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Transport Policy

journal homepage: www.elsevier.com/locate/tranpol

A theoretical study on yardstick competition and franchise bidding based on a dynamic model^{☆, ☆ ☆}

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ARTICLE INFO

Keywords:

Yardstick competition
Franchise bidding
Collusion
Dynamic model
Hidden action
Hidden information

ABSTRACT

This study develops a dynamic model based on the static model of Harada and Yamauchi (2014), which compares yardstick competition with franchise bidding.

We focus on collusion among firms, which is one of the differences between dynamic and static models. The results of the new model reveal that the Shleifer-style yardstick competition, which can effectively function under the static model, does not effectively function under the dynamic model. On the other hand, franchise bidding may effectively function under certain conditions. Thus, we demonstrate that franchise bidding is superior to yardstick competition.

1. Introduction

In recent years, regulatory reforms have been effected in markets that have been subject to previous strong official intervention. These reforms have generated more efficiency by introducing competition. However, perfect competition has not been achieved in many markets. In particular, using an incentive design in the private sector has become a problem because of asymmetric information between regulators and private companies.

Incentive design after regulatory reform has often taken the form of incentive regulations, such as yardstick competition or franchise bidding. These regulations were first adopted in practice, and theoretical studies followed their implementation; however, a substantial body of literature has now accumulated.

The study of yardstick competition and franchise bidding developed separately in different research fields. Yardstick competition has been mainly explored in information economics, whereas franchise bidding was often examined in the context of mathematics. However, in recent years, knowledge from information economics has been applied to franchise bidding. Thus, a comparison using a common analytical model has become possible.

Currently, some studies like Chong and Huet (2009) have compared these two mechanisms to analyze which should be adopted under particular market conditions. Harada and Yamauchi (2014) consider such a background and divide two cases by the cause of information

asymmetry: hidden information versus hidden action. Then, we investigate the effectiveness of both mechanisms in each model.

However, our old analysis uses a static model, whereas we would usually assume that the relationship between regulator and firm does not end after only one interaction. Rather, we should assume that the regulation game is repeated multiple times. Therefore, this study develops the static model of Harada and Yamauchi (2014) into a dynamic model.

The rest of the paper is structured as follows. Section 2 provides a literature survey of theoretical studies of the two mechanisms. Section 3 provides details of the model. Section 4 presents the discussion of our model. Section 5 presents the conclusions.

2. Literature review

The theoretical study of yardstick competition was proposed by Shleifer (1985), whose model illustrated a situation in which information asymmetry arises from a hidden action. Hidden actions mean that regulators cannot observe efforts to reduce production costs by regulated firms. In this situation, there is no means to adopt the “cost-plus” pricing mechanism. Accordingly, the regulated firm lacks an incentive to reduce costs because its profit always equals zero under the cost-plus mechanism. In addition, Shleifer (1985) examines the “price-cap” method, in which a firm’s price is set at the mean cost of all firms, except the firm’s own cost. This method is known as yardstick

[☆] This paper was presented in the E Session, Transport Economics and Finance, at the 14th WCTR in Shanghai in July 2016. Peer-review under responsibility of World Conference On Transport Research Society.

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<http://dx.doi.org/10.1016/j.tranpol.2017.03.005>

Received 24 September 2015, Received in revised form 31 October 2016, Accepted 30 January 2017
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competition, under which firms voluntarily perform socially desirable cost reductions. Thus, Shleifer (1985) concludes that an incentive design through yardstick competition is effective.

Auriol and Laffont (1992) support the conclusion of the Shleifer (1985) model. They claim that a duopoly is preferable to a monopoly because the former could lead a cost-reduction effort through the indirect competition arising through yardstick competition. Sobel (1999) indicates that yardstick competition could cancel information asymmetry, leading the firm to under invest. Thus, Sobel (1999) concludes that regulators should strongly commit to effective regulation.

In contrast, regarding the theory of yardstick competition proposed by Shleifer (1985), some problems arise when applying it as a real policy. One problem is the possibility of collusion among firms. If one firm makes a greater effort to reduce costs than another, then the firm that makes less effort should fall into a deficit. Yardstick competition is an incentive mechanism to lead firms to make voluntary efforts to avoid such a situation. However, the mechanism does not function when all firms collude to make decisions in which no firm tries to reduce costs. Based on this, Tangeras (2002) demonstrates that profit from yardstick competition could be completely lost by collusion if correlation of private information among firms becomes large.

On the other hand, franchise bidding sets franchising rights for utilities and then bids for these rights, which are given to the most price-competitive company. Demsetz (1968) initiated the study of franchise bidding, stating that it could prevent the setting of a monopoly price. In addition, the possibility of collusion among firm declines with an increase in the number of bidders because more bidders would lower the funds distributed among colluding firms.

Williamson (1976) examines the effectiveness of the bidding system presented by Demsetz (1968). Williamson (1976) demonstrates that firms with franchising rights are superior to other firms in terms of financial sustainability. In addition, he states that the contract needs to specify ways to handle a future environmental change, but this is considerably difficult. Following these studies, franchise bidding is considered to be an effective regulatory mechanism, but several problems emerge when applying it as real policy.

Consequently, many studies on franchise bidding have focused on information asymmetry between bidders and regulators. A famous study by Riordan and Sappington (1987) analyzes the types of policies that regulators should adopt to enable monopolistic firms to produce efficiently. They suggest a bidding system that uses a revealing mechanism to choose an effective company. In the revealing mechanism, both price and subsidy are set to meet the participation constraint condition and the incentive-compatible constraint condition of the most efficient bidder. However, the price and subsidy realized in the revealing mechanism differ from the social optimum, which is interpreted as an information rent. In addition, Laffont and Tirole (1987) and McAfee and McMillan (1987) employ a model of a monopolistic firm's private information to analyze the issue. These two studies conclude that cost and effort to reduce costs differ from the social optimum when using the franchise bidding system.

The theme in the study by Chong and Huet (2009) is closest to that of this study. They compare franchise bidding with yardstick competition in the dynamic model and calculate the conditions necessary to prevent collusion. Their results reveal that firms have an incentive to leave collusion under yardstick competition with compensation but not under yardstick competition with a fine or under franchise bidding. Notably, yardstick competition with compensation or a fine differs from that illustrated by Shleifer (1985), which is based on the mean cost of firms.

Harada and Yamauchi's (2014) analysis is based on the model of Chong and Huet (2009). Harada and Yamauchi (2014) focus on the so-called "Japanese yardstick competition," which differs from yardstick competition with compensation or a fine as well as from the so-called "Shleifer yardstick competition." Although the Japanese yardstick

competition is close to the Shleifer yardstick competition as both mechanisms are based on mean cost, they differ in whether to include the firm's own cost in the mean cost. In addition, Harada and Yamauchi (2014) indicate that this divergence affects regulation effectiveness, although their analysis uses a static model.

3. Model¹

3.1. Model of Hidden Information

We assume two monopoly markets separated by region. Each market has a demand of one unit, which is inelastic. There are two firms, denoted by $i=1,2$, and both firms are capable of producing the good.

C_i denotes the production cost of firm i and is defined as

$$C_i = \beta_i - e_i \quad (1)$$

β_i is firm i 's productivity parameter; both firms have the same productivity parameter $\beta_1 = \beta_2 = \beta$. Chong and Huet (2009) consider β as an exogenous parameter, determined by $\beta = \bar{\beta}$ or $\underline{\beta}$ ($\bar{\beta} > \underline{\beta}$); $\bar{\beta}$ has a probability of v , and $\underline{\beta}$ has a probability of $1-v$. The term e_i represents the cost-reduction effort, which involves disutility, represented by the term $\varphi(e_i)$, with the assumption of $\varphi(e_i) > 0$, $\varphi'(e_i) > 0$, and $\varphi''(e_i) > 0$. Specifically, a firm's cost level is determined by its exogenous productivity parameter and endogenous effort toward cost reduction.

Because both markets are monopolies by nature, regulators are present. These regulators face an asymmetric information problem; they have no information on any firm's productivity parameter. Therefore, we can conclude that Chong and Huet (2009) use the hidden information model, in which firms' productivity parameter is the private information available to firms' insiders only.

The regulators reimburse firms for their production cost, C_i , and grant them a subsidy, t_i , as a reward for their cost-reduction efforts. The regulators have no information about the true disutility, $\varphi(e_i)$, and firm i can thus obtain information rent U_i , defined by $U_i = t_i - \varphi(e_i)$.

To overcome the asymmetric information problem, regulators can adopt certain policies that compel the firms to report their true cost parameter and frequently choose between yardstick competition and franchise bidding, the details of which we now discuss.

In the Japanese-style yardstick competition, the average operating cost of all firms is used as the yardstick. Therefore, any reimbursement is based on the average, and no compensation or penalty is considered when calculating the subsidy, which can be represented mathematically as

$$C_c = (\tilde{\beta}_i + \tilde{\beta}_j)/2 - e_c t_i = t_c$$

Here, t_c is set to satisfy the firm's participant constraint.

Yardstick competition applied to the Japanese regional transport market includes the cost of all firms. In contrast, yardstick competition proposed by Shleifer (1985) excludes the firm's own cost from the yardstick. Now, we modify the Japanese-style yardstick competition to exclude the firm's own cost. Under the Shleifer-style yardstick competition, the reimbursed cost is $C_{ci} = \tilde{\beta}_j - e_c$.

In franchise bidding, the regulators are assumed to define the rights to operate the monopoly market, which they then grant to firms that report the lowest cost. For example, if two firms report the same parameter, both firms will obtain the right to operate in their respective markets. If the two firms report different parameters, the firm reporting the lower cost $\underline{\beta}$ will obtain the right to operate in both markets.

¹ This model is based on Harada and Yamauchi (2014).

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