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PRICE SQUEEZE AND CASE OF DEUTSCHE TELEKOM: ECONOMIC PERSPECTIVE

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Abstract

We explore the price squeeze test proposed by the European Commission in a partial and a no relation environments in network industries, which assumes that a new entrant is an equally efficient competitor to the incumbent firm. Under this assumption, the test in a partial regulation environment can show precisely what strategies the incumbent employs in a market, and can also show that differences in costs between the incumbent and the entrant generate either a false negative or a false positive when the one is superior in costs to the other. Moreover, the incumbent in a no regulation environment has no incentives to employ a price squeeze and the test generates a false positive in Subgame Perfect Equilibrium. Thus, the test is not a reliable measure to judge strategies of the incumbent if a firm can not enjoy costs advantage. As the Commission decision is based on the test, there is a legal flaw in the procedures for judging true reasons why the entrant exists from a market. It then follows these that the Commission decision fining Deutsche Telekom should be declined.

JEL classification: K23, L13, L43, L51
Keywords: price squeeze test; equally efficient competitor; difference in costs; false positive; false negative; legal flaw

1 Introduction

Deregulation of a network industry, for example, Telecommunications and a water industry, has caused new firms to enter into a market. Some firms may succeed in supplying outputs profitably, while others may exit from a market. Thus, price squeeze cases have arisen. When new entrants are forced out of a market, deregulation does not enhance market efficiency. There are several ways to explore whether the entrant is driven out of a market by market competition or exclusionary strategies by the incumbent.[1] Typical examples are given in the U.S. and Europe. In the U.S., a new act is introduced to deal with these issues. In fact, the 1996 Telecommunications Act requires the regulation authority to examine only whether access rates for essential inputs are cost based.[2]

To judge whether the incumbent firm employs such a strategy, the European Commission (henceforth, EC) proposed two definitions of Price Squeeze tests (henceforth, PS test).[3] Bouckaert and Verboven (2004) introduce regulatory environments to analyze price squeeze tests. We follow their definition of regulatory environments. Bruno, Rey and Saavedra (2013) give an excellent survey on the economics of a price squeeze.

When we consider the German telecommunication industry, we have to pay attention to paragraph 5 in the European Commission decision of 21 May 2003, which states:

" Charges for access to local networks are partially regulated by the regulatory authority, but this decision is concerned with unfair prices which have been set by DT itself in the exercise of its own commercial freedom, and for which it is directly responsible."

It follows that it can be modeled as a partial regulatory environment (or game) or a no regulation environment (or game). The characteristics of the PS test can be examined in these environments: The partial regulatory environment is modeled as a one shot Cournot game, while the other is modeled as a two stage game. Our model is the same as one of important types of market structure in vertically related markets which Rey and Tirole (2007) explores. Basic framework and a notation are close to Armstrong (2002) and Bouckaert and Verboven (2004). The PS test is based upon the assumption that a new entrant is an equally efficient competitor to the incumbent.[4] This assumption will be called the PS assumption. If this

[1]Weisman (2003) points out two types of exclusionary behavior that the incumbent can adopt: a price squeeze and sabotage.

[2]Bork (1978) and Carlton (2008) insist that the incumbent firm has no incentives to employ a price squeeze.

[3]See the 1998 Notice of the European Commission (1998).

[4]This is called *equally efficient competitor* test by Bruno, Rey and Saavedra (2013).

assumption holds true, the test can show what strategy the incumbent firm adopts. On the other hand, we introduce a new test to examine the PS test in these games where the PS assumption is not valid: Costs of the incumbent and the entrant are not the same. It will be shown in the partial regulation game that the PS test generates a false negative or a false positive depending upon the relative values of costs of two competitors.[5] It then follows from these and costs of the real firms that the PS test is not necessarily a reliable measure to judge whether the incumbent has employed such an exclusionary strategy as a price squeeze.

If we turn our attention to the no regulation game, it will be shown that the incumbent has no incentives to drive the competitor out of a market, and that the exit of the entrant is solely due to inefficiency of the entrant, not by a price squeeze by the incumbent. These observations of two regulatory environments reveal that the PS test is not necessarily a reliable measures to judge behavior of the incumbent. The EC decision, which is based upon the PS test, is not well founded in that its decision should be declined. In particular, our analysis of the PS test in the no regulation game strongly shows that the EC oversteps the mark in the decision of the case of Deutsche Telekom.

Such concerns about the reliability of the PS test proposed by the EC have been noticed by Weisman (2003) and Bouckaert and Verboven (2004). Salop (2010) proposes a new test to judge whether the incumbent practices such an exclusionary strategy. However, the European Commission has not noticed the possibility that the PS test fails to show precisely what strategy the incumbent adopts.[6] It follows from these that there is a legal flaw in the procedures for judging the case of DT. Moreover, it follows from Mathematical Logic that inferences driven from a false assumption are logically true, but is meaningless. Our analysis of the PS test in two regulatory environments reveals that the EC decision of 21 May 2003 is not well founded in that it should be declined.

Our paper is organized as follows: Section 2 sets forth our model and the PS test that is proposed by the European Commission together with our new test. In Section 3, we set forth a partial regulation game and explore the PS test proposed by the European Commission. It will be show that a false negative or false positive can arise depending upon the relative values of firms' average costs. In Section 4, we examine the case of DT in the partial regulatory game. It will be shown that there is a legal flaw in the EC decision on the case of DT. Section 5 examines the PS test in the no regulatory game. It will be shown that the incumbent has no incentives to drive a rival out of a market, and that the test generates a false negative. The EC

[5]Petulowa and Saavedra (2013) pointed out that the test generates a false negative or a false positive.

[6]See, European Commission (2003).

decision is not well founded in the no regulatory games. Thus, the decision should be declined. Section 5 summarizes our observations.

2 The Model and Price Squeeze Tests

Consider a network industry where there are the incumbent firm (firm 1) and a new entrant (firm 2). The incumbent produces an essential input and sells it to the entrant. Thus, foreclosure is assumed away.[7] Both firms produce outputs in one-to-one proportion. The average costs of an essential input are given by c_0, which is assumed equal to zero for simplicity of our analysis.[8] The average costs of outputs of firms 1 and 2 are fixed constants $c_1, c_2 + \alpha$, respectively, where c_i stands for average costs of firm i net of an access rate, and α for an access rate for inputs.

A demand function is given by

$$P = A - (x_1 + x_2) = A - X, \tag{1}$$

where P stands for price for outputs, x_i for outputs of firm i, and A for a constant parameter. To make our analysis tractable, assume that firms are viable in a partial regulation game in which access rates are determined by the regulatory authority. This assumption is given by

$$A > 2 \times max\{c_1, c_2\}. \tag{2}$$

These assumptions guarantee that outputs supplied by firms are positive.

A price squeeze (henceforth, PS) tests proposed by the European Commission, which Bruno, Rey and Saavedra (2013) calls it the Equally Efficient Competitors (EEC) test, has been used to examine whether the incumbent is responsible for price squeeze cases in the partial regulation game. In what follows, the features of the PS tests will be examined concerning whether a new entrant can reap positive profits.[9] The PS test which we will take up amounts to examining whether the following inequality is satisfied:

$$P - \alpha \geq c_1. \tag{3}$$

However, if the assumption that a new entrant is not as efficient as the incumbent firm, the PS test will not work well, and some serious problems may occur. To examine the features of the PS test, we introduce the new test using costs of the entrant. Our new test directly considers

[7]Yang and Kawashima (2011) shows that the incumbent firm does not have incentives to employ a price squeeze in no regulation games.

[8]We follow Armstrong (2002) in the sense that upstream costs for producing inputs and additional upstream costs to the entrants are both equal to 0.

[9]For an excellent explanation of price squeeze tests, see Bouckaert and Verboven (2004).

whether the entrant can make positive profits. This is called the profitability (henceforth, PR) test, which is

$$P - \alpha - c_2 > 0, \tag{4}$$

where $\alpha + c_2$ is average costs of outputs by the entrant. This test examines if per-unit profits of the entrant are positive. If they are positive, the entrant can supply outputs profitably and can be viable. Otherwise, the entrant has to exit form a market. Then, this is a direct test of viability of the entrant.

3 Partial Regulation Game

Now, consider a partial regulation game where price for inputs is regulated by the authority. It is a fixed constant and given by $\bar{\alpha}$. Although Bouckaert and Verboven (2004) have not considered the price squeeze tests in a partial regulation game, we will consider the partial regulation game by a one shot Cournot game.

The timing of our game is as follows:

1. The authority chooses an access rate $\bar{\alpha}$ for inputs from the closed interval $S_{sq} = [0, 2A - c_1 - c_2)$.
2. The incumbent and a new entrant compete downstream in supplying outputs.
3. The entrant decides whether it can stay at or exit from a market.
4. The authority examines whether the set of access rates and downstream prices can pass the PS test.

Note that it does not matter whether there is the difference in productivities between two firms. A less efficient entrant can enter into a market. It will be shown in Section 5 that less efficient entrant can not be viable in no regulation games. In this game, if outputs and/or profits of a firm is not larger than zero, that firm cannot reap positive profits and then it has to exit from a market. Note also that total outputs are positive for $\bar{\alpha} \in S_{sq}$. It will be shown in what follows.

In view of (1), profits of two firms are given respectively by

$$\pi_1 = (P - c_0 - c_1)x_1 + (\bar{\alpha} - c_0)x_2 = ((P - c_1)x_1 + \bar{\alpha}x_2 = (A - X - c_1)x_1 + \bar{\alpha}x_2,$$

$$\pi_2 = (P - \bar{\alpha} - c_2)x_2 = (A - X - \bar{\alpha} - c_2)x_2,$$

where upstream costs c_0 of producing inputs is equal to 0.

Then, we can now establish:

Lemma 1. *If the authority sets access price* $\bar{\alpha} < \alpha_{sq} = \frac{A + c_1 - 2c_2}{2}$, *outputs of the incumbent and the entrant, and price of outputs under a partial regulation game are given by*

$$\bar{x}_1 = \frac{A - 2c_1 + c_2 + \bar{\alpha}}{3},$$
$$\bar{x}_2 = \frac{A + c_1 - 2c_2 - 2\bar{\alpha}}{3},$$
$$\bar{X} = \bar{x}_1 + \bar{x}_2 = \frac{2A - c_1 - c_2 - \bar{\alpha}}{3},$$
$$\bar{P} = A - \bar{X} = \frac{A + c_1 + c_2 + \bar{\alpha}}{3}.$$

However, the entrant can not enter into a market for $\alpha_{sq} \leq \bar{\alpha} < (2A - c_1 - c_2)$.

Proof. Differentiating profits π_i with respect to x_i yields the best response functions of two firms. The first order condition of the incumbent is given by

$$\frac{\partial \pi_1}{\partial x_1} = -x_1 + (A - X - c_1) = 0.$$

Solving x_1 yields the best response function of the incumbent (firm 1), which can be expressed as

$$x_1 = R_1(X) = A - X - c_1.$$

Similarly, differentiating profits of the entrant with respect to x_2 yields

$$\frac{\partial \pi_2}{\partial x_2} = -x_2 + (A - X - \bar{\alpha} - c_2) = 0,$$

which enables us to have the best response function of firm 2. It is given by

$$x_2 = R_2(X) = A - X - \bar{\alpha} - c_2.$$

Noting these functions, we have

$$R_1(X) + R_2(X) - X = 0,$$

which gives us total outputs $\bar{X}$ as

$$\bar{X} = \frac{2A - c_1 - \bar{\alpha} - c_2}{3} > 0 \; for \; \bar{\alpha} \in S_{sq}.$$

Solving these equations for x_i yields competitive outputs of the incumbent and the entrant. For example, output $\bar{x}_i$ of firm i is given respectively by

$$\bar{x}_1 = R_1(\bar{X}) = A - \bar{X} - c_1 = \frac{A - 2c_1 + c_2 + \bar{\alpha}}{3},$$
$$\bar{x}_2 = R_2(\bar{X}) = A - \bar{X} - c_2 = \frac{A + c_1 - 2c_2 - 2\bar{\alpha}}{3}.$$

If access rate $\bar{\alpha}$ is less than α_{sq}, outputs $\bar{x}_2$ is positive. Outputs of two firms are given by $\bar{x}_i$ above. Thus, substituting $\bar{X}_i$ into a demand function (1) yields downstream price of outputs. It is given by

$$\bar{P} = A - \bar{X} = \frac{A + c_1 + c_2 + \bar{\alpha}}{3}. \quad (5)$$

Positivity of outputs depends crucially upon access rates set by the authority.

However, if access rate $\bar{\alpha}$ is not less than α_{sq}, the entrant can not make positive profits and then it can not stay at a market. Outputs of the incumbent can be positive only if access rate is less than $(2A - c_1 - c_2)$. □

It then follows from Lemma 1 that downstream price is determined by an access rate and that it increases with the access rates.

When we apply the PS test (3) to the partial regulation game, it is easy to show that

$$\bar{P} - \bar{\alpha} - c_1 = \frac{A - 2c_1 + c_2 - 2\bar{\alpha}}{3} \geq 0 \quad \text{iff} \quad \bar{\alpha} \leq \tilde{\alpha} = \frac{A - 2c_1 + c_2}{2}.$$

The result of the PR test (4) is given by

$$\bar{P} - \bar{\alpha} - c_2 = \frac{A + c_1 - 2c_2 - 2\bar{\alpha}}{3} > 0 \quad \text{iff} \quad \bar{\alpha} < \alpha_{sq} = \frac{A + c_1 - 2c_2}{2}. \tag{6}$$

Note that $\tilde{\alpha}$ and α_{sq} are both less than A in view of (2).

The entrant can not make positive profits and exits from a market if the authority sets access rates equal to α_{sq}.

It would be easy to show the arguments above by the use of the PS and the PR lines, which are given respectively by

$$P - \alpha - c_1 = 0,$$
$$P - \alpha - c_2 = 0.$$

Both of them are depicted in Figures 1 and 2 together with the Downstream Price line (or DP), which is given by

$$P = \frac{A + c_1 + c_2 + \alpha}{3}.$$

*****Fig.1*****

*****Fig.2*****

In what follows, let first take up a game where the entrant is less efficient: i.e., $c_1 < c_2$. Then, the PS line (or PS) is below the PR line (or PR). Thus, Fig. 1 shows that $\alpha_{sq} < \tilde{\alpha}$. However, if $c_1 \geq c_2$, the PS is above the PR. Thus, it follows from Fig. 2 that the intersection point of the PS with the DP is left to that of the PR with the DP. Then, Fig. 2 shows that $\alpha_{sq} \geq \tilde{\alpha}$.

Comparing Fig. 1 with Fig. 2, it is straightforward to show that

$$\alpha_{sq} \gtreqless \tilde{\alpha} \quad \text{iff} \quad c_1 \gtreqless c_2.$$

Note that if outputs and/or profits of a firm is not larger than zero, then the firm has to exit from a market. Then, we can now summarize our results as:

Lemma 2. *When we apply the Price Squeeze test proposed by the European Commission to the partial regulation game, the results are shown in the following cases:*

Case 1: The incumbent can enjoy efficiency advantage: i.e., $c_1 < c_2$.

If access price $\bar{\alpha}$ *set by the authority is in the set* $[0, \alpha_{sq})$*, both tests can be passed. The entrant can be viable. If it is in the closed* $[\alpha_{sq}, \tilde{\alpha}]$*, it leads to a false negative: The entrant can not supply outputs profitably even if the PS test is passed. Finally, if it is larger than* $\tilde{\alpha}$*, both tests are failed. The entrant can not be viable.*

Case 2: The entrant can not enjoy efficiency advantage: i.e., $c_1 \geq c_2$.

If access price $\bar{\alpha}$ *set by the authority is in the closed set* $[0, \tilde{\alpha}]$*, both tests can be passed. The entrant can stay at a market. If it is in the open set* $(\tilde{\alpha}, \alpha_{sq})$*, it leads to a false positive: Although the PS test is failed, the entrant can be viable. Finally, if it is equal to or more than* α_{sq}*, both tests are failed and the entrant can not stay at a market.*

Proof. Case 1: This game is shown in Fig. 1, where the PR is above the PS . First, if $\bar{\alpha} \in [0, \alpha_{sq})$, the PS and the PR tests can be passed. Second, if $\bar{\alpha} \in [\alpha_{sq}, \tilde{\alpha}]$, it follows from the definitions of α_{sq} and $\tilde{\alpha}$ that the PR test is not passed, but that the PS test can be passed. Thus, the entrant can not be viable in a market even if the PS test indicates that the incumbent does not practice a price squeeze. Thus, a falsenegative occurs. The typical example of a false negative is shown in point B in Fig. 1. For $\tilde{\alpha} \geq \alpha_{sq}$, both tests are violated.

Case 2: This is a game which is shown in Fig. 2, where the PS is above the PR. First, for $\bar{\alpha} \in [0, \tilde{\alpha}]$, both tests can be passed. If $\bar{\alpha}$ is in $(\tilde{\alpha}, \alpha_{sq})$, it follows from the definitions of α_{sq} and $\tilde{\alpha}$ that the PR test is passed, but the other can not be passed. Although the entrant can reap positive profits, the PS test indicates that access price set by the authority can not pass the PS test. Thus, we can say that the access rate leads to a false negative. One of examples of a false positive is shown in point C in Fig. 2. It is easy to show that access price $\bar{\alpha}$, which is larger than α_{sq}, violates both tests. □

Note that it does not matter whether the entrant is more efficient than the incumbent in a partial regulation game. This is because an access price is set by the authority and then the entrant is less squeezed its profits in an upstream market than in no regulation game. Note that less efficient entrants can not be viable in no regulation game.[10]

[10]For example, see Bork (1978) and Carlton (2008) in which a downstream market is

We can summarize our results of the exit of a new entrant as:

Proposition 1. *Depending upon the relative values of average costs of firms, we will encounter two distinct types of games, where new entrants are excluded from a market:*

1. If a new entrant is less efficient than the incumbent firm, there are two basic games which cause the entrant to exit from a market:

(a). The set $(\bar{\alpha}, \bar{P})$ *is below the PS test line: The regulatory authority sets too high access rates for the entrant to be viable.*

(b). The set $(\bar{\alpha}, \bar{P})$ *is above the PS test line, but below the PR test line: The inefficiency of the entrant causes the entrant not to make positive profits if the access rate is not so high.*

2. If a new entrant is not less efficient than the incumbent firm, then the entrant exits from a market when the set $(\bar{\alpha}, \bar{P})$ *is below the PR test line.*

Proof. The first game is shown in Fig. 1, where the entrant is less efficient than the incumbent. It is easy that the entrant can not reap positive profits only if the access rate is larger that α_{sq}. Moreover, it follows from Fig. 1 that the entrant can not reap positive profits if either $\bar{\alpha} > \tilde{\alpha}$ or $\alpha_{sq} \leq \bar{\alpha} \leq \alpha$.

If the entrant is not less efficient, this game is shown in Fig. 2. It can not make positive profits only if access rate is below the PR line. □

In short, we find that there are two basic factors which cause the entrant not to stay at a market: One is a higher access rate set by regulatory authority and the other is inefficiency of the entrant. Note that new entrants cannot stay at a market even if the PS test is passed. The exit from a market is due to its inefficiency in that market competition causes an inefficient firm to be excluded from a market. Thus, the PS test, which assumes that the entrant is equally efficient competitor to the incumbent, is not always a reliable measure to judge whether the authority approves the incumbent to employ a price squeeze.

4 Price Squeeze Test and Case of Deutsche Telekom

So far, it has not been paid attention to the assumption of the PS test: A new entrant is an equally efficient competitor to the incumbent firm: $i.e., c_1 = c_2$. This is called the PS

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competitive, and Yang and Kawashima(2011) in which a downstream market is a duopoly. Moreover, this will be shown in Section 5.

assumption. To explore the characteristics of the PS test, our new test, which is called the PR test, was introduced and expressed as (4). If the PS assumption holds true, the PS test coincides with the PR test. However, one point should be noted. For $c_1 = c_2$, the intersection point of the PS with the DP coincides with that of the PR and the DP. If the intersection is given by a set $(\bar{\alpha}, \bar{P})$, it turns out that

$$\bar{P} - \bar{\alpha} - c_1 = 0,$$
$$\bar{P} - \bar{\alpha} - c_2 = 0.$$

It follows from (3) and (4) that a false negative occurs when costs of both firms are equal. In fact, the PS test can be passed, but the entrant can not make positive profits. However, the set of an access rate which satisfies equations above does not play an important role in what follows. Thus, we will ignore it in what follows.[11] Noting these, our arguments are summarized in what follows:

Lemma 3. *If average costs of a new entrant are equal to those of the incumbent firm, then we have:*
a). If a set of upstream (or access rates) and downstream prices can pass the PS test, the entrant can profitably supply outputs.
b). If the set can not pass the test, the entrant can not be viable.

This is what the European Commission would have supposed. Under the PS assumption, if the PS test is passed, the entrant can be viable. If it is not, it turns out that the incumbent has employed a price squeeze and then the entrant can not stay at a market. Thus, the PS test is a precise signal of whether the incumbent has practiced such an exclusionary strategy. If the entrant exit from a market, it turns out that the incumbent has adopted a price squeeze. Under the PS assumption, the decision of the European Commission on the case of DT holds true.

The German markets in telephone services has been liberalized since 1996, and the Deutsche Telecom has been subject to regulation at both the wholesale and the retail levels. Although the DT has been subject to a price cap for baskets of services, it was given discretion to the pricing strategy of individual component services within the basket. Thus, we consider the German telecommunications market from the view point of the partial regulation game where the PS assumption holds true. Although pricing strategy of DT was approved by the German regulatory authority, the entrant was not able to make positive profits and then exited from the market. It

[11] We can be more precise than this: Access rate at which the PS intersects the DP defines a zero-measure set in the S_{sq}. Then, we can ignore such an access rate.

then follows from these that a pair of access rates set by the authority and decreases in downstream price by DT were judged that DT practiced a price squeeze and then it was fined for an abusive price squeeze.

When costs of firms are taken into account, we will encounter quite different scenarios. If the entrant is less efficient than the incumbent, it follows from Proposition 1 that there is a possibility that the entrant are excluded by market competition. Thus, an exclusionary strategy such as a price squeeze is not a sole reason why the entrant can not stay at a market. We should not ignore a possibility that an inefficient entrant is excluded from a market by market competition.

As Rey and Tirole (2007) pointed out, it is well known that costs of firms are difficult to estimate. The EC and the regulatory authority can more easily get access to costs information of firms than private firms. They are publicly financed for their social duties. Moreover, the Commission hires many experts and staffs such as lawyers, accountants and economists, who can analyze data. It is evident that the EC is more qualified to estimate precisely costs of firms than the incumbent firm. Moreover, the EC holds the position to judge and fine firms which employ such an exclusionary strategy.

Ignoring costs of firms causes a serious problem to the Commission, which is summarized in the following proposition:

We can now establish:

Proposition 2. *There is a legal flaw in the procedures of the European Commission for judgments on case of Deutsche Telekom unless the Commission can give evidence that new entrants are as efficient as the incumbent firm.*

Proof. It follows from Lemma 3 that if the PS assumption is valid a new entrant exits from a market only when a price squeeze is practiced. However, if the PS assumption does not hold true, Lemma 3 does not hold and it follows from Proposition 1 that a false negative or a false positive can arise. This means that the PS test is not a reliable measure to judge whether a price squeeze has been adopted.

To justify to fine DT for an abusive price squeeze, the EC has to examine whether the PS assumption holds true in the case of DT. However, the Commission decision does not refer to costs of the entrant. It is indispensable for the EC to show clear evidence that the test can show precisely strategies of the incumbent. As it has not made such efforts until now, there is a legal flaw in the procedures for its decision making and the decision by the Commission on the case

of DT is not well founded. □

As the EC keeps closed the data of costs of the incumbent and the entrant to the public in its decision, there will be serious concerns that the EC can manipulate figures and the definitions of costs to justify its decision. In these situations, no one can review the details of its decision. Instead of estimating costs of firms, the PS assumption is made. As shown in Proposition 1, difference in productivities of firms plays a key role in our arguments of the case of DT: The PS test proposed by the EC is not always a reliable means to judge whether a price squeeze has been practiced. Depending upon the relative values of costs of two competitors, cause and effect differ.

The EC may have strong incentives not to disclose the data concerning the case of DT. If data are open to the public, there will be a lot of criticisms on the EC decision. For example, it is difficult to define the definition and figures of costs which many people agree with. Thus, the disclosure of the data *opens Pandora's box* and incurs huge amounts of money and time to EC in order to justify the decision. Depending upon the definition of costs, it may or may not conclude from Proposition 1 and Lemma 3 that DT does not employ a price squeeze. It follows from these arguments that the strategy of not opening data to the public enabled the EC to save efforts and costs, and enables it to succeed in persuading the European Court of Justice to approve its decision. Thus, it was *the dominant strategy* for EC.

Moreover, real firms differ in management, production facilities and so on. This means that it is almost impossible for costs of the entrant to equal those of the incumbent. The assumption that the entrant is as efficient as the incumbent does not generally hold true. Even if costs can be estimated precisely, the assumption is not valid for real firms.[12]

Noting these arguments, we can conclude:

Proposition 3. *The European Commission decision fining Deutshe Telekom should be declined unless the Commission has made sure that the entrant is as efficient as the incumbent.*

Proof. As pointed out above, the PS assumption that the entrant is as efficient as the incumbent does not generally hold true. In fact, the Commission has paid no attention to this assumption. Then, the decision of the EC on the case of DT is derived from false assumptions.

[12]We can be more precise than this. Let C be a set of possible costs of firms, which is the closed interval. It follows from Measure theory in Mathematics that for $c_i \in C$, a set (c_1, c_2) such that $c_1 = c_2$ defines a zero-measure set in $C \times C$. Thus, we can ignore the possibility that the entrant is an equally efficient competitor.

It follows from Mathematical Logic that the conclusions from false assumptions are logically true, but are meaningless. Thus, it follows from Proposition 2 and arguments above that the Commission decision is meaningless and then it is unfounded. Thus, the European Commission decision should be declined. □

5 Price Squeeze and No regulation Game

Now, consider a no regulation game in which upstream market is not regulated. To proceed with our analysis, let assume that

$$c_1 > c_2, \tag{7}$$

and

$$A \geq 2c_1, \tag{8}$$

which is due to (2) and (7). It takes the place of (2) in what follows. In fact, this is a more useful and direct expression than (2). A demand function is given by (1).

No regulation game is modeled as a two-stage game with complete and perfect information. The timing of this game is as follows:

1. The incumbent chooses access rate $\bar{\alpha}$ from the colsed interval $S_{sq} = [0, 2A - c_1 - c_2)$.

2. Two firms compete in supplying outputs in a downstream market.

In the second stage, profits of them are expressed as

$$\pi_1 = (P - c_1)x_1 + \bar{\alpha}x_2,$$
$$\pi_2 = (P - \bar{\alpha})x_2.$$

The best response functions are given respectively by

$$\frac{\partial \pi_i}{\partial x_i} = 0, for\ i = 1, 2.$$

It follows from (6) that if access rate $\bar{\alpha}$ set by the incumbent is less than α_{sq}, outputs of firms and price are shown in Lemma 1. However, if $\bar{\alpha}$ is not less than α_{sq}, the entrant can not enter into a market. In what follows, our focus is mainly on the former game where $\bar{\alpha}$ is less that α_{sq}. We will take up the latter if necessary.

In the first stage, the incumbent maximizes its profits given demand for inputs. Noting that one unit of outputs is produced with one unit of inputs, demand for inputs is given by outputs of the entrant, which is given In Lemma 1: $\bar{x}_2 = \frac{A + c_1 - 2c_2 - 2\bar{\alpha}}{3}$ if $\bar{\alpha}$ is less than α_{sq}.[13]

Substituting outputs $\bar{x}_i$ and price $\bar{P}$ into profits of the incumbent yields

[13]If it is not less than α_{sq}, $\bar{x}_2 = 0$.

$$\pi_1(\bar{\alpha}) = (\bar{P} - c_1)\bar{x}_1 + \bar{\alpha}x_2 = (\frac{A - 2c_1 + c_2 + \bar{\alpha}}{3})^2 + \frac{\bar{\alpha}(A + c_1 - 2c_2 - 2\bar{\alpha})}{3}.$$

The first order condition yields

$$\frac{\partial \pi_1(\bar{\alpha})}{\partial \bar{\alpha}} = \frac{2(A - 2c_1 + c_2 + \bar{\alpha})}{9} + \frac{(3A + 3c_1 - 2c_2 - 12\bar{\alpha})}{9} = \frac{(5A - c_1 - 4c_2 - 10\bar{\alpha})}{9} = 0.$$

The optimal access rate is given by

$$\alpha^* = argmax\pi(\bar{\alpha}) = \frac{5A - c_1 - 4c_2}{10} > 0, \tag{9}$$

where the inequality is due to (7) and (8).

We can now establish:

Lemma 4. *The incumbent does not have incentives to monopolize a downstream market.*

Proof. Noting that the profits function of the incumbent is concave,

$$\pi(\alpha^*) \geq \pi(\bar{\alpha}), for\ \bar{\alpha} \in S_{sq},$$

where the quality holds at $\bar{\alpha} = \alpha^*$. Note also that α^* is less than α_{sq}. In fact,

$$\alpha^* - \alpha_{sq} = \frac{5A - c_1 - 4c_2}{10} - \frac{A + c_1 - 2c_2}{2} = \frac{3(c_2 - c_1)}{5} < 0,$$

where the inequality is due to (7). Thus, the maximum profits can be achieved by supplying inputs to its competitor. □

Although the incumbent can exclude the entrant by setting access rate equal to α_{sq}, the incumbent does not employ such an exclusionary strategy. The monopolization of a downstream market provides additional profits with the incumbent and at the same time the incumbent loses a customer in an upstream market. This causes loss of profits to the incumbent. It is not straightforward that additional profits overcome loss in the upstream. Our Lemma above shows that the loss is larger than additional profits so that the monopolization of both markets does not enable the incumbent to reap the maximum profits. This is one of the important features in vertically related markets. From now on, we can ignore the games in which access rate is larger than α_{sq}.

Next, we can show subgame perfect equilibrium in no regulation game. Substituting α^* into $\bar{x}_i$, and $\bar{P}$ in Lemma 1 yeilds equilibrium outputs and prices in no regulation game.

We can summarize them:

Lemma 5. *If access rate $\bar{\alpha}$ set by the incumbent is less than α_{sq}, equilbrium outputs and*

prices are expressed respectively as,

$$x_1^* = \frac{(A - 2c_1 + c_2 + \alpha^*)}{3} = \frac{5A - 7c_1 + 2c_2}{10} > 0,$$
$$x_2^* = \frac{(A + c_1 - 2c_2 - 2\alpha^*)}{3} = \frac{2(c_1 - c_2)}{5} > 0,$$
$$X^* = x_1^* + x_2^* = \frac{(5A - 3c_1 - 2c_2)}{10} > 0,$$
$$P^* = A - X^* = \frac{5A + 3c_1 + 2c_2}{10} > 0.$$

However, if access rate by the incumbent is not less than α_{sq}, the entrant can not enter into a market and then a market is monopolized by the incumbent.

It is easy to show that subgame perfect equilibrium in the no regulation game generates a false positive. In fact, substituting P^* and α^* into (3) and (4) yields

$$P^* - \alpha^* - c_1 = \frac{5A + 3c_1 + 2c_2}{10} - \frac{5A - c_1 - 4c_2}{10} - c_1 = \frac{3}{5}(c_2 - c_1) < 0,$$
$$P^* - \alpha^* - c_2 = \frac{5A + 3c_1 + 2c_2}{10} - \frac{5A - c_1 - 4c_2}{10} - c_2 = \frac{2}{5}(c_1 - c_2) > 0,$$

where these inequalities are due to (7).

Note that outputs of the entrant depends solely on the difference in costs between two firms. If the entrant can enjoy advantage in costs, it can reap positive profits and can stay at a market. However, if it can not, the entrant can not stay at a market. The intuition behind this is simple: the entrant has disadvantage in costs, which can be overcome by efficiency of production. However, it is assumed that efficiency is the same to both firms. Then, the entrant can not cope effectively with the incumbent. Disadvantages in costs play a crucial role in market competition. This argument can be summarize as follows:

Lemma 6. *A necessary and sufficient condition that the new entrant can be viable at a market is that the entrant is more efficient than the incumbent: $i.e., c_1 > c_2$.*

Proof. It is easy to show that when we notice outputs x_2^* of the entrant it can stay at a market if and only if $c_1 > c_2$. □

It is interesting to note that the exit of the entrant can arise not by exclusionary strategy such as a price squeeze by the incumbent, but by inefficiency of the entrant. As the EC assumes away differences in costs, a possibility that the entrant can not cope effectively with the incumbent may be ignored.

When we apply Lemma 6 to the case of DT, fining DT for abusive price squeeze is not well founded. Moreover, it also follows from Lemma 4 that the monopolization of two markets does not provide the maximum profits with DT. If a new entrant exits from a market, it is due to disadvantages in costs of the entrant, not by exclusionary strategies by the incumbent. Without examining costs of firms, there can be a legal flaw in the procedures for the case of DT. These arguments show that the EC decision is not reasonable judgment of the case of DT.

Thus, we can conclude:

Proposition 4. *The EC decision that DT should be fined for abusive price squeeze should be declined.*

It was shown in Proposition 3 that the EC decision is not founded when we apply a partial regulation game. Following the fact which is expressed in the Commission decision of 21 May 2003, the decision is examined by the use of the no regulation game and then it is concluded that the decision is not well founded. Our results above still show that there is a possibility that the EC oversteps the mark. To justify its decision, it is required that the EC should construct a model which supports its decision.

6 Conclusions

This paper has analyzed the nature of the Price Squeeze test in two distinct types of regulatory environments, which assumes that new entrants are as efficient as the incumbent firm. When we consider that costs differ between firms, it turns out that there are several reasons why a new entrant can not be viable at a market. Our model showed that the PS test arises a false negative or a false positive depending upon the relative values of firms' costs. Thus, the entrant exits from a market not only bya price squeeze by the incumbent, but also by inefficiency of the entrant: Less efficient entrants can not cope effectively with the incumbent. This is a game in which the incumbent is not responsible for the exit and should not be fined.

If new entrants are *equally efficient competitors* to the incumbent, the test proposed by the EC is reliable means to judge whether the incumbent has adopted a price squeeze. However, if the entrants are not equally efficient we have shown that we encounter quite different scenario: It is not reliable measures to judge whether the incumbent has adopted a price squeeze. This means that there is a legal flaw in the procedures for making decision of the case of DT. In fact, the EC has not demonstrated by its model that DT might not have employed such an exclusionary strategy. Thus, the present model has shown that there is a legal flaw in the decision of the EC

on the case of DT not only in the partial regulation environment, but also in a no regulation environment. Thus, the EC decision fining DT for abusive price squeeze should be declined.

It is true that precise estimation of firms' costs is a very difficult and complicated job. After the estimation of costs of the entrant, it will be found that the entrant is not equally efficient. Thus, the EC decision depends upon a false assumption. It follows from Mathematical Logic that the decision on the case of DT is logically true, but is meaningless. To answer our criticism, the EC has to construct its own model which supports its decision.

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Fig. 1 False Negative

$c_1 < c_2$

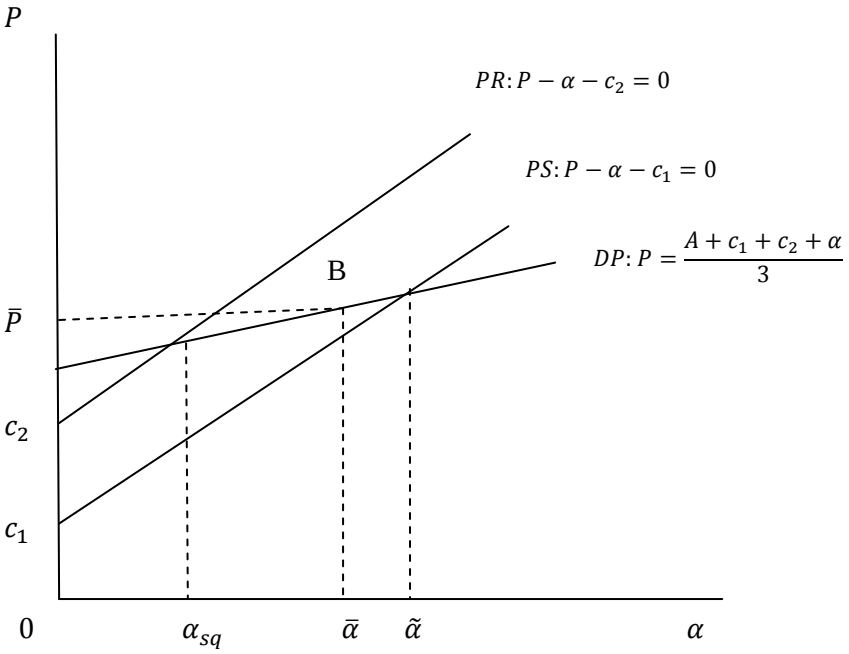

Fig. 2 False Positive

$c_1 \geq c_2$