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A Model of Free Riding Incentives in Franchise Chains

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Abstract

This paper explains the free riding phenomenon in franchise chains where all chain members benefit mutually from the positive network externality of service quality. Starting from a simple formal model with two independent outlets, we present the analytical form of the optimal reaction function in which two outlets interact through service quality externalities. With complete information, no outlet finds any interest in free riding on service quality at the expense of the other. Contrary to previous findings, the positive demand externality increases the optimal service quality through interactions among chain members with complete information. By relaxing the complete information assumption, we demonstrate that incompleteness of information is the main source of free riding incentives. Contrary to the prevailing explanation based on agency theory, incompleteness of information leads outlets facing a smaller externality to free ride more on service quality compared to its optimal level with complete information.

(Key words: Franchise, service quality, externalities, free riding)

1. INTRODUCTION

A franchise contract is a bilateral agreement between a franchisor and a franchisee, which gives the franchisee the right to receive most of the residual revenues earned from operating a given outlet under the franchisor's instructions or guidelines for outlet management(Lafontaine 1992). The franchise contract

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includes more or less standard clauses about the provision of managerial assistance, agreement of the franchisee to run the business in the franchisor's manner(price, hours of operation, inventory management, etc.), royalty payments, and contract termination(Ozanne and Hunt1971). The revenue of the franchisor and the franchisee depends mainly on local outlet sales because royalties are proportional to the sales of franchised outlets and the franchise fee is related to the market value of a new outlet which, in turn, depends largely on the performance of existing outlets and the location of the chosen outlet(Caves and Murphy 1976; Rubin 1978).

In general, franchising takes two distinct forms: product franchising, in which a manufacturer creates a contractual channel of distribution for one or more of its products; and business format franchising, in which a retailer licenses the right to replicate its business concept in another location. In both cases, the manufacturer's or retailer's decision to franchise is derived from its desire to distribute its product or branded service concept more broadly(Lafontaine 1992).

In a franchise system, the franchisor's main objective is to increase the sales of outlets of the chain, usually a mixture of company owned and franchised outlets, without deteriorating the franchise's global brand image. The global brand image of a company consists of various dimensions, such as product attributes, intangibles, customer benefits, prices, uses/applications, user celebrities, life styles, product classes, competitors, and countries of origin(Aaker 1991). As elements of these dimensions change, the brand image evolves over time. In its evolutionary process, service quality plays an important role because only buying customers can verify it and give feedback to modify the previous image of the brand(Zeithaml, Berry, and Parasuraman 1996).

The improved service quality of one outlet contributes to the sales of other outlets by reinforcing the global brand image. All members of a franchise chain benefit from positive externalities, such as service quality, which affect another's welfare without being regulated by the pricing systems(Milgrom and Roberts 1992). To maximize the profit generated by the positive externality, the franchisor puts in place vertical constraints, such as exclusive territories, that minimize intra-brand competition(Mathewson and Winter 1985). Service quality is a central question especially for business format franchising, because it includes not only the product, service, and brand, but also the entire business format which is a growing phenomenon (Shane and Spell 1998). Moreover, even in product distribution franchising, the role offered by the franchisee plays a major role in its sales as the distribution channel becomes more complex; its design principles need to be aligned with the firm's performance objectives and overall competitive strategy (Anderson, Day, and Shugan 1997). Thus, more effort is required for monitoring by the franchisor to prevent chain members from free riding on service quality. Even if the franchisor reinforces provisions in the franchise contract concerning the free riding problem, the franchisor cannot include all necessary provisions preventing the franchisee from free riding, due to the incompleteness of the contract (Brickley and Dark 1987). Under the positive network externality of service quality, free riding by franchised outlets remains as a paradox because the individual entrepreneur chose to be a franchisee to benefit from the positive externality of the franchise's brand in the chain instead of running its own business. When a franchisee attempts to free ride on service quality, the initial benefit to the franchisee is eroded.

In this paper, we first develop a formal model incorporating the interaction on service quality in franchise chains. Specifically, by analyzing the optimal service quality with complete versus incomplete information, we demonstrate that the main cause of free riding incentives is not the positive externality, but rather the positive externality combined with whether information is complete or incomplete. Contrary to previous findings, a positive externality is shown to increase the optimal service quality through interactions on service quality among chain members with complete information, instead of eroding it by escalating free riding incentives. By relaxing the complete information assumption, we demonstrate that incompleteness of information is the main source of free riding incentives. Contrary to prevailing explanations based on agency theory, incompleteness of information leads outlets facing a smaller externality to free ride more on service quality compared to its optimal level with complete information.

2. A FORMAL MODEL OF INTERACTIONS ON SERVICE QUALITY

To make our analysis as simple as possible, we assume a market situation with two geographically-separated cities, such as Los Angeles and San Francisco. In each market, there is only one outlet(outlet *i* or *j*) which provides the service of a given brand. Outlet *i* and *j* consequently hold monopolistic power of the brand in each market because no consumer intends to make a shopping trip to the other city in search of a better quality service of the same brand due to higher transportation costs. The consumer may purchase a service in the other city only when he travels for other purposes. The high transportation costs minimize the cross-influence of price on purchase decision making. The consumer of one market is minimally sensitive to the price change of the outlet located in the other city. On the other hand, the sales of each outlet is influenced by the service quality of the other outlet because the consumer travels from one city to the other for other purposes, which creates a positive externality of demands.

2.1. A formal model

In the following model, based on that of Gal-Or(1995), we assume each outlet has local monopoly power in its respective market. The demand (q_i) of market i is a function of the price (p_i) and service quality of the outlet in market *i* (e_i) and service quality of the other outlet in market *j* (e_j). This positive cross-effect of service quality incorporates the positive externality of service quality into the demand function. The consumer's potential willingness to buy a product in a given market is presented as a constant 'α' which implicitly means the potential size of the monopolized market. Parameters 'b' and 'β' show the sensitivity of the consumer to price and service quality change. They reflect the level of inter-brand competition on price and service quality.[1] The demand function is $q_i = \alpha_i + \beta_i e_i + \delta_i e_j - b_i p_i$.

1) The model of Gal-Or (1995) reflects well this business reality by integrating the existence of other outlets (j) whose service quality level can influence the

The complete list of variables in the model is shown below. No intra-brand competition is assumed because the two outlets operate in their exclusive territory.

Variable	Characteristics
e	service quality
p	price
q	demand
Parameter	
a	potential willingness to buy(baseline market size)
b	consumer's sensitivity to the price change
c	unit cost of production
β	consumer's sensitivity to the service quality change
δ	magnitude of service quality externality
ω	efficiency of providing quality service

On the other hand, the cost function of outlet i is given as $c(e_i, q_i) = \omega_i e_i^2 + c_i q_i$. This cost function reflects mainly business format franchising that costs the outlet to provide a certain quantity of service, as well as a certain service quality. The cost of improving service quality increases marginally, varying with the cost efficiency parameter 'ω'. As for the cost of producing service, we assume the unit cost of production 'c' (no scale effect). The production quantity (q) and the level of service quality (e) are not directly associated, for example, $c(e, q) = \omega eq + cq$, because the partial cost change influenced by the service quality is implicitly comprehended by the cost change due to the quality improvement or deterioration ($c(e, q) = \omega e^2 + cq(e)$). Other demand fluctuations not related to the service quality go directly through the quantity variable in the cost function, and finally affect the total cost. By separating the cost function into quality and quantity components, we are able to analyze distinctively their impact on the total cost.[2)]

sales of *i*. She mentions also the possibility of having a weaker cross- effect on service quality level. Here, we relax this assumption because δ can have a larger value than β.

2) Mathewson and Winter(1985) develop a model based on "product franchising" in which the retailer mainly resells the product provided by the

2.2. The impact of positive externalities on optimal service quality

In this model two outlets fix simultaneously the level of two controllable variables, price (p) and service quality (e), in order to maximize each outlet's profit. We assume a situation with complete information in which both outlets know perfectly about each other's market situation and the existence of positive service quality externalities between their two outlets. Due to the positive service quality externality ($\delta_i e_j$ for outlet i and $\delta_j e_i$ for outlet j), the optimal service quality of one outlet depends also on the service quality of the other outlet, which engenders the interaction of two outlets on the service quality until they reach an optimum which maximizes the profit of each outlet.

Proposition: With complete information, the positive externality of service quality improves the optimal service quality level of both outlets.

Proof: The outlet fixes the optimal level of price and service quality to maximize its profit. The profit function of outlet i is defined as

$$\Pi_i = p_i q_i - c_i(e_i, q_i) = p_i(a_i + \beta_i e_i + \delta_i e_j - b_i p_i)$$
$$- (\omega e_i^2 + c_i(a_i + \beta_i e_i + \delta_i e_j - b_i p_i))$$

and its first-order conditions are

$$\frac{\partial \Pi_i}{\partial p_i} = -2b_i p_i + \beta_i e_i + \delta_i e_j + a_i + b_i c_i = 0$$
$$\frac{\partial \Pi_i}{\partial e_i} = \beta_i p_i - 2\omega_i e_i - \beta_i c_i = 0$$

Combining the two first-order conditions leads to an equation of the optimal service quality reaction of outlet i on e_i as a function of outlet j's service quality (e_j)[3]

manufacturer with a constant cost of production. In contrast, our model is based on "business format franchising" in which the retailer(franchisee) offers service with a marginally increasing cost of quality.

$$e_i = \frac{\delta_i}{(4b_i\omega_i / \beta_i - \beta_i)} e_j + \frac{(a_i - b_i c_i)}{(4b_i\omega_i / \beta_i - \beta_i)}$$

Outlet j has the same type of reaction function because its structure is identical (has the same parameters) as that of outlet i. Its slope and intercept are positive with respect to the second-order conditions for the profit maximization of each outlet ($4b\omega/\beta - \beta > 0$ and $a - bc > 0$).[4]

With complete information about the other's structure, both outlets react spontaneously on the service quality level of the other as in the case of the equilibrium of Cournot and Bertrand. As illustrated in Figure 1, the equilibrium service quality is reached through the interaction of both outlets on service quality mediated by the positive externality:

$$e_i^* = e_j^* = \frac{(a - bc)}{(4b\omega / \beta - \beta - \delta)}$$

As the externality of service quality is positive ($\delta > 0$), the optimum service quality with the positive externality, $\frac{(a-bc)}{(4b\omega/\beta-\beta-\delta)}$, is larger than it would be without the positive externality, $\frac{(a-bc)}{(4b\omega/\beta-\beta)}$. With complete information, both outlets improve their service quality level by incorporating the positive externality through interactions.[5] Q.E.D.

According to the comparative statics[6] of this equilibrium, optimal service quality can be improved if (1) market size (willingness to pay, 'a') increases, (2) the consumer becomes less

3) The second order conditions are presented in Appendix 1.

4) To get a positive equilibrium (e^*), two reaction functions should cross in the quadrant where e_i and e_j are positive. We need one more constraint about the slope of the reaction function that should be smaller than 1 to obtain a positive equilibrium ($4b\omega - \beta^2 - \beta\delta > 0$).

5) The maximum profit with the positive externality is $\Pi^*_\delta = \frac{\omega(a-bc)^2(4b\omega-\beta^2)}{(4b\omega-\beta^2-\beta\delta)^2}$.

We compare optimal profit with and without externalities; therefore, $\Pi(\delta > 0)$ is always larger than $\Pi^*_{\delta=0} = \frac{\omega(a-bc)^2}{(4b\omega-\beta^2)}$.

6) The detail of comparative statics of the equilibrium is presented in Appendix 2.

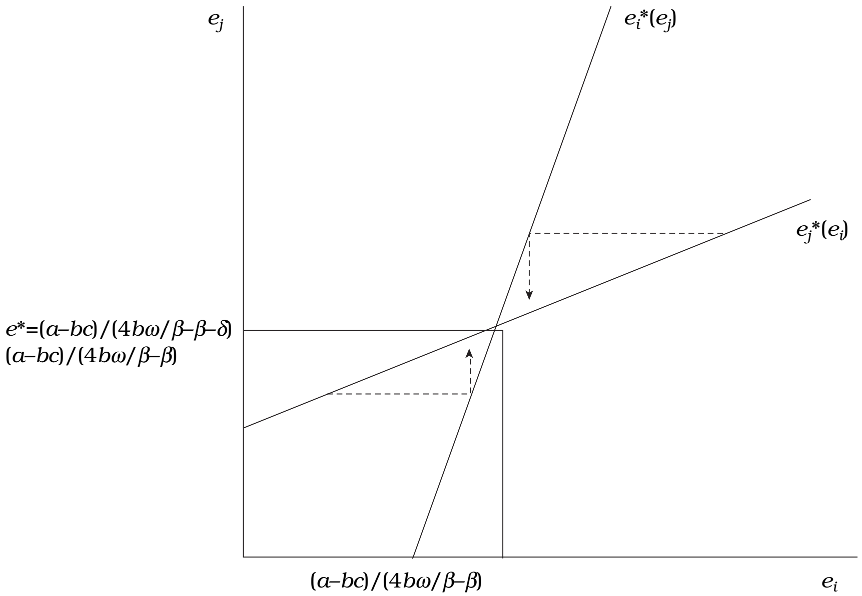

Figure 1. Reaction functions of service quality and interactions

price sensitive (smaller 'b'), (3) the consumer becomes more quality sensitive (larger 'β'), (4) the outlet enhances its production efficiency of service quality (ω) and quantity (c), or (5) the magnitude of the externality (δ) becomes larger. No outlet has any incentive to fix its service quality lower than the optimal level as long as the optimal reaction function is upward. No free riding incentive is systematically created by the positive externality on service quality.

3. INFORMATION AND THE FREE RIDING PHENOMENON

The free riding phenomenon is observed frequently when many people have the right to use a single shared resource which is at risk of overuse. Correspondingly, it happens also where many people share the obligation to provide some resources. In this case, the resources are at risk of undersupply(Milgrom and Roberts 1992). Klein(1980) and Brickley and Dark(1987) note that the franchisee can free ride on the tradename and it is more likely to occur in situations where consumers do not repeat purchases at the same outlet. Brickley and Dark(1987) provide an industry level comparison in which industries with a high non-repeat purchase rate(a large externality) rely less on franchising. The franchisor has to consider the risk of free riding as a fatal threat to the success of the chain in which customer satisfaction may play the key role. Service quality failure due to free riding weighs especially high on customer satisfaction as consumers are more sensitive to service quality failure(negative disconfirmation) than service quality excellence(positive disconfirmation)(Anderson and Sullivan 1993).

What if service quality is not limited by shared resources and the outlet provides quality service voluntarily instead of being obliged? As we have seen in an earlier section, service quality is not a limited resource, but the link of mutual benefits that attracts both outlets to improve their service quality to maximize profit through the interaction process. In the process of interactions, outlets provide service quality voluntarily without being obliged by the franchisor. According to the impact of the interactions on service quality in the franchise chains, fitting the formal model of free riding to franchise chains bears systematic limitations to explain the phenomenon. Some previous research shows mixed evidence of the impact of the externality(for example, non-repeating customers) on franchising(Brickley, Dark and Weisbach 1991; Minkler 1990). Lafontaine and Slade (1997) attempt to explain the lack of strong evidence on free riding by referring to the self-enforcing capability of the franchisor. However, their explanation is limited due to the lack of a theoretical background. In the next section, we look for the source of free riding incentives by relaxing the complete information assumption.

3.1. Free riding with complete information

As shown by the proof in Section 2.2, if the optimal service quality reaction function of each outlet has a positive slope ($4b\omega/\beta - \beta > 0$) and a positive intercept ($a - bc > 0$), no one has an incentive to deviate from the optimal service quality level, $e_i^* = e_j^* \frac{(a-bc)}{(4b\omega/\beta-\beta-\delta)}$, that maximizes the mutual profit because it is a Nash equilibrium. No outlet can be better off by deviating from this equilibrium. It is, however, possible that this Nash equilibrium service quality lies below the standard quality required by the franchisor due to the unfavorable market environments required to maintain the standard service quality. As we have seen in the result of comparative statics, the optimal service quality level deteriorates if the outlet faces a small market size, price sensitive consumers, low production efficiency or small positive externalities. For example, the high unit cost of production leads the outlet to reduce the service quality to compensate for the increased demand by (positive) externalities (Lal 1990; Rubin 1978). In the case of service quality deterioration due to market environments, the outlet can be considered to free ride despite the full functioning of the service quality interaction process that leads the outlet to reach the optimal level of service quality with complete information.

3.2. Free riding with incomplete information

In the real world, the outlet faces various types of uncertainty which suggests that our initial assumption of complete information be relaxed to reflect decision making with incomplete information. To make our analysis as clear as possible, we explore a situation in which two outlets have complete information except for the magnitude of the service quality externalities of the other outlet. Other things being equal, we assume that the magnitude of the service quality externalities (δ) of each outlet is given, but an outlet can observe only its own δ not that of the other outlet. To analyze the impact of incomplete information on free riding incentives, we form a static Bayesian game where two outlets have the same demand and cost structures as the earlier case, and two levels (high and low: δ_H, δ_L) of service quality externalities.[7] Due to incomplete information about the other outlet's demand externalities, each outlet will form a belief, $p_i(\delta_j)$, representing the probability of the other outlet's externalities depending on the value of δ_j conditional to its own type ($p_i[(\delta_j = \delta_H)/\delta_i] + p_i[(\delta_j = \delta_L)/\delta_i] = 1$).

7) In case of $\delta = 0$, the outlet will choose $e^*(\delta = 0)$ whatever the magnitude of outlet i's δ because it has no interest in increasing its quality more than $e^*(\delta = 0)$ without enjoying the benefits of the other outlet's effort.

Because the externality links the optimal service quality function of both outlets, they choose one level of service quality on the optimal reaction function, $e_i^*(e_j)$, depending not on the actual service quality, but on the service quality derived by their belief about the other outlet's demand externalities.

Because we suppose that there are two outlets having two levels of demand externalities (outlet i faces high level externalities ($\delta_i = \delta_H$) and outlet j faces low level externalities ($\delta_j = \delta_L$)), outlet i's optimal strategy will be based on the optimal reaction function of its own service quality level and that of outlet j. Because outlet i has complete information on all parameters, except the level of demand externalities of outlet j, outlet i fixes its optimal service quality based on its own reaction function and that of outlet j with its belief, $(p_i[(\delta_j = \delta_H)/(\delta_I = \delta_H)] + p_i[(\delta_j = \delta_L)/(\delta_i = \delta_H)] = 1)$. Therefore, two reaction functions with outlet i's belief on outlet j's demand externalities are

$$e_i = \frac{\delta_H}{(4b\omega/\beta - \beta)} e_j + \frac{(a-bc)}{(4b\omega/\beta - \beta)} \text{ and}$$

$$e_j = \frac{p_i[(\delta_j = \delta_H)/(\delta_i = \delta_H)]\delta_H + p_i[(\delta_j = \delta_L)/(\delta_i = \delta_H)]\delta_L}{(4b\omega/\beta - \beta)} e_i + \frac{(a-bc)}{(4b\omega/\beta - \beta)} .$$

Due to the uncertainty about the demand externalities of outlet j, outlet i formulates the slope of outlet j' reaction function with its belief about the high demand externalities of outlet j, $(p_i[(\delta_j = \delta_H)/(\delta_i = \delta_H)])$, and on the low demand externalities of outlet j, $(p_i[(\delta_j = \delta_L)/(\delta_i = \delta_H)])$. The slope of outlet j's reaction function gets steeper, lying between $\frac{\delta_L}{(4b\omega/\beta-\beta)}$ and $\frac{\delta_H}{(4b\omega/\beta-\beta)}$, compared to that of complete information ($\frac{\delta_L}{(4b\omega/\beta-\beta)}$). This reaction function is illustrated by the dotted line in Figure 2. As a result of interactions based on the above two reaction functions, outlet i fixes its optimal service quality level (the Bayesian Nash equilibrium) as follows[8]:

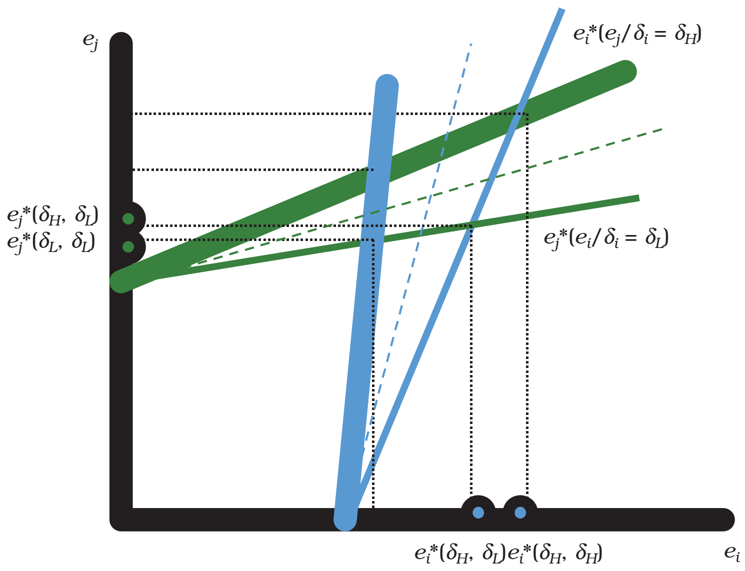

Figure 2. Service quality equilibria with different levels of demand externalities

$$\tilde{e}_i^* = \frac{(a-bc)(\delta_H + A)}{A^2 - \delta_H[p_i(\delta_H,\delta_H)\delta_H + p_i(\delta_H,\delta_L)\delta_L]}$$
$$where \quad A = (4b\omega / \beta - \beta) \quad .$$

The optimal service quality of outlet i ($\tilde{e}_i^*(\delta_H, \delta_L)$) with incomplete information about outlet j's demand externalities lies between $e_i^*(\delta_H, \delta_L)$ and $e_i^*(\delta_H, \delta_L)$ in Figure 2.[9] Incomplete information pushes outlet i, which has a high level of demand externalities, to over-invest in the service quality because outlet i overestimates the demand externalities of outlet j.

On the other hand, outlet j which has a low level of demand externalities faces the same uncertainty about the magnitude of outlet i's demand externalities due to incomplete information. In the same way, outlet j formulates its belief on the level of outlet

8) $p_i(\delta_H, \delta_L)$ is the simplified notation of $p_i[(\delta_j = \delta_L)/(\delta_i = \delta_H)]$, where we put the value of δ of outlet i first and then that of outlet j respectively.

9) The solution of optimal service quality with two different levels of demand externalities is presented in Appendix 3.

i's demand externality is $p_j[(\delta_i = \delta_H)/(\delta_j = \delta_L)] + p_j[(\delta_i = \delta_L)/(\delta_j = \delta_L)] = 1$. The reaction functions are

$$e_j = \frac{\delta_L}{(4b\omega/\beta - \beta)} e_i + \frac{(a - bc)}{(4b\omega/\beta - \beta)} \text{ and}$$

$$e_i = \frac{p_j[(\delta_i = \delta_H)/(\delta_j = \delta_L)]\delta_H + p_j[(\delta_i = \delta_L)/(\delta_j = \delta_L)]\delta_L}{(4b\omega/\beta - \beta)} e_j + \frac{(a - bc)}{(4b\omega/\beta - \beta)} .$$

Due to incomplete information the slope of outlet i's reaction function gets flatter compared to the assumption of complete information. As a result of the interactions based on the above two reaction functions, outlet *j* fixes its optimal service quality level (the Bayesian Nash equilibrium) as follows:

$$\tilde{e}_j^* = \frac{(a - bc)(\delta_H + A)}{A^2 - \delta_L[p_j(\delta_H, \delta_L)\delta_H + p_j(\delta_L, \delta_L)\delta_L]}$$
$$where \quad A = (4b\omega/\beta - \beta) .$$

The optimal service quality of outlet *j* ($\tilde{e}_i^*(\delta_H, \delta_L)$) with incomplete information about outlet *i*'s demand externalities lies between $e_j^*(\delta_L, \delta_L)$ and $e_j^*(\delta_H, \delta_L)$. Incomplete information pushes outlet *j* which has a low level of demand externalities to under-invest on the service quality. As a result, the Bayesian Nash equilibrium (($\tilde{e}_i^*(\delta_H, \delta_L)$), $\tilde{e}^*(\delta_H, \delta_L)$) due to incomplete information always deviates from the Nash equilibrium ($e_i^*(\delta_H, \delta_L)$, $e_j^*(\delta_H, \delta_L)$) with complete information unless both outlets formulate a perfect belief about the other's demand externalities. The incomplete information about the level of demand externalities of the other outlet leads to under-invest (over-invest) on the level of service quality for the outlet having a low (high) level of demand externalities.

With regard to the profit at the equilibrium, both outlets improve their service quality in order to maximize the profit by integrating demand externalities into their decision making. The existence of demand externalities on service quality increases the profit of both outlets as long as they possess complete information. However, the situation changes as both outlets do not possess complete information about the level of demand externalities of the other outlet. In the worst situation where both outlets fail completely to formulate their belief, $p_i[(\delta_j = \delta_H)/(\delta_i = \delta_H)] = 1$ and $p_j[(\delta_i = \delta_L)/(\delta_j = \delta_L)] = 1$, both outlet's profit can be worse than that without demand externalities as outlet i (j) over(under)-invest too much on service quality by deviating substantially from the Nash equilibrium. In this case, both outlets still provide the service quality better than their level without demand externalities but their profit shrinks due to misjudgment of the other outlet's demand externalities. The profit deteriorates more as the gap of demand externalities between two outlets gets wider.[10)]

According to previous research(Brickley and Dark 1987; Caves and Murphy 1976; Klein 1980; Rubin 1978), the outlets facing larger externalities tend to free ride compared to other outlets facing smaller externalities. But our findings show completely opposite results. The outlet facing smaller externalities tends to free ride by under-investing in the level of service quality due to incomplete information. On the other hand, the outlet facing larger externalities tend to over-invest: there is no risk of free riding for outlets facing high externalities. Regardless of the precision of the formulated belief about the other's externalities, the outlet facing low externalities tends to free ride in the case of two outlets facing high and low levels of externalities.

If decision making with incomplete information is repeated, the outlets may fix their level of service quality close to the optimal level with complete information by correctly updating their belief. However, findings from experimental economics demonstrate the functioning difficulty of the Bayesian updating process mainly due to under weighing the base rates(Grether 1980; Kahneman and Tversky 1972) and the likelihood information(Griffin and Tversky 1992). Therefore the risk of free riding by the outlet facing relatively small externalities may last permanently.

10) The profit comparison of different conditions is explained in Appendix 4.

4. DISCUSSION AND FURTHER RESEARCH

Our research addresses clearly two questions not addressed by previous research because previous researchers applied formal models of free riding for franchise chains in which service quality is not a limited shared resource, and the outlet provides voluntarily the level of service quality which maximizes its profit through the process of interaction. First, in our formal model with complete information, we explain the impact of managerial factors, such as market size, human capital(production efficiency), sensitivity to price and service quality, as well as to the externalities of the level of service quality. The interactions with the service quality of outlets linked through positive externalities actually improve the optimal level of quality without risk of free riding. Second, also contrary to previous research on free riding incentives, our second model with incomplete information shows that the outlet facing smaller externalities has more incentive to free ride than the outlet facing larger externalities.

Our model addresses some issues that showed discrepancies between theories and empirical findings. Brickley and Dark (1987) reported the “Freeway” effect on ownership decisions. According to conventional theories, outlets facing larger externalities (more non-repeat customers) tend to be company-owned(i.e., owned by the franchisor) to minimize free riding. However, based on data from 36 franchise companies, there were contradictory findings indicating that franchising appears more likely near freeways. Our model explains this discrepancy because it is the outlet facing relatively smaller externalities that tends to free ride. Because a relatively large proportion of customers are non-repeaters to outlets near highways(large externalities), these outlets need to be franchised instead of company-owned to maximize the benefits of interactions with service quality.

In addition to the “Freeway” phenomenon, Lafontaine and Slade(1997) reported two other discrepancies between theories and empirical findings about outlet ownership decisions. The first discrepancy concerns the effect of risk that should be negatively related to franchising according to traditional agency theory; in fact, outlets facing higher risk in terms of demand variation show a relatively high chance of being franchised. The empirical results come from three separate research studies (Lafontaine 1992; Martin 1988; Norton 1988). The data analysis of all three research studies is done at the aggregate level without controlling the key factor, demand externalities. This systematic data analysis problem fails to separate managerial aspects from the free-riding phenomenon as we suggest. If the magnitude of externalities is the key factor in making the ownership decisions, outlets facing high externalities will be franchised. Consequently, franchised outlets may face relatively large demand fluctuations due to high externalities. The second discrepancy lies in the outlet size effect. Conventional theories address the size effect of ownership from the monitoring perspective. As large outlets require high monitoring costs, they need to be franchised instead of company-owned. However, three empirical studies showed the opposite tendency(Brickley and Dark 1987; Lafontaine 1992, Martin 1988). Large outlets tend to be company-owned instead of franchised. Lafontaine and Slade (1997) provide a possible reconciling explanation: the effect of a high urban concentration of large outlets may distort the result. Because large outlets are concentrated in urban areas that require relatively cheap monitoring costs, the large outlets tend to be company-owned instead of franchised. But they do not question why small urban outlets tend to be franchised instead of company-owned despite cheaper monitoring costs.

Our model with incomplete information integrates not only the effect of incoming externalities, but also that of outgoing externalities. In our model with two outlets, the outlet facing small externalities generates large externalities and it also faces a high probability of free-riding(i.e., under-performance in service quality compared to its optimum with complete information). For the franchisor, it is necessary to monitor the performance of the outlet facing small, and generating large, externalities because its service quality improvement contributes more substantially to the profit of the chain than the other outlet facing large, and generating small, externalities. Other things being equal, as the size of an outlet gets larger, it generates larger externalities on service quality. As a result, in urban areas with similar monitoring costs, large outlets tend to be company-owned.

Our model has a couple of limitations because it assesses only the horizontal interactions between two outlets with the assumption of a monopolist in each market. Even though the clause of territorial exclusivity reflects the viability of this assumption, it would be better to relax this assumption and assume intra-brand competition to assess free riding incentives. Also, a model with one principal(franchisor) and two agents (franchisees) could be useful for explaining monitoring and channel coordination issues. To test the empirical validity of our model, company data having outlet-level information, including the magnitude of externalities, are recommended to explain in detail the theoretical findings of our model. In further empirical research, it is necessary to separate the information completeness factor by treating it as a control variable. Otherwise, there is a high risk of biased results due to mixed effects of the information and other factors, such as externalities and outlet size.

Appendix 1: Conditions for the optimal service quality

To get the maximum of these equations, the Hessian matrix of them should satisfy two conditions:

1) the elements on the diagonal of Hessian matrix should be negative;

ii) the determinant of the Hessian matrix should be positive.

So the elements of the Hessian matrix are as follow:

$$\frac{\partial^2 \Pi_i}{\partial p_i^2} = -2b_i, \quad \frac{\partial^2 \Pi_i}{\partial e_i^2} = -2\omega_i, \quad \frac{\partial^2 \Pi_i}{\partial p_i \partial e_i} = \beta_i,$$

$-2b_i < 0_i$ and $2\omega_i < 0$ for all b, ω positive

$$\det(H) = \begin{vmatrix} -2b_i & \beta_i \\ \beta_i & -2\omega_i \end{vmatrix} = 4b_i\omega_i - \beta_i^2 = 4b_i\omega_i - \beta^2 \phi 0$$

To get a positive maximum, the denominator ($4b\omega/\beta - \beta$) of the equation 1 should be positive ($4b\omega/\beta - \beta > 0$). As consequent, in the same equation, 'a' should be bigger than 'bc' to get a positive numerator ($a - bc > 0$). The service quality productivity coefficient "ω" should be greater than 1 in order to meet the assumption of increasing marginal cost of providing service quality.

Appendix 2: Comparative statics of service quality Nash equilibrium

The comparative statics of the equilibrium quality of services according to main parameters (a, b, c, β, ω, δ) satisfying the second order conditions of the profit maximization.

The quality of services at the equilibrium is

$$e_i{}^* = e_j{}^* = \frac{(a - bc)}{(4b\omega / \beta - \beta - \delta)}$$

$$\partial e^* / \partial a = \frac{1}{(4b\omega / \beta - \beta - \delta)} > 0 \quad where \quad (4b\omega / \beta - \beta - \delta)$$

$$\partial e^* / \partial b = \frac{-4\beta\omega(a-bc) - \beta c(4b\omega - \beta^2 - \beta\delta)}{(4b\omega - \beta^2 - \beta\delta)^2} < 0$$

$$\partial e^* / \partial c = \frac{-b}{(4b\omega / \beta - \beta - \delta)} < 0$$

$$\partial e^* / \partial \beta = \frac{4\beta\omega(a-bc)}{(4b\omega - \beta^2 - \beta\delta)^2} > 0$$

$$\partial e^* / \partial \omega = \frac{-4\beta b(a-bc)}{(4b\omega - \beta^2 - \beta\delta)^2} < 0$$

$$\partial e^* / \partial \delta = \frac{\beta^2(a-bc)}{(4b\omega - \beta^2 - \beta\delta)^2} > 0$$

Appendix 3: Optimal service quality with two levels of demand externalities

The optimum quality with asymmetric demand externalities can be derived from the optimal reaction functions with different parameters of demand externalities (δ_i and δ_j).

$$e_i^* = \frac{\delta_i}{(4b\omega / \beta - \beta)} e_j + \frac{(a-bc)}{(4b\omega / \beta - \beta)}$$

$$e_j^* = \frac{\delta_j}{(4b\omega / \beta - \beta)} e_i + \frac{(a-bc)}{(4b\omega / \beta - \beta)}$$

$$e_i^* = \frac{(a-bc)(\delta_i + A)}{A^2 - \delta_i\delta_j}, \quad e_j^* = \frac{(a-bc)(\delta_j + A)}{A^2 - \delta_i\delta_j}$$

where $A = (4b\omega / \beta - \beta)$

and

$$\frac{\partial e_i^*}{\partial \delta_j} = \frac{\delta_i(a-bc)(\delta_i + A)}{(A^2 - \delta_i\delta_j)^2} > 0, \quad \frac{\partial e_j^*}{\partial \delta_i} = \frac{\delta_j(a-bc)(\delta_j + A)}{(A^2 - \delta_i\delta_j)^2} > 0$$

Appendix 4: Profit comparison

The profit function is $\Pi_i = \frac{2\omega}{\beta} e_i (-\frac{A}{2} e_i + a - bc + \delta_i e_j)$. If there is no demand externality ($\delta_i = \delta_j = 0$), the profit function becomes

$$\Pi_{i,\delta_i=\delta_j=0} = \frac{2\omega}{\beta} e_i (-\frac{A}{2} e_i + a - bc) = \frac{2\omega}{\beta} \times \frac{(a-bc)}{A}$$
$$\times \left(-\frac{A}{2} \frac{(a-bc)}{A} + a - bc \right) = \frac{\omega (a-bc)^2}{\beta A} = \frac{\omega (a-bc)^2}{(4b\omega - \beta^2)}$$
$$\text{where} \quad e_i = \frac{(a-bc)}{A} \quad \text{and} \quad A = (\frac{4b\omega}{\beta} - \beta)$$

and the profit function of outlet i having a high level demand externalities with incomplete information is

$$\tilde{\Pi}_{i,\delta_i=\delta_H,\delta_j=\delta_L} = \frac{2\omega}{\beta} e_i (-\frac{A}{2} e_i + a - bc + \delta_i e_j)$$
$$= \frac{2\omega}{\beta} \times \frac{(a-bc)^2 (A+\delta_H)}{A^2 - \delta_H (p_i \delta_H + (1-p_i)\delta_L)} \times$$
$$\left(-\frac{A}{2} \times \frac{(A+\delta_H)}{A^2 - \delta_H (p_i \delta_H + (1-p_i)\delta_L)} + 1 + \right.$$
$$\left. \delta_H \frac{(A+\delta_L)}{A^2 - \delta_L (p_j \delta_H + (1-p_j)\delta_L)} \right).$$
$$\text{where} \quad p_i = p_i[(\delta_j = \delta_H),\ (\delta_i = \delta_H)]$$
$$\text{and} \quad p_j = p_j[(\delta_i = \delta_H),\ (\delta_j = \delta_L)]$$

This profit function is derived from the service quality equilibrium of outlets i and j with incomplete information.

The profit function with asymmetric demand externalities (high and low) under complete information is a special case when both outlets make the perfect belief ($p_i = 0$ and $p_j = 1$). It is derived as follows:

$$\Pi_{i,\delta_i=\delta_H,\delta_j=\delta_L} = \tilde{\Pi}_{i,\delta_i=\delta_H,\delta_j=\delta_L,p_i=0,p_j=1} = \frac{2\omega}{\beta}\frac{(a-bc)^2(A+\delta_H)}{A^2-\delta_L\delta_H}$$
$$\left[-\frac{A}{2}\times\frac{(A+\delta_H)}{A^2-\delta_L\delta_H}+1+\delta_H\frac{(A+\delta_L)}{A^2-\delta_L\delta_H}\right]$$
$$=\frac{\omega(a-bc)^2A(A+\delta_H)^2}{\beta(A^2-\delta_L\delta_H)^2}.$$

We can also think about the worst case when both outlets make perfectly the wrong belief (p_i = 1 and p_j = 0). Outlet *i*(*j*) believes that outlet *j*(*i*) faces high (low) demand externalities. In this worst case, the profit function of outlet *i* is derived as follows:

$$\tilde{\Pi}_{i,\delta_i=\delta_H,\delta_j=\delta_L,p_i=1,p_j=0} = \frac{2\omega}{\beta}\frac{(a-bc)^2(A+\delta_H)}{A^2-\delta_H^2}$$
$$\times\left(-\frac{A}{2}\times\frac{(A+\delta_H)}{A^2-\delta_H^2}+1+\delta_H\frac{(A+\delta_L)}{A^2-\delta_L^2}\right)$$
$$=\frac{\omega(a-bc)^2[A(A-\delta_L)+2\delta_H(\delta_L-\delta_H)]}{\beta(A-\delta_H)^2(A-\delta_L)}.$$

Based on derived profit functions, we compare the difference of profits of following situations.

1. Profit with complete information (or perfect belief) and asymmetric demand externalities vs. no demand externality

$$\Pi_{i,\delta_i=\delta_H,\delta_j=\delta_L} - \Pi_{i,\delta_i=\delta_j=0}$$
$$=\frac{\omega(a-bc)^2}{\beta}\left(\frac{A(A+\delta_H)^2}{(A^2-\delta_H\delta_L)^2}-\frac{1}{A}\right)=\frac{\omega(a-bc)^2}{\beta A(A^2-\delta_L\delta_H)^2}[2\delta_H A^3$$
$$+\delta_H^2A^2+2\delta_H\delta_L A^2-(\delta_H\delta_L)^2]>0 \quad \text{where} \quad \delta_H\delta_L A^2-(\delta_H\delta_L)^2$$
$$=\delta_H\delta_L(A^2-\delta_H\delta_L)>\delta_H\delta_L(A^2-\delta_H^2)=\delta_H\delta_L(A+\delta_H)(A-\delta_H)>0.$$

It shows that the outlet *i*'s profit is improved as the outlets face demand externalities either both outlets possess complete information about the demand externalities of the other.

2. Profit with incomplete information and demand externalities vs. no demand externality

We assume the worst case in which both outlets formulates perfectly wrong belief about the level of the other outlet's demand externalities. Outlet *i*(*j*) assumes that Outlet *j*(*i*) faces a high (low) level of demand externalities (p_i = 1 and p_j = 0), vice versa. This equilibrium is the one that deviates mostly from its optimum profit, $\Pi_{i,\delta_i=\delta_H,\delta_j=\delta_L}$.

$$\tilde{\Pi}_{i,\delta_i=\delta_H,\delta_j=\delta_L,p_i=1,p_j=0} - \Pi_{i,\delta_i=\delta_j=0}$$

$$= \frac{\omega(a-bc)^2}{\beta}\left[\frac{A(A-\delta_L)+2\delta_H(\delta_L-\delta_H)}{(A-\delta_H)^2(A-\delta_L)} - \frac{1}{A}\right]$$

$$= \frac{\omega(a-bc)^2}{\beta A(A-\delta_H)^2(A-\delta_L)}[(A-\delta_L)A^2+\delta_H(\delta_L-\delta_H)]$$

$$= \frac{\omega(a-bc)^2}{\beta A(A-\delta_H)^2(A-\delta_L)}[2\delta_H A(A-\delta_H)-\delta_H^2(A-\delta_L)]$$

In this worst case, outlet *i*'s profit with the wrong belief is substantially deteriorated and it can not fully dominate the profit level with no demand externality as the difference could be negative. We may say that in certain circumstances where both outlets fail completely to formulate the other's demand externalities, the outlet profit could be smaller than the situation with no demand externalities.

3. Profit with demand externalities with incomplete information perfect vs. wrong belief.

This comparison is trivial as profit gets deteriorated as the outlet deviates from its optimal service quality (Nash equilibrium) with complete information that is the special case of incomplete information with the perfect belief.

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