INTRA-FIRM BRANCH COMPETITION FOR A MONOPOLIST

WENLI CHENG*
New Zealand Treasury

YEW-KWANG NG**
Monash University

This paper studies the effect of intra-firm branch competition in a monopoly setting. It demonstrates that intra-firm branch competition has a significant impact on the firm’s market decisions, and consequently on the market outcome. The paper has identified the sufficient conditions under which a branch-competitive monopoly is superior to a pure monopoly from the consumer’s viewpoint in that the former supplies more quantity and higher quality at the same price.

I. Introduction

Competition is, by definition, the act of striving for better performance against rivalry. The traditional neoclassical theory of the firm treats the firm as a profit-maximising black box participating in market competition. With this convention, the neoclassical theory has provided important insights regarding inter-firm competition. However, the assumption of the firm as an elementary decision unit has ignored the internal structure of the firm, and thus has assumed away possible effects of competition within a firm (intra-firm competition). In this paper, we attempt to model intra-firm competition in a simple setting and to find out what the effects are that have been assumed away.

There may be various reasons for the existence of intra-firm competition. In some cases, intra-firm competition is desired and designed by the firm. For instance, independent competing branches (divisions) may be created as a strategy to deter entry (Schwartz and Thompson, 1986). Intra-firm competition may also be used by the central management to stimulate work incentive and creativity (Lazear and Rosen, 1981, Nalebuff and Stiglitz 1983).

In other cases, intra-firm competition is unintended by the firm and is associated with the organisational form of the firm. For instance, a firm with multiple branches (the M-form firm) typically has stronger intra-firm competition than a unitary form firm (the U-form firm). The essential difference between an M-form firm and a U-form firm is that decision making is decentralised in the former and centralised in the latter (Williamson, 1975). In an

* The views expressed are the authors’ own and do not necessarily represent those of the New Zealand Treasury.
** Department of Economics, Monash University, Clayton, Vic 3168, Australia; Tel: 61 3 9905 2309; fax: 61 3 9905 5476, email: kwang.ng@buseco.monash.edu.au.

© Blackwell Publishers Ltd, 108 Cowley Road, Oxford OX4 1JF, UK and 350 Main Street, Malden MA 02148, USA and the University of Adelaide and Flinders University of South Australia 1999.
M-form firm, if a branch manager’s reward is tied to the performance measured by, say, the profitability of his own branch, the branch manager will use his discretionary power and compete with other branches to maximise his own branch’s profit. Such intra-firm branch competition generates a business stealing effect that reduces the profitability of the firm as a whole. The focus of this paper is on the effects of intra-firm competition in an M-form firm.

Before analysing the effects of intra-firm competition, we need to first know the reason why such competition is tolerated if the firm knows that it may be detrimental to the firm’s profitability as a whole. In other words, we need to know why the management of the firm does not centralise decision making so as to avoid the business stealing effect of intra-firm competition. The simple answer is that there are costs associated with centralised decision making, which includes, for example, the cost of gathering information, assessing information and acting based on the assessment. If the cost of centralisation is higher than the potential loss of profit due to business stealing, the firm will choose to decentralise decision making and tolerate the related intra-firm competition. That is, the management makes a choice about its decision making process and the corresponding organisational form that facilitates the process based on the following criterion: if \( \pi_{NC} - \pi_C < c \) (where \( \pi_{NC} \) is the profit obtainable if there is no intra-firm competition and \( \pi_C \) is the profit obtainable if there is intra-firm competition, \( c \) is the cost of centralisation), choose decentralised decision making and the M-form organisation; otherwise, choose centralised decision making and the U-form organisation.

Not surprisingly, the U-form organisation is mostly found in smaller firms where the cost of centralisation is low. As a U-form firm expands, it faces increasing control cost, for instance, information required for central decision making increases, and the risk of information distortion also increases. More importantly, the management can be overloaded with operational details to the extent that the quality of medium-term and long-term decisions is compromised. When this happens, the firm has to change its organisation or face serious losses. In fact, the M-form organisation was introduced in the 1920s when some large U-form firms were facing increasing internal control problems. The DuPont Company and General Motors were among the first to adopt the M-form organisation and had huge success with it (Williamson, 1975). More recently, the M-form organisation has been favoured by more and more large firms. For instance, the international electrical engineering company ABB has now 1500 business units each with a separate balance sheet; and a major oil company has recently split its operation into 80 business units.\(^1\)

To argue that the central management may rationally choose to tolerate profit reducing intra-firm branch competition is not to say that it will do nothing to reduce the negative effects of such competition. Rather, the central management would choose to influence its branches’ decision without resorting to centralising decision making. Since decision making is decentralised in an M-form firm, we can think of the decision making process as having two layers – at the bottom layer, each branch has control over some variables; and at the top layer, the central management controls others. While the central management does not have direct control over everything the branches do, it can influence the branches’ behaviour indirectly through the variables in its control. This indirect influence can rectify some (but not all) of the negative effects of intra-firm competition. The two-layer decision process of the branches and the central management leads to optimal choices of the firm given the constraint of high centralisation cost, but the choices are not first-best.

---

1 This information is from Mckinsey & Company’s presentation in the 1997 European Corporate Finance Conference. The name of the oil company is suppressed because of client confidentiality.
In the following, we analyse the effects of the intra-firm competition in an M-form firm. The analysis is conducted in a monopoly setting. We shall show that a pure monopoly, which does not have intra-firm branch competition, behaves systematically differently from a branch-competitive monopoly, which consists of competing branches. As a result, the market outcome for a pure monopoly is different from that for a branch-competitive monopoly. An implication of our analysis is that the conventional analysis of monopoly may be biased as it treats a monopoly as a pure monopoly even when branch competition exists.

The rest of the paper is organised as follows. Section II develops a general model that compares the market decisions of a pure monopoly and those of a branch-competitive monopoly. Section III illustrates the general model using specific functional forms. Finally, Section IV presents the conclusion and possible policy implications.

II. The General Model

In order to demonstrate the impact of intra-firm competition, we compare the market outcome of two types of monopolists: a pure monopoly and a branch-competitive monopoly consisting of $N$ symmetrical competing branches. Both monopolists are assumed to maximise their profits with respect to two decision variables, the price ($p$) and the quality ($s$) of their product or service. Here, $s$ can be thought to include a variety of decisions such as advertising and after-sale service, etc. We assume that for a given price, an increase in $s$ increases the quantity demanded for the monopolists’ product.

For the pure monopoly, we assume that the management has full control over both $p$ and $s$. For the branch-competitive monopoly, the headquarters controls $p$, while each branch controls its own $s'$. We may regard $p$ as a strategic variable which is chosen first; $s'$ as a non-strategic variable which is at the discretion of each branch. For instance, $p$ may be the price of a standard product, $s'$ may be the quality of services after the product is sold. The pure monopoly chooses only one $s$; each branch of the branch-competitive monopoly can choose different ways to change its quality $s'$. In this sense, each branch can be regarded as supplying a close substitute competing with one another. Since the branches are assumed to be symmetrical, in equilibrium, the level of $s'$ will be the same, but the attributes of the product/service quality supplied by each branch may differ.

We first consider the market decisions of the pure monopoly and the branch-competitive monopoly separately. By assumption, the pure monopoly maximises profit with respect to both $p$ and $s$, its decision problem is

$$\max_{p, s} \pi = pq(p, s) - C(q(p, s), s)$$

where $q(p, s)$ is the demand faced by the monopoly, $q_p < 0, q_s > 0$; $C(q(p, s), s)$ is the cost of production, $C_q > 0, C_s > 0$.

The first-order conditions are

$$\pi_p = p \left(1 + \frac{1}{\eta} \right) - C_q = 0 \quad (1)$$

$$\pi_s = (p - C_q)q_s - C_s = 0 \quad (2)$$

where $a_b = \partial a/\partial b$ (this notation will be used throughout the paper), $\eta$ is the price elasticity of demand.

The second-order conditions are $\pi_{pp} < 0, \pi_{pp}\pi_{ss} - \pi_{ps}^2 > 0$. 

© Blackwell Publishers Ltd/University of Adelaide and Flinders University of South Australia 1999.
For a branch-competitive monopoly consisting of $N$ symmetrical branches, each branch manager chooses its own quality ($s^i$, $i = 1, \ldots, N$) to maximise the profit of its own branch. The sum of each branch’s profit is the monopoly’s total profit. Since the branches compete with one another over quality, each branch’s demand depends on both its own quality and the quality of other branches, i.e., $q^i = q^i(p, s', s)$, where the average quality ($s$) is used to approximate the quality of other branches, assuming the number of branches is large. The decision problem for branch $i$ is

$$\max_{s^i} \pi^i_i = pq^i(p, s^i, s) - C^i(q^i, s^i)$$

The first-order condition is

$$\pi^i_i = pq^i_s - C^i_{q^i} q^i_s - C^i_{s^i}$$

(3)

The second-order condition is $\pi^i_{i, j, i} < 0$.

The headquarters has no direct control over $s$, but it can indirectly affect each branch’s choice of $s'$ through its choice of $p$. Thus, the headquarters takes this indirect influence into account in its decision making, its decision problem is

$$\max_p \pi = pq(p, s(p)) - C(q(p, s(p)), s(p))$$

where $s(p)$ equals $s'(p)$ which is the solution to equation (3). As the branches are assumed to be symmetric, each branch’s quality level equals the average quality level in equilibrium.

The first-order condition is

$$\pi_p = p \left(1 + \frac{1}{\eta}\right) - \frac{pq_s - C_q q_s - C_s ds}{q_p \frac{ds}{dp}} - C_q = 0$$

(4)

The second-order condition is $\pi_{pp} < 0$.

We now investigate how the pure monopoly’s market decisions differ from those of the branch-competitive monopoly. First look at the quality decision.

We start by making the following observation. When a single branch, say branch $i$, increases its quality, the response of the demand for branch $i$’s product can be said to consist of two effects – first, branch $i$ will have more demand from its old customers; second, it will attract new customers from other branches which now have lower quality than branch $i$. In contrast, if all branches increase their quality to the same extent, the second effect will be absent. Similar reasoning applies to the case of a quality decrease. Hence, branch $i$’s demand response to its own quality change must be greater than its demand response to an average quality change. That is

$$q^i_s > q_s / N$$

(5)

From equation (2), we have

$$pq_s|_{p_{PM}, s_{PM}} = (C_q q_s + C_s)|_{p_{PM}, s_{PM}}$$

(2’)

where $|_{p_{PM}, s_{PM}}$ means ‘evaluated at the pure monopoly’s equilibrium price and quality level’. Equations (5) and (2’) imply

The aggregated demand is the sum of each branch’s demand, and the total cost is the sum of each branch’s cost.

3 The analysis below also applies to cases where the number of branches is small as long as each branch still takes the price and other branches’ quality as beyond its control.
It is reasonable to assume that the firm’s marginal cost is the sum of the $N$ branches’ marginal cost, i.e.

$$C_q q_s + C_s = (s_q q_s + C_s) N$$

(7)

From equations (6) and (7), we derive

$$p q_s \bigg|_{p_{PM}, s_{PM}} > (C_q^i q_s^i + C_s^i) \bigg|_{p_{PM}, s_{PM}}$$

(8)

Next, we look at the price decision. The difference in the price decision for the two types of monopolists results from their different abilities to control the quality of their output. From Proposition 1, we know that a branch-competitive monopoly supplies a higher quality at the pure monopoly’s equilibrium price level. This higher quality has two effects on the branch-competitive monopoly’s price decision.

First, the counter-quality effect. Knowing that the branches will compete in quality and thus producing excess quality from the whole firm’s point of view, the headquarters would want to reduce the branches’ quality level. As the headquarters can only indirectly affect each branch’s quality by changing the price level, it will reduce price level if the effect of price on quality is positive; if the effect of price on quality is zero, then the headquarters does not have any control (direct or indirect) on each branch’s quality, and it has no incentive to charge a price different from that of the pure monopoly as far as the counter-quality effect is concerned.\(^4\)

Second, the demand-adaptation effect. The higher quality implies that the branch-competitive monopoly has a higher demand than the pure monopoly, which means that the headquarters may want to set a different price in view of the higher demand. The direction of the change in price depends on whether the higher demand is associated with a higher price elasticity and whether the marginal cost with respect to quantity, which is assumed here to be independent of quality,\(^5\) changes with the level of output. Ceteris paribus, the headquarters will set a lower price if the price elasticity is higher and/or the marginal cost decreases as the output increases.

Taking into account both of the counter-quality and the demand-adaptation effects, we

\(^4\) We assume that the effect of price on quality is non-negative as will be explained later in the following footnote.

\(^5\) This assumption is reasonable if we assume that the marginal cost with respect to quantity relates to the cost of producing a physical product, whereas the marginal cost with respect to quality relates to the cost of service in selling the product. This assumption is applicable to, for instance, a factory retail outlet.
can investigate, with reference to the monopolists’ first-order conditions, how a branch-competitive monopoly’s price is different from a pure monopoly’s at equilibrium.

Suppose the headquarters of the branch-competitive monopoly chooses the same price level as the pure monopoly, its price decision satisfies the pure monopoly’s first-order condition equation (1), which is rewritten into

$$p \left(1 + \frac{1}{\eta}\right)_{p_{PM,s_{PM}}} = C_q|_{p_{PM,s_{PM}}}$$

where $\eta$ is the price elasticity of demand.

At the pure monopoly’s equilibrium price level, each branch chooses a quality level $s^*$ that satisfies

$$pq_i\bigg|_{p_{PM,s^*}} = (C_{qi}q_i + C_{qi}^i)|_{p_{PM,s^*}}$$

Recall equation (5)

$$q_i^s > \frac{q_s}{N}$$

Equations (3’) and (5) imply

$$pq_s\bigg|_{p_{PM,s^*}} < (C_qq_s + C_s)|_{p_{PM,s^*}}$$

which in turn implies

$$p_{q_s} - C_qq_s - C_s \frac{ds}{dp} \bigg|_{p_{PM,s^*}} \geq 0 \quad \frac{ds}{dp} \geq 0$$

where

$$\frac{ds}{dp} = \frac{q_i^s - (C_{qi}q_i^s + C_{s_i}^i q_i^s) - q_s C_qq_s q_s^p + pq_i^s}{C_i^s q_i + (C_i^s q_i + q_i^s C_i q_i^s)(q_i + q_i^s) + (C_i - p)(q_i^s q_i + q_i^s q_i^s) + q_i^s C_i q_i}$$

See the Appendix for the derivation.

We know if the headquarters of the branch-competitive monopoly sets a price that equals the pure monopoly’s equilibrium price level, the branches will accordingly choose quality level $s^*$. Equation (9) implies that at $s^*$, the marginal revenue from a quality change from the headquarters’ viewpoint is less than the marginal cost, thus the headquarters would want to reduce quality by reducing the price level if the change in price could indirectly change the branches’ quality choice. This captures the counter-quality effect.

Adding equations (1’) and (9’), we have

$$p \left(1 + \frac{1}{\eta}\right)_{p_{PM,s_{PM}}} + \frac{p_{q_s} - C_qq_s - C_s}{q_p} \frac{ds}{dp} \bigg|_{p_{PM,s_{PM}}} \geq C_q|_{p_{PM,s_{PM}}} \left(\frac{ds}{dp} \geq 0\right)$$

Notice that inequality (10) is similar in construction to the first-order condition (4) which determines the branch competitive monopoly’s price decision. Notice also that in inequality (10), the two terms on the left-hand side are evaluated at different quality levels. To

Intuitively, an increase in price means an increase in unit profit, which would provide extra incentive for each branch to increase its own quality and the average quality would increase. But the increase in price also reduces the demand for each branch, which serves as a disincentive for branches to increase quality. We assume that the net effect of price on quality is non-negative; this assumption holds as long as $pq_i^s$ is not too negative.
determine whether the branch-competitive monopoly will set a different price from the pure monopoly, we need to re-evaluate inequality (10) at the pure monopoly’s equilibrium price level \( (p_{PM}) \) and the corresponding quality level the branches will choose \((s^*)\). If inequality still holds, then the branch-competitive monopoly will set a price no higher than the pure monopoly. This is because the re-evaluated inequality implies at the pure monopoly’s equilibrium price level, the marginal revenue (with respect to quantity) for the branch-competitive monopoly is greater than or the same as the marginal cost, thus the monopoly would increase or maintain quantity by reducing or maintaining price. If the re-evaluated inequality (10) no longer holds, then the branch-monopoly will set a higher price than the pure monopoly. We re-evaluate inequality (10) in the following, assuming \( ds/dp > 0 \).

If marginal cost \((C_q)\) is constant, we only need to re-evaluate \( p(1 + (1/\eta)) \) at the new quality level \( s^* \). If \( s^* \) is associated with a lower price elasticity, the re-evaluated \( p(1 + (1/\eta)) \) is smaller. Although \[
\left. \frac{pq_s - C_q q_s - C_s dq}{dp} \right|_{p_{PM}, s^*}
\]
is positive, it may not be large enough to compensate the lower value of \( p(1 + (1/\eta)) \), thus we cannot determine whether the inequality (10) still holds. However, if \( s^* \) is associated with a higher or the same price elasticity, then inequality (10) still holds, which implies the branch-competitive monopoly will charge a lower price than the pure monopoly.

If marginal cost \((C_q)\) increases with output, \( s^* \) is associated with a higher marginal cost because of its higher demand. This means that the re-evaluated inequality (10) may not hold even if \( s^* \) is associated with a higher price elasticity. In contrast, if marginal cost decreases with output, then the re-evaluated inequality (10) may still hold even if \( s^* \) is associated with a lower price elasticity.

Similarly, we can re-evaluate inequality (10) assuming \( ds/dp = 0 \). We present the overall results of the re-evaluation in Table I.

From Table I, we have

**Proposition 2**  For given cost and demand conditions, at equilibrium

(1) a branch-competitive monopoly charges a lower price than a pure monopoly if

(i) the effect of price on quality is positive \((ds/dp > 0)\), higher quality is associated with an unchanged or higher price elasticity of demand, and the marginal cost with

<table>
<thead>
<tr>
<th>Table I</th>
<th>A comparison of the price choice for the monopolists (The marginal cost with respect to quantity is assumed to be independent of quality)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>( ds/dp &gt; 0 )</td>
</tr>
<tr>
<td>Increasing ( C_q )</td>
<td></td>
</tr>
<tr>
<td>higher ( \eta )</td>
<td>higher ( p )</td>
</tr>
<tr>
<td>Constant ( \eta )</td>
<td>higher ( p )</td>
</tr>
<tr>
<td>lower ( \eta )</td>
<td>lower ( p )</td>
</tr>
<tr>
<td>Decreasing ( C_q )</td>
<td></td>
</tr>
<tr>
<td>higher ( \eta )</td>
<td>lower ( p )</td>
</tr>
<tr>
<td>Constant ( \eta )</td>
<td>lower ( p )</td>
</tr>
<tr>
<td>lower ( \eta )</td>
<td>lower ( p )</td>
</tr>
</tbody>
</table>
respect to quantity is constant or decreasing; or
(ii) the effect of price on quality is zero \((ds/dp = 0)\), higher quality is associated with unchanged or higher (higher) price elasticity of demand, and the marginal cost with respect to quantity is decreasing (constant).

(2) a branch-competitive monopoly charges the same price as a pure monopoly at equilibrium if the effect of price on quality is zero \((ds/dp = 0)\), higher quality is associated with unchanged price elasticity of demand, and the marginal cost with respect to quantity is constant.

(3) a branch-competitive monopoly charges a higher price than a pure monopoly at equilibrium if the effect of price on quality is zero \((ds/dp = 0)\), higher quality is associated with unchanged or lower (lower) price elasticity of demand and the marginal cost with respect to quantity is increasing (constant or increasing).

Proposition 2 tells how the equilibrium price for the branch-competitive monopoly differs from that for the pure monopoly. If the branch-competitive monopoly charges a price no lower than a pure monopoly, then it follows from Proposition 1 that it will supply higher quality at equilibrium than the pure monopoly. Thus we have

Proposition 3 For given cost and demand conditions, if the conditions (2) and (3) in Proposition 2 are satisfied, a branch-competitive monopoly supplies higher quality at equilibrium than a pure monopoly.

The analysis in this section suggests that a branch-competitive monopoly may set a price lower than /higher than/ the same as that of the pure monopoly. If the branch-competitive monopoly sets a higher or the same price, then it will supply a higher quality. Hence, we can conclude that when it charges the same price as the pure monopoly, the branch-competitive monopoly is superior to the pure monopoly from the consumers’ viewpoint.

In the following section, we illustrate the above general model with specific functions of consumer utility and producer costs.

III. An Illustration

Consider a representative consumer who has a Cobb-Douglas utility function

\[ U = q^\gamma I y \]

where

\[ I = \frac{(s/p)^\theta}{1 - \gamma(s/p)^\theta} \quad \left(0 < \theta, \frac{s}{p} < 1\right) \]

\(q\) is the quantity of good \(Q\) produced by the industry of our concern, and \(y\) is the quantity of other goods; \(\gamma\) is a parameter that indicates the relative importance of the \(Q\) industry in the whole economy (and thus it is reasonable to assume it to be a lot less than one). \(I\) is a quality index which increases with quality \((s)\) and decreases with price \((p)\). The design of the index reflects the hypothesis that both higher quality and lower price increase utility. That a lower price contributes to consumer utility can be justified by the observation that consumers usually gain some extra psychological satisfaction from obtaining a bargain, which is over and above the satisfaction obtained by the increase in consumption due to the lower price. In
addition, the more important the item \( Q \) is, the higher the utility gained from higher quality and the higher the extra psychological satisfaction from a bargain, thus \( I \) increases with \( \gamma \).

(Readers who are not comfortable with this specification can dispense with the utility function and start directly from the conventional demand function (equation (11) below).

The representative consumer maximises utility subject to the budget constraint

\[
pq + y = E
\]

where \( E \) is the total endowment.

Solving the consumer’s maximisation problem, we obtain the consumer demand for good \( Q \):

\[
Q = \gamma Ep^{-(1+\theta)}s^\theta
\]  

(11)

Given the constant-elasticity demand function, we now look at the decisions of a pure monopoly and those of a branch-competitive monopoly.

1) Pure monopoly

The pure monopoly chooses price and quality to maximise its profit. Suppose the pure monopoly’s cost function is \( C = aq + bs \), its decision problem is

\[
\max_{p,s} \pi = pq - C = p\gamma Ep^{-(1+\theta)}s^\theta - (a\gamma Ep^{-(1+\theta)}s^\theta + bs)
\]

Solving the decision problem, we obtain the equilibrium price, quantity, quality and profit levels for the pure monopoly. The results are presented in Table II

2) Branch-competitive monopoly

Suppose the branch-competitive monopoly consists of \( N \) symmetric branches. Each branch’s cost of production \( (C^i) \) is \( 1/N \) of the total cost, i.e.

\[
C^i = \frac{(aq + bs)}{N} = aq^i + \frac{bs^i}{N}
\]

Each branch’s demand will be \( 1/N \) of the total demand. In addition, a branch’s demand relates positively to its own quality and negatively to the quality of other branches; and a branch’s demand response to a quality change by its own branch alone is larger than the demand response to an average change in quality of the same magnitude. We specify a branch’s demand as

\[
q^i = \gamma Ep^{-(1+\theta)}(s^i)^{\theta+\varepsilon}S^{-\varepsilon}/N
\]

By our assumption of asymmetry, \( s = s^i \), thus \( \sum_{i=1}^{N} q^i = q \). A branch’s demand response in elasticity terms to a quality change by its own branch is \( (\theta + \varepsilon) \), which is larger than the demand response in elasticity terms to an average change in quality \( (\theta) \).

Each branch’s decision problem is to choose its quality to maximise its own profit, taking price and other branches’ quality as given, i.e.

\[
\max_{s^i} \pi = pq^i - C^i = [p\gamma Ep^{-(1+\theta)}(s^i)^{\theta+\varepsilon}S^{-\varepsilon} - a\gamma Ep^{-(1+\theta)}(s^{i})^{\theta+\varepsilon}S^{-\varepsilon} - bs^i]/N
\]

The headquarters chooses price to maximise profit, taking into account the knowledge that it can affect each branch’s choice through its choice of price, its decision problem is

© Blackwell Publishers Ltd/University of Adelaide and Flinders University of South Australia 1999.
\[
\max_p \pi = pq - C = p\gamma Ep^{-(1+\theta)}s^{-\theta} - (a\gamma Ep^{-(1+\theta)}s^{-\theta} + bs)
\]

where \(s\) equals the solution to the branch’s decision problem \(s'\).

Solving decision problems, we obtain the optimal price, quality, quantity and profit for the branch-competitive monopoly. The results are presented in Table II.

To make our analysis complete, we also present in Table II the equilibrium outcome for an unconstrained social planner and that for a constrained social planner. An unconstrained social planner is assumed to choose quantity and quality to maximise net social gain defined as the total social value of production (the area under the demand curve) net of the total production cost, i.e.

\[
\max_{q,s} W = \int_0^q p(x)dx - aq - bs = \int_0^q (\gamma E)^{\frac{1}{1+\theta}}x^{\frac{\theta}{1+\theta}}s^{\frac{\theta}{1+\theta}}dx - aq - bs
\]

A constrained social planner maximises the same net social gain, but is subject to a zero profit constraint \(\pi = pq - aq - bs = 0\).

From Table II we conclude that the branch-competitive monopoly charges the same price, yet supplies more quantity and higher quality\(^7\). However, the branch-competitive monopoly charges a higher price and supplies a lower quantity and quality than a constrained social planner, and the constrained social planner in turn charges a higher price and supplies a lower quantity and quality than an unconstrained social planner. It is also clear from Table II that the branch-competitive monopoly makes a positive profit but its profit level is lower than that of the pure monopoly. This indicates that there is still strong incentive for firms to merge in order to make a profit, although such mergers do not usually eliminate competition among the merged firms.

### Table II  Equilibrium levels of price, quantity, quality and profit for different producers

<table>
<thead>
<tr>
<th>Producers</th>
<th>Price</th>
<th>Quantity</th>
<th>Quality</th>
<th>Profit</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pure monopoly</td>
<td>(a(1+\theta))</td>
<td>((1+\theta)^{\frac{1}{1+\theta}}\theta\alpha_\pi)</td>
<td>((1+\theta)^{\frac{1}{1+\theta}}\theta\alpha_\eta)</td>
<td>((1+\theta)^{\frac{1}{1+\theta}}(ab)^{\frac{1}{1+\theta}}(\gamma E)^{\frac{1}{1+\theta}})</td>
</tr>
<tr>
<td>Branch-competitive</td>
<td>(a(1+\theta))</td>
<td>((1+\theta)^{\frac{1}{1+\theta}}\theta\beta\gamma)</td>
<td>((1+\theta)^{\frac{1}{1+\theta}}\theta\beta\gamma)</td>
<td>((1+\theta)^{\frac{1}{1+\theta}}(ab)^{\frac{1}{1+\theta}}(\gamma E)^{\frac{1}{1+\theta}})</td>
</tr>
<tr>
<td>Planner</td>
<td></td>
<td>((\theta + \epsilon)^{\frac{\alpha}{\theta}}\beta^2\beta^2a^{\alpha_\eta})</td>
<td>((\theta + \epsilon)^{\frac{\alpha}{\theta}}\beta^2\beta^2a^{\alpha_\eta})</td>
<td>((1 - \theta - \epsilon)(\theta + \epsilon)^{\frac{\alpha}{\theta}}\beta^2\beta^2)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>((\gamma E)^{\frac{1}{1+\theta}}\beta\gamma)</td>
<td>((\gamma E)^{\frac{1}{1+\theta}}\beta\gamma)</td>
<td>(0)</td>
</tr>
<tr>
<td>Constrained social</td>
<td>(2a)</td>
<td>(2a)</td>
<td>(2a)</td>
<td>(-(ab)^{\frac{1}{1+\theta}}(\gamma E)^{\frac{1}{1+\theta}})</td>
</tr>
<tr>
<td>Planner</td>
<td></td>
<td>(b^{\alpha_\pi}(\gamma E)^{\frac{1}{1+\theta}}\beta^2\beta^2a^{\alpha_\eta})</td>
<td>(b^{\alpha_\pi}(\gamma E)^{\frac{1}{1+\theta}}\beta^2\beta^2a^{\alpha_\eta})</td>
<td>(-(ab)^{\frac{1}{1+\theta}}(\gamma E)^{\frac{1}{1+\theta}})</td>
</tr>
</tbody>
</table>

\(^7\) This does not represent the general result, but is consistent with Proposition 2 (2) as the demand elasticity is constant, the marginal cost with respect to quantity is constant, and it is easy to show that the effect of price on quality is zero. If we assume an alternative demand and cost structure, for instance, a linear demand and a quadratic cost function, it can be shown that the branch-competitive monopoly would supply the same quantity, but higher quality at the same price as the pure monopoly.
IV. Conclusion

In this paper, we have analysed the intra-firm branch competition in an M-form monopoly firm. We have shown that such intra-firm competition alters the firm’s market decisions, which in turn affects the market outcome. We have identified certain sufficient conditions, (namely, the effect of price on quality is zero, the price elasticity of demand is constant and the marginal cost with respect to quantity is constant) under which intra-firm branch competition is preferred by consumers. As an illustration, we analysed a specific model with a Cobb-Douglas utility function and linear cost functions. We found that the branch-competitive monopoly produces a larger quantity, and higher quality than the pure monopoly. We also found that a social planner (constrained or unconstrained) supplies a larger quantity and higher quality than the two types of monopolies.

The result of this paper suggests that by neglecting the firm’s internal structure, the traditional analysis of the market structure may be biased. For example, the traditional analysis may over-estimate the anti-competitive effect of a horizontal merger if the firms continues to compete with each other after they have merged. This may have important policy implications because in reality, competition after a merger is often not reduced, or at least not by as much as commonly thought; in some cases, competition is even more fierce among firms after they have merged (probably because that competitors can observe each other more closely, and thus feel more competitive pressure).

This paper is our first attempt to relate the firm’s internal structure to the market outcome. It has only investigated the role of intra-firm branch competition in a simple monopoly model. However, in the real world, where intra-firm branch competition is present, the market structure is likely to be oligopolistic, in which case, an increase in the quality of a single branch’s product not only attracts customers from other branches of the same firm, but also from other firms. Future studies can extend the model to more complicated market structures.

Appendix

The derivation of $ds/dp$

Totally differentiating equation (3), we get

$$q_{i'} dp + pq_{i's'} ds + pq_{i's'} dp + pq_{i's'} ds = C_{i's'} dq_{i'} + C_{i's'} dq_{i'} + C_{i's'} dq_{i'} + q_{i'} dC_{i'}$$  \hspace{1cm} (A1)

Then totally differentiating

$$q_{i'} = q'(p, s', s)$$

$$q_{s'} = q'(p, s', s)$$

$$C_{q'} = C_{q'}(q'(p, s', s), s')$$

we have

© Blackwell Publishers Ltd/University of Adelaide and Flinders University of South Australia 1999.
\[ dq^i = q^i_p dp + q^i_s ds^i + q^i ds \]
\[ dq^i_s = q^i_s p dp + q^i_s s ds^i + q^i_s ds \]
\[ dC^i_q = C^i_q q^i dq^i + C^i_{q^i s_t} ds^i \] (A2)

Substituting (A2) and \( ds = ds^i \) into (A1) and re-arranging gives
\[
\frac{ds}{dp} = \frac{q^i_s - (C^i_{q^i p} q^i_p + C^i_{q^i q^i} q^i_q) - q^i_s C^i_{q^i q^i} q^i_s + pq^i_s q^i}{C^i_{q^i s_t} + (C^i_{q^i q^i} + q^i_s C^i_{q^i q^i})(q^i_s + q^i_s) + (C^i_{q^i p} - p)(q^i_s + q^i_s) + q^i_s C^i_{q^i q^i}}
\]

References


