus unable to capture completely the extra surplus from a higher program quality. In contrast, when the market equilibrium is saturated, $R_0' = R_1' = 1$. The social welfare and the monopoly operator's profit alike increase by the same amount as does program quality (Δv).

Consequently, when the market equilibrium is saturated it is also socially optimal. However, when the market is not saturated, society is worse off in the market equilibrium with the program quality falling short of the socially optimal level. This supports the view of the market experts that the program quality is below socially optimal level in market equilibrium.

V. Equilibrium with Regulation of Program Licensing Fee

We saw that a benevolent dictator can achieve the social optimum. However, it is not realistic for the regulator to directly control both program quality and price. In this section, we examine whether a more feasible regulatory intervention in the market can improve social welfare. As the saturated market equilibrium is socially optimal, the focus of this section is on the non-saturated market equilibrium. Specifically, we modify the time sequence of events depicted in the previous section by letting the regulator introduce a regulation in stage 0 with the remaining events proceeding similarly as before.

For simplicity of exposition, we assume that the regulator directly controls the absolute level of licensing fee, which is slightly different from the current regulation in Korea mandating cable operators to pay at least 25% of their subscription revenues to program networks as licensing fees. Suppose that the regulator mandates a licensing fee of r_g. Naturally, the regulated licensing fee will be set above r^{**} with the aim of increasing the market equilibrium level of program quality, which is below the socially optimal level. When the regulator sets $r_g = \overline{\delta} c'(v_g) - z (> r^{**})$ in order to induce $v = v_g (v^{**} < v_g)$, apparently the cable operator can respond in two ways. He can either allow v to rise from v^{**} to v_g and increase the subscription fee to his optimal level given $v = v_g$, or he can "defend" $v = v_m$, where $v_m \in [v^{**}, v_g)$ by lowering the subscription fee to $p = v_m - \overline{\delta}$.[20] In other words, the operator is now required to satisfy either a constraint on program quality $(v = v_g)$, or a constraint on subscription fee ($p = v_m - \overline{\delta}$).

Consider first the case where the social optimum is obtained where the market is saturated e.g. $c'(v) = c_2'(v)$ in Figure 3. If he accepts the latter constraint, i.e., chooses to keep program quality lower than v_g by saturating the market, his profit equals $z + v_m - \overline{\delta} - c(v_m)$ (from equation 8). This value is maximized when $v_m = v^*$ since $c'(v^*) = 1$. Therefore, should the operator decide to defend a lower program quality and accept a constraint on subscription fee, both values become socially optimal ($v_m = v^*$ and $p = v^* - \overline{\delta}$). Thus the regulator can achieve the social optimum by inducing the operator to defend program quality. This is easily achieved by setting r_g high enough.

Next we consider the case where the social optimum is obtained where the market is not saturated e.g. $c'(v) = c_1'(v)$ in Figure 3. In this case, the former option dominates the latter. When the operator lowers the subscription fee to $v_m - \overline{\delta}$, his profit becomes $z + v_m - \overline{\delta} - c(v_m)$. As $c'(v_m) < 1$, this means that he is better off with a higher program quality, i.e., and $p = v_g - \overline{\delta}$, earning a profit of $z + v_g - \overline{\delta} - c(v_g)$. But at $v = v_g$, setting $p = (v_g - z)/2(< v^* - \overline{\delta})$ gives more profit.

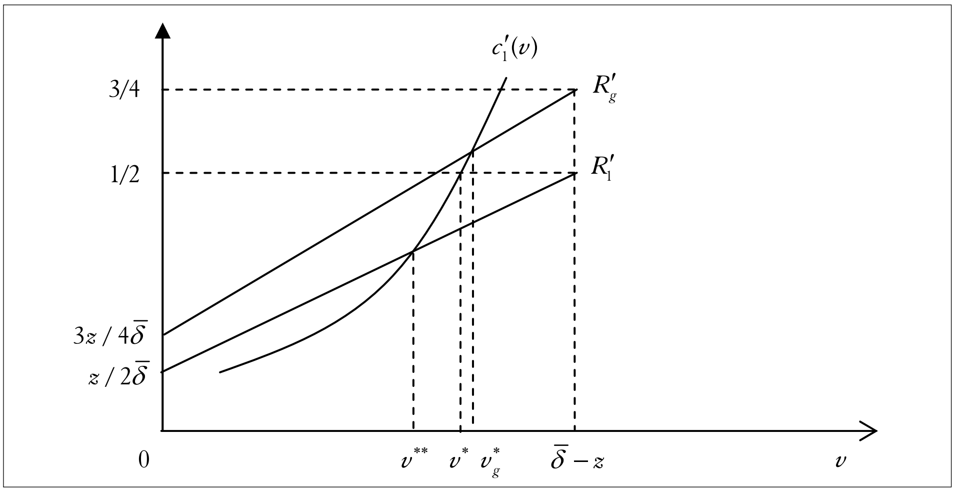
Thus the regulator can control program quality, at least up to $v_g = \overline{\delta} - z$. The cable operator will take program quality as given and choose his profit maximizing subscription fee, which is $p_g = (v_g - z)/2$. Thus the welfare function becomes $W_g = W|_{p=(v_g - z)/2}$, and the regulator's "marginal revenue function" is $R_g'(v_g) = d(W_g + c(v_g))/dv_g = 3(v_g + z)/4\overline{\delta}(v_g \le \overline{\delta} - z)$. The optimal level of v_g, or v_g^*, is obtained by solving $R_g'(v_g) = c'(v_g)$, as shown in Figure 4.

Because $R_g' > R_1'$, v_g^* is always higher than v^{**}. By setting $r_g^* = \overline{\delta} c'(v_g^*) - z$, the regulator can induce v_g^* and improve social welfare. This is essentially because the licensing fee regulation allows control of one of the two key variables that determine social welfare, i.e. program quality. The regulator is able to choose the level of program quality that leads to social welfare that is constrained-optimal, taking as given the cable operator's choice of subscription fee ($p = (v - z)/2$). However, because the other key variable, subscription fee, is left to the monopoly operator, the regulation necessarily falls short of achieving the socially optimal equilibrium.

---

[20] Given r_g set by the regulator, the only way for the operator to induce the network to produce program at quality other than v_g is to lower p so that the market is saturated at quality lower than v_g.

[Figure 4] Equilibrium with Regulation of Licensing Fee



The findings in this section are summarized in the following Proposition 3.

Proposition 3.

Consider a regulator controlling program licensing fee that the cable operator pays to the program network. When the social optimum is obtained where the market is saturated, the regulator can obtain the socially optimal equilibrium. However, when the social optimum is obtained where the market is not saturated, the regulation improves social welfare but necessarily falls short of achieving the socially optimal equilibrium.

Finally, note that throughout we have assumed that when per subscriber licensing fee is regulated, the cable operator can still make use of the lump-sum fee to extract the entire surplus from the network. This captures the industrial reality that lump-sum fees are widely used in contracts. If the licensing fee only consisted of a per subscriber fee, the regulation may induce the operator to pass on the burden to the viewers by charging higher subscription fees.[21]

VI. Concluding Remarks

In order to promote program production and develop the CATV industry, the KCC introduced regulation mandating cable operators to increase the licensing fee paid to program networks. However, this regulation was introduced without a

[21] We thank an anonymous referee for directing our attention to this point.

formal analysis of its effects on the industry or social welfare.

This paper sets up a simple model focusing on the two-sided market nature of CATV industry. It is shown that the market equilibrium is generally suboptimal and program quality is below the socially optimal level. When the market equilibrium is suboptimal, regulating the licensing fee improves social welfare, but may not reach the socially optimal equilibrium.

However, the pay-TV industry is being transformed into a more competitive industry with the advent of new technologies such as satellite broadcasting, IPTV and so on. We need to see if we can obtain a better outcome by facilitating competition in pay-TV industry rather than regulating a program licensing fee. It is a future research topic to examine the effect of the regulation in a market with a multiple number of platforms. It is also an interesting topic to examine empirically the effects of the regulations.

References

Armstrong, M. (2006), "Competition in Two-Sided Markets," *The Rand Journal of Economics*, Vol. 37, No. 3, 668-691.

Anderson, S. and S. Coate (2005), "Market Provision of Broadcasting: A Welfare Analysis," The Review of Economic Studies, Vol. 72, No. 4, 947-972.

Economides, N. and J. Tåg (2012), "Network Neutrality on the Internet: A two-sided market analysis," *Information Economics and Policy*, Vol. 24, No. 2, 91-104.

Gabszewicz, J. J., D. Laussel, and N. Sonnac (2001), "Press Advertising and the Ascent of the 'Pensée Unique'," *European Economic Review*, Vol. 45, No. 4, 641-651.

Gal-Or, E. and A. Dukes (2003), "Minimum Differentiation in Commercial Media Markets," *Journal of Economics & Management Strategy*, Vol. 12, No. 3, 291-325.

Haigu, A. (2004), "Two-Sided Platforms: Pricing and Social Efficiency," Research Institute for the Economy, Trade and Industry Discussion Paper Series, Princeton University

Jung, Y. (2005), "Policies and Regulations for the Era of Digital Broadcasting," mimeo (in Korean).

Kim, K. (2005), "Market Structure and Regulation of Program Providers in Korean Pay-TV Market," mimeo (in Korean).

Kwon, H. (2005), "Current Status and Development Strategy in Pay-TV Industry," mimeo (in Korean).

Nam, Y. and J. Yoo, (2011), *A Research on Improvements of the PP program fee policy in the Cable TV industry*, Policy Report 11-49, Korea Information Society Development Institute (in Korean).

Lee, R. S. and T. Wu, (2009), "Subsidizing Creativity through Network Design: Zero-Pricing and Net Neutrality," *Journal of Economic Perspectives*, Vol. 23, No. 3, 61-76.

Rochet, J. C. and J. Tirole, (2004), "Two-Sided Markets: An Overview," Vol. 258, IDEI working paper.