

Profit-Raising Entry with Heterogeneous Incumbent Firms

Chiu-Hui Li, Jen-Yao Lee

Department of International Business, NKUST, Taiwan, China

Email: itjylee@nkust.edu.tw

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Abstract

This paper studies profit-raising entry with heterogeneous incumbent firms. In a homogeneous-product Stackelberg model with two incumbent leaders and a follower entrant, entry always increases total output. However, profit effects depend on incumbent cost asymmetry. Because outputs are strategic substitutes, the inefficient incumbent contracts output more after entry, relaxing competition and allowing the efficient incumbent to gain. With intermediate entrant efficiency, entry raises the efficient incumbent's profit, acting as a selection mechanism.

Keywords

Heterogeneous Firms, Profit-Raising Entry, Stackelberg Competition

1. Introduction

A large literature has identified circumstances under which market entry may raise, rather than reduce, incumbents' profits. Existing explanations include input-price effects (Tyagi, 1999), wage bargaining in vertically related markets (Naylor, 2002), input-market entry (Matsushima, 2006; Mukherjee, 2019), knowledge spillovers (Wang & Lee, 2015), heterogeneous-cost incumbents (Pal & Sarkar, 2001; Mukherjee & Zhao, 2017), network industries (Fanti & Buccella, 2017), and competition mode (Fanti & Meccheri, 2014; Brito & Catalão-Lopes, 2023). A common feature of these studies is that firms are typically homogeneous within each strategic role, or heterogeneity is introduced only in a reduced and stylized manner.

This paper revisits the profit-raising entry phenomenon from the perspective of heterogeneous incumbent firms. We argue that incumbent heterogeneity is not a secondary modeling detail but a central determinant of how entry reshapes competitive interaction and profit distribution. Once incumbents differ in marginal

costs, entry no longer has a uniform effect on all firms. Instead, it generates asymmetric strategic responses, which may relax competition for some incumbents even as market output expands.

To capture this mechanism in the simplest possible setting, we consider a homogeneous-product market with two incumbent leaders and a potential entrant. The incumbents are heterogeneous in marginal costs, modeled in reduced form through firm-specific cost distortions. These distortions generate cost asymmetry across incumbents while preserving identical demand conditions and product homogeneity. Although such distortions may be interpreted as managerial slackness, the analysis does not rely on any particular organizational or behavioral mechanism. What matters for the results is cost heterogeneity itself, rather than its underlying source.

The strategic interaction is modeled as a Cournot benchmark without entry and a Stackelberg leader–follower game with entry, where the heterogeneous incumbents act as leaders and the entrant follows. The central insight of the paper is that profit-raising entry emerges as an inherently asymmetric outcome once incumbents are heterogeneous. Because outputs are strategic substitutes, a relatively inefficient incumbent contracts output more aggressively in response to entry, thereby relaxing competitive pressure. This contraction creates room for the relatively efficient incumbent to expand output, and under appropriate conditions on the entrant’s marginal cost, this heterogeneity-induced asymmetry can outweigh the standard negative price effect of entry.

The contributions of the paper are threefold. First, we provide a simple and transparent framework in which incumbent heterogeneity in marginal costs fundamentally shapes the strategic effects of entry. Second, we characterize the conditions under which entry raises the profit of the relatively efficient incumbent while reducing that of the less efficient one, highlighting the distributional consequences of entry among heterogeneous firms. Third, we show that when incumbents are symmetric, profit-raising entry does not arise in a robust manner; the symmetric case therefore serves as a benchmark rather than a source of novel effects.

The remainder of the paper presents the model and equilibrium results with and without entry, followed by concluding remarks.

2. The Model

2.1. No Entry

We consider a homogeneous-product market with two incumbent firms, indexed by $i = 1, 2$. The incumbents are heterogeneous in marginal costs, reflecting firm-specific cost distortions that generate asymmetry across firms. These distortions are introduced in reduced form and are treated as exogenous; the analysis does not rely on any particular organizational or behavioral interpretation.

The inverse market demand is given by

$$p = a - q_1 - q_2 \quad (1)$$

where p and a denote the market price and scale respectively, and q_1 together with q_2 are the output of incumbent firms 1 and 2 producing with constant marginal costs $c < a$.

Each incumbent produces with a baseline marginal cost c . Cost heterogeneity is captured by firm-specific cost distortion parameters g_i , which shift marginal costs asymmetrically across firms. The effective marginal costs of the two incumbents are therefore given by $(1+g_1)c$, and $(1+g_2)c$, respectively. Although these cost distortions may be interpreted as reflecting internal inefficiencies, they are introduced solely to capture cost asymmetry among incumbents, which is the key structural feature driving the results. Without loss of generality, we assume that $g_1 < g_2$, implying that firm 2 is less efficient than firm 1.

We express the profit functions of both incumbent firms as follows:

$$\pi_1 = (p - (1+g_1)c)q_1 \quad (2)$$

$$\pi_2 = (p - (1+g_2)c)q_2 \quad (3)$$

In the absence of entry, the two heterogeneous incumbents compete à la Cournot, simultaneously choosing output levels to maximize their respective profits.

From the first order conditions, the equilibrium outputs are

$$q_1^{NE} = \frac{1}{3}(a - 2c(1+g_1) + c(1+g_2)) \quad (4)$$

$$q_2^{NE} = \frac{1}{3}(a + c(1+g_1) - 2c(1+g_2)) \quad (5)$$

Adding (4) and (5), we obtain the total industry output

$$Q^{NE} = q_1^{NE} + q_2^{NE} = \frac{1}{3}(2a - c(1+g_1) - c(1+g_2)) \quad (6)$$

where the superscript NE denotes “No Entry”.

Positive outputs of both firms require that,

$$a - 2c(1+g_1) + c(1+g_2) > 0 \quad (7)$$

$$a - 2c(1+g_2) + c(1+g_1) > 0 \quad (8)$$

The equilibrium results of firms' profits without entry are that:

$$\pi_1^{NE} = \frac{1}{9}(a - 2c(1+g_1) + c(1+g_2))^2 \quad (9)$$

$$\pi_2^{NE} = \frac{1}{9}(a + c(1+g_1) - 2c(1+g_2))^2 \quad (10)$$

2.2. Entry

In many industries, incumbent firms possess advantages such as established capacity, market experience, and existing distribution networks. These advantages allow incumbents to commit to output or capacity decisions earlier than potential entrants. Following this standard incumbency advantage argument, we model the

entry regime as a Stackelberg leader–follower game in which incumbent firms act as leaders and the entrant behaves as a follower. This timing assumption captures the idea that entrants optimally respond to the production commitments of existing firms. This timing structure is the key driver of the output expansion result relative to the Cournot benchmark.

We now introduce a third firm, an entrant (firm 3), with constant marginal cost c_3 . Unlike the incumbents, the entrant does not face cost distortions and therefore operates with a uniform marginal cost. All firms supply a homogeneous product.

To ensure that entry is economically relevant, we impose the condition

$c_3 < \bar{c} = \frac{a+4c}{5} < a$, which guarantees that the entrant produces a positive output even when incumbents are fully efficient.

The inverse market demand can be rewritten as

$$p = a - q_1 - q_2 - q_3 \quad (11)$$

We express the profit functions of firm 1, firm 2 and firm 3 as follows:

$$\pi_1 = (p - (1 + g_1)c)q_1 \quad (12)$$

$$\pi_2 = (p - (1 + g_2)c)q_2 \quad (13)$$

$$\pi_3 = (p - c_3)q_3 \quad (14)$$

Strategic interaction is modeled as a Stackelberg leader–follower game. In the first stage, the two heterogeneous incumbents simultaneously choose outputs as leaders. In the second stage, the entrant observes incumbents' output choices and selects its optimal output as a follower. Because incumbents differ in marginal costs, their optimal responses to entry are inherently asymmetric, even though products and demand conditions are identical.

In stage 2, given the outputs of the incumbents, the entrant firm chooses its output to maximize its own profit. From the first order condition of firm 3, we have

$$q_3 = \frac{1}{2}(a - c_3 - q_1 - q_2). \quad (15)$$

In stage 1, firms 1 and 2 choose their outputs anticipating the entrant's reaction to maximize their profits. Substituting (15) into (12) and (13), and differentiating π_1 and π_2 with respect to q_1 and q_2 , from the first order conditions, we obtain the equilibrium outputs of the two heterogeneous incumbents, respectively,

$$q_1^E = \frac{1}{3}(a + c_3 - 4c(1 + g_1) + 2c(1 + g_2)) > 0, \text{ if } g_1 < \frac{a - 2c + c_3}{2c} \quad (16)$$

$$q_2^E = \frac{1}{3}(a + c_3 + 2c(1 + g_1) - 4c(1 + g_2)) > 0, \text{ if } g_2 < \frac{a - 2c + c_3}{2c} \quad (17)$$

Since firm 2 has a higher marginal cost distortion, condition (17) automatically implies that condition (16) is satisfied. Hence, the equilibrium output of the efficient incumbent remains positive.

Substituting (16)-(17) into (15), we obtain the output of firm 3 in equilibrium as

$$q_3^E = \frac{1}{6}(a + 2c(1 + g_1) + 2c(1 + g_2) - 5c_3) > 0, \quad (18)$$

$$\text{if } c_3 < \bar{c} < \frac{1}{5}(a + 2c_1(1 + g_1) + 2c_2(1 + g_2))$$

To ensure that all equilibrium quantities are positive, the following conditions must hold: (16), (17), and (18). Adding (16)-(18), we obtain the total industry output

$$Q^E = q_1^E + q_2^E + q_3^E = \frac{1}{6}(5a - c_3 - 2c(1 + g_1) - 2c(1 + g_2)) \quad (19)$$

Substituting (16)-(18) into (11), we get the equilibrium price

$$p^E = \frac{1}{6}(a + c_3 + 2c(1 + g_1) + 2c(1 + g_2)) > 0 \quad (20)$$

We immediately obtain the equilibrium profits of both incumbent firms and the entrant firm as follows

$$\pi_1^E = \frac{1}{18}(a + c_3 - 4c(1 + g_1) + 2c(1 + g_2))^2 \quad (21)$$

$$\pi_2^E = \frac{1}{18}(a + c_3 + 2c(1 + g_1) - 4c(1 + g_2))^2 \quad (22)$$

$$\pi_3^E = \frac{1}{36}(a - 5c_3 + 2c(1 + g_1) + 2c(1 + g_2))^2 \quad (23)$$

Comparing the total industry output between no entry and entry cases, we get

$$Q^{NE} - Q^E = -\frac{1}{6}(a - c_3) < 0 \quad (24)$$

We have Proposition 1.

Proposition 1: *In equilibrium, the total market output with entry is higher than without entry.*

Proposition 1 reflects a standard Stackelberg mechanism, but it is useful to interpret the result in the presence of heterogeneous incumbents. When entry occurs, the incumbent firms act as Stackelberg leaders and internalize the entrant's best-response behavior. Anticipating that the follower optimally adjusts its output in response to their production decisions, the leaders face a flatter residual demand curve, which reduces the marginal incentive to restrict output.

As a result, both incumbents expand output relative to the no-entry Cournot benchmark. In addition, the entrant itself produces a positive quantity whenever its marginal cost is sufficiently low. The combination of incumbents' strategic output expansion and the entrant's own production therefore leads to a higher level of total market output under entry.

Importantly, this increase in total output does not rely on incumbent heterogeneity. Cost asymmetry among incumbents does not affect the qualitative output

result in Proposition 1; instead, heterogeneity becomes crucial when considering the distributional and profit effects of entry, which are analyzed next.

Cost heterogeneity among incumbents implies that entry does not affect leaders symmetrically. Instead, entry reshapes strategic interaction by inducing asymmetric output adjustments, which play a central role in determining the profit consequences of entry.

We now turn to the profit effects of entry. Comparing the profits of firms 1 and 2 between no entry and entry case, we have the following Proposition 2.

Proposition 2:

(i) *The profit of firm 1 (firm 2) with entry is higher (lower) than the case without entry if $c_3 \in (\hat{c}, \bar{c})$;*

(ii) *The profit of both firm 1 and firm 2 with entry are lower than the case without entry if $c_3 \in (\underline{c}, \hat{c})$.*

Proof:

We get

$$\pi_1^{NE} - \pi_1^E = \frac{1}{18} \left\{ 2 \left[a - 2c(1+g_1) + c(1+g_2) \right]^2 - \left[a + c_3 - 4c(1+g_1) + 2c(1+g_2) \right]^2 \right\}, \quad (25)$$

$$\pi_2^{NE} - \pi_2^E = \frac{1}{18} \left\{ 2 \left[a - 2c(1+g_2) + c(1+g_1) \right]^2 - \left[a + c_3 - 4c(1+g_2) + 2c(1+g_1) \right]^2 \right\}. \quad (26)$$

We have $\pi_1^{NE} - \pi_1^E < 0$, if

$$c_3 > \hat{c} \equiv (\sqrt{2} - 1)a + (2 - \sqrt{2})c(1 + 2g_1 - g_2). \quad (27)$$

Similarly, we have $\pi_2^{NE} - \pi_2^E < 0$, if

$$c_3 > \tilde{c} \equiv (\sqrt{2} - 1)a + (2 - \sqrt{2})c(1 - g_1 + 2g_2). \quad (28)$$

Because firm 2 is more inefficient than firm 1, $g_1 < g_2$, we obtain $\hat{c} < \tilde{c}$. Hence, condition (27) necessarily holds whenever condition (28) is satisfied. However, conditions (18) and (28) cannot hold simultaneously.

Unlike Proposition 1, the profit implications of entry crucially depend on cost heterogeneity among incumbents. Entry generally intensifies competition and exerts downward pressure on prices, which tends to reduce incumbents' profits. However, when incumbents differ in marginal costs, entry induces asymmetric strategic responses that can mitigate or even reverse this standard negative effect.

Because outputs are strategic substitutes, a point that is standard but crucial in this setting, the relatively inefficient incumbent responds to entry by contracting output more aggressively. This contraction relaxes competitive pressure in the market and creates room for the relatively efficient incumbent to expand production. As a result, entry redistributes market power away from the inefficient incumbent and toward the efficient one. When the entrant's marginal cost is intermediate, this heterogeneity-induced reallocation effect dominates the negative

price effect of entry, allowing the efficient incumbent's profit to increase.

By contrast, if the entrant is either too efficient or too inefficient, this moderating channel disappears. A highly efficient entrant intensifies price competition and compresses incumbents' margins, while a highly inefficient entrant produces too little to meaningfully alter incumbents' strategic interaction. In both cases, entry reduces the profits of all incumbents.

Hence, profit-raising entry should be understood as a heterogeneity-driven and asymmetric phenomenon. Entry acts as a selection device among heterogeneous incumbents, benefiting the relatively efficient firm while disciplining the less efficient one.

Assuming $g_1 = g_2 = g$, we obtain threshold conditions determining when entry increases both incumbents' profits. We then have $\pi_1^{NE} - \pi_1^E < 0$ and $\pi_2^{NE} - \pi_2^E < 0$, if

$$a(\sqrt{2}-1) + (2-\sqrt{2})c(1+g) < c_3 \quad (29)$$

When incumbents are symmetric ($g_1 = g_2$), conditions (18) and (29) cannot hold simultaneously. Hence, the heterogeneity-driven selection mechanism disappears and entry uniformly reduces incumbents' profits.

Corollary 1 (Symmetric incumbents).

If incumbents are symmetric, entry intensifies price competition and therefore unambiguously reduces the profits of both incumbents.

Our result demonstrates the robustness of Mukherjee and Zhao (2017). Even when the more efficient incumbent among the two incumbents does not have zero marginal cost, the main conclusion remains valid. By contrast, when incumbents are symmetric in costs, entry uniformly reduces incumbents' profits.

3. Concluding Remarks

This paper revisits the profit-raising entry phenomenon from the perspective of heterogeneous incumbent firms. In a homogeneous-product Stackelberg market with two incumbent leaders and a follower entrant, we show that incumbent heterogeneity in marginal costs fundamentally reshapes the competitive consequences of entry. Once incumbents are asymmetric, entry no longer has a uniform effect on all firms; instead, it redistributes profits across incumbents according to their relative efficiency.

Our analysis delivers three main insights. First, while entry robustly increases total market output through a standard Stackelberg mechanism, this aggregate effect is independent of incumbent heterogeneity. Second, the profit effects of entry are inherently asymmetric when incumbents differ in marginal costs. Entry induces unequal output adjustments: the relatively inefficient incumbent contracts output more aggressively, which relaxes competitive pressure and creates scope for the efficient incumbent to expand production. Third, profit-raising entry arises only when this heterogeneity-induced reallocation effect dominates the standard negative price effect, which occurs for an intermediate range of entrant efficiency.

These results imply that profit-raising entry should not be viewed as a paradoxical outcome of entry per se, but rather as a heterogeneity-driven selection mechanism. Entry acts to reallocate market power away from inefficient incumbents and toward more efficient ones, even as overall competition intensifies and total output rises. In the absence of incumbent heterogeneity, this selection channel vanishes, and entry uniformly reduces incumbents' profits, rendering the symmetric case a benchmark rather than a source of robust profit-raising effects.

From a broader perspective, the findings carry implications for competition policy and market design. Evaluations of entry based solely on aggregate welfare or average incumbent profits may be misleading in industries characterized by heterogeneous firms. Entry may simultaneously enhance market efficiency and strengthen the position of dominant, efficient incumbents, while disciplining less efficient ones. Recognizing this redistributive dimension is essential for understanding the true competitive impact of entry.

Future research may extend the analysis to dynamic settings, alternative forms of heterogeneity, or endogenous sources of cost asymmetry. Such extensions could further clarify how entry interacts with firm heterogeneity to shape market structure and long-run industry performance.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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