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Abstract

This study investigates the equilibrium and welfare properties of free entry under common ownership. We formulate a model in which incumbents under common ownership choose whether to enter a new market. We find that an increase in common ownership reduces entries, which may or may not improve welfare. Welfare has an inverted-U shaped relationship with the degree of common ownership. However, if firms do not have common ownership before the entry, after entry common ownership harms welfare.

JEL classification L13, L22

Keywords Overlapping ownership; Free entry, Insufficient entry, Excessive entry, Circular markets

Highlights

A model in which firms have common ownership before their market entry is examined.

Common ownership reduces entries, which may or may not improve welfare.

The optimal degree of common ownership is strictly positive.

Common ownership is harmful if firms have common ownership only after their entry.

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1 Introduction

In practice the same set of institutional investors often own many listed firms ((Azar et al., 2019). Partial ownership by common owners in the same industries may internalize industry-wide externalities and improve welfare.[1] However, common ownership reduces firms' incentives to compete in product markets and may be harmful for welfare (Azar et al., 2019). Common ownership has become a central issue in recent debates on antitrust policies because the degree of common ownership grew substantially in recent years, and some empirical studies show that it has a substantial effect on the strategic behavior of firms held by institutional shareholders.[2]

In some markets, common ownership also affects firms' entry decisions. For example, Newham et al. (2018) show that an increase in common ownership decreases the likelihood of the entry of generic medications in pharmaceutical markets. However, the body of theoretical literature on welfare and the policy implications of common ownership in free-entry markets is quite small.

In this note, we consider the welfare impact of common ownership in free entry markets. To consider the welfare impacts of common ownership, we must first understand whether the presence of common ownership mitigates or exacerbates excessive entry in free entry markets (Mankiw and Whinston, 1986). Common ownership tends to make firms less aggressive and thus increases firms' profits, which increases incentives for entry. Common ownership may, however, make firms internalize the business-stealing effects at the time of entry, which then reduces the incentives for entry. When the latter dominates the former, the presence of common ownership may mitigate excessive entry and thus improve welfare. We formulate a model in which incumbent firms under common ownership choose whether they enter a new market. Using a circular-city model of Salop (1979), we investigate how the degree of common ownership affects the equilibrium and welfare properties in free entry markets. We find that an increase in common ownership reduces entries, which may or may not improve welfare. This means that both excessive and insufficient entries can emerge. Moreover, we find an inverted-U shape relationship between the degree of common ownership and welfare.

However, if no common ownership exists before the entry, and firms are under common ownership only after the entry, an increase of common ownership increases entry, which is harmful for welfare, because the number of entering firms is always excessive in this case.

[1] López and Vives (2019) point out that common ownership internalizes a spillover effect of R&D and may accelerate welfare-improving R&D.

[2] See Backus et al. (2019) for an example of a rise in common ownership in the US, and Schmalz (2018) for a review of empirical studies that suggests links between common ownership and firms' behaviors. For antitrust concerns, see Elhauge (2016).

2 Model

There are $N \in \mathbb{N}$ potential entrants in a market. Among the potential entrants, n firms enter another market and compete in prices.[3] Following the recent theoretical literature on common ownership (e.g., López and Vives, 2019), we assume that each firm i has the following post-entry objective function

$$\psi_i = \pi_i(p) + \lambda \sum_{j \neq i} \pi_j(p), \tag{1}$$

where

$$\pi_i(p) := d_i(p)(p_i - c) - F \tag{2}$$

is the product-market profit of firm i given a price profile $p := (p_j)_{j=1,\dots,N}$, c is the constant marginal cost of production, F is the entry cost, and λ is the degree of common ownership. To focus on the partial ownership by common investors, we assume $\lambda < 1/2$.

Assuming a symmetric demand system and symmetric equilibrium in a product market, we obtain the equilibrium price $p^S(n, \lambda)$ and profit $\pi^S(n, \lambda)$ as functions of n and λ, where the superscript S denotes the short-run equilibrium (given the number of firms). We assume that π^S is decreasing in n.

Each firm enters the market whenever ψ_i increases as a result of its entry. Then, the number of firms in free-entry equilibrium is given by

$$\psi^E(n, \lambda) = \psi^O(n - 1, \lambda), \tag{3}$$

where

$$\psi^E(n, \lambda) := \pi^S(n, \lambda) + \lambda(n - 1)\pi^S(n, \lambda) \tag{4}$$

and

$$\psi^O(n, \lambda) := \lambda n \pi^S(n, \lambda) \tag{5}$$

are the value of objective functions when a firm enters the market and when it does not. Let $n^*(\lambda)$ be the solution to equation (3). By arranging equation (3), we have

$$\pi^S(n^*, \lambda) = \lambda(n^* - 1)\left\{\pi^S(n^* - 1, \lambda) - \pi^S(n^*, \lambda)\right\}. \tag{6}$$

Assuming $n^* > 1$, we obtain $\pi^S(n^*, \lambda) > 0$.

[3] The model describes the following situation. There are incumbents under common ownership. A new market emerges and incumbents are potential new entrants in this new market. For example, pharmaceutical companies under common ownership consider whether to enter a new immune checkpoint drug market with R&D expenditure. Another example is the Japanese gas market. This market was liberalized in 2016, and thereafter, electric and oil companies under common ownership entered the new market.

3 Circular Market

In this section, we present the welfare analysis of the equilibrium number of firms using a circular-city model of Salop (1979). Consumers are located uniformly on a circle with a perimeter equal to 1 and density is unitary around the circle. Firms are located around the circle. Consumers buy one unit of the good at the lowest cost (the price of the product + the transportation cost). Transport cost is proportional to the distance and the unit transport cost is $t > 0$. We assume that the willingness to pay for the product is so high that all consumers buy the products.

First, we consider the price competition stage. Suppose that firm i chooses price p_i and all other firms choose p^S. Each firm has only two real competitors, namely the two on either side of it.[4] A consumer located at the distance of $x \in (0, 1/n)$ from firm i is indifferent about purchasing from firm i or purchasing from its closest neighbor if $p_i + tx = p^S + t(1/n - x)$. Each firm i faces a demand of

$$d_i(p_i, p^S) = 2x = \frac{1}{n} - \frac{p_i - p^S}{t}.$$

Firm i maximizes $(p_i - c)d_i + 2\lambda(p^S - c)(1/n - d_i/2)$. Note that firm i's pricing affects only the two neighboring firms' profits. The first-order condition is

$$d_i - \frac{p_i - c}{t} + \lambda\frac{p^S - c}{t} = 0.$$

Substituting $p_i = p^S$, we obtain

$$p^S(n, \lambda) = c + \frac{t}{n(1-\lambda)}.$$

Given the number of firms n, the equilibrium profit is

$$\pi^S(n, \lambda) = (p^S(n, \lambda) - c)d_i(p^S(n, \lambda), p^S(n, \lambda)) - F = \frac{1}{n^2}\frac{t}{1-\lambda} - F.$$

We obtain the number of firms that maximizes welfare by minimizing of the following sum of transport and entry costs:

$$K(n) := 2n\int_0^{1/2n} tx dx + nF = \frac{t}{4n} + nF,$$

[4] If $n = 2$, the the firm competes with the same rival at each side, and the following analysis applies to this case as well. However, the following analysis does not apply when $n = 1$ because the monopolist has no competitor and ontains profit greater than $\pi^S(1)$.

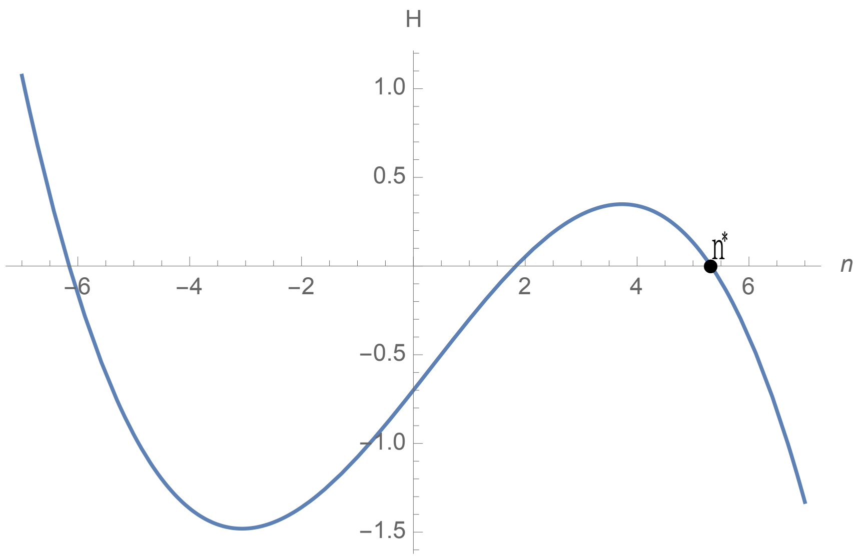

Figure 1: The stable equilibrium

which leads to the socially optimal number of firms

$$n^O = \frac{1}{2}\sqrt{\frac{t}{F}}.$$

We assume that $\sqrt{t/F}/2 > 1$ so that $n^O > 1$.

By arranging the free-entry condition (3), we obtain the following condition:[5]

$$G(n, \lambda, t, F) := \frac{t}{1-\lambda}\frac{1}{n^2}\left\{1 - \lambda\frac{2n-1}{n-1}\right\} - F = 0.$$

or equivalently

$$H(n, \lambda, F/t) := n - 1 - \lambda(2n-1) - \frac{(1-\lambda)F}{t}n^2(n-1) = 0.$$

H is a cubic function of n and the equation $H = 0$ has at most three solutions. Figure 1 illustrates the shape of $H(n, \lambda, F/t)$.[6]

[5] $H >\ (=, <)\ 0$ if $\psi^E(n, \lambda) >\ (=, <)\ \psi^O(n, \lambda)$.

[6] We set $\lambda = 0.3, F = 0.05$, and $t = 3$.

One of three possible solutions is negative, and thus it is not equilibrium. Two are positive whenever they exist and the largest solution is the unique stable equilibrium. The positive solutions exist and the greater solution exceeds one unless F/t is too large.[7] We denote the unique stable equilibrium number of firms as $n^*(\lambda, F/t)$.[8] We denote the unique stable equilibrium number of firms as $n^*(\lambda, F/t)$.

Calculations show that $\partial H/\partial \lambda < 0$ and $\partial H/\partial (F/t) > 0$ at $n = n^*(\lambda, F/t)$. These results implies the following proposition.

Proposition 1 *$n^*(\lambda, F/t)$ decreases with λ and F/t.*
Proof See the Appendix.

Proposition 1 is consistent with Newham et al.'s (2018) findings that the presence of common ownership reduce the incentive for entry in pharmaceutical markets. Common ownership internalizes the business-stealing effects at the entry stage, which reduces the incentives for entry.

Evaluating $G(n, \lambda)$ at $n = n^O$, we can check whether $n^* > n^O$ (excess entry) or $n^* < n^O$ (insufficient entry); the latter holds if and only if

$$\Gamma(n^O, \lambda) := G(n^O, \lambda) = \frac{F}{1-\lambda}\left\{3 - \lambda\frac{7n^O - 3}{n^O - 1}\right\} < 0,$$

where we use $n^O = \sqrt{t/F}/2$.

Figure 2 illustrates the range for excess and insufficient entries.[9]

Because $\partial\Gamma/\partial n^O > 0$ and $\partial\Gamma/\partial\lambda < 0$, we obtain that $\Gamma(n^O, \lambda) < 0$ more likely holds when n^O

[7] The local maximum of H is given by the first-order condition

$$3n^2 - 2n - \frac{t}{(1-\lambda)F}(1 - 2\lambda) = 0.$$

Thus, the local maximum of H is attained at

$$\hat{n}(\lambda, t, F) = \frac{1 + \sqrt{1 + 3\frac{t}{(1-\lambda)F}(1 - 2\lambda)}}{3}.$$

Because $\lambda < 1/2$, we find that $\hat{n}$ is decreasing in F/t, and $F/t \to 0$, then $\hat{n} \to \infty$. Therefore, there exists $\hat{\beta}$ such that $\hat{n} > 1$ if and only if $F/t < \hat{\beta}$.

By the envelope theorem, we have

$$\frac{dH(\hat{n}(\lambda, F/t), \lambda, F/t)}{d(F/t)} = -(1-\lambda)\hat{n}^2(\hat{n} - 1) < 0,$$

as long as $\hat{n} > 1$. $F/t \to 0$, then $\hat{n} \to \infty$ and $\hat{n} \to \infty$, then $dH/d(F/t) \to -\infty$. Therefore, together with the fact that $H(1, \lambda) < 0$, there exists $\hat{\alpha} < \hat{\beta}$ such that $\hat{n} > 1$ and $H(\hat{n}, \lambda, F/t) > 0$ for $F/t < \hat{\alpha}$. Finally, if $H(\hat{n}, \lambda, F/t) > 0$, there are two positive solutions to $H(n, \lambda) = 0$. In summary, $n^* > 1$ exists if F/t is not too large.

[8] If $H(n, \lambda, F/t)$ has no positive solution, then the equilibrium number of the firms is one (if the monopolist obtains positive profits) or zero (even the monopolist cannot obtain positive profits). If $\lambda \geq 1/2$, then $H(n, \lambda, F/t)$ has no positive solution, and thus, either the monopoly or no entry emerges in equilibrium.

[9] We set $t/F = 1,000$.

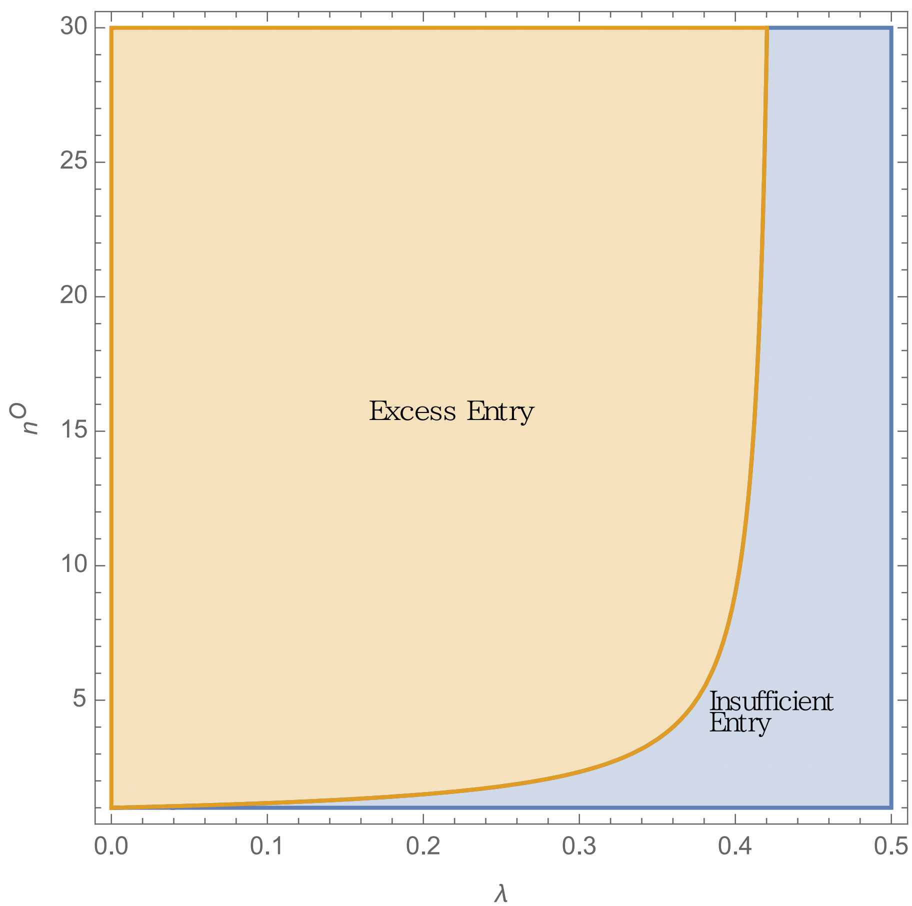

Figure 2: Range for insufficient entry

is smaller and λ is greater. Thus, we obtain the following proposition.

Proposition 2 *(i) The equilibrium welfare decreases with λ if and only if $n^*(\lambda, F/t) < n^O$ (entry is insufficient). (ii) There exists $\bar{\lambda} \in (0, 3/7)$ such that $n^*(\lambda, F/t) < n^O$ (entry is insufficient) if and only if $\lambda > \bar{\lambda}$.*
Proof See the Appendix.

When $\lambda = 0$, the entry is excessive for welfare due to the business-stealing effects (Salop, 1979; Mankiw and Whinston, 1986). Until λ hits the critical value $\bar{\lambda}$, entry is excessive. Because an increase in common ownership reduces the equilibrium entry, it improves welfare. However, once λ exceeds $\bar{\lambda}$, insufficient entry emerges because the business-stealing effects are internalized, and further increases in common ownership reduce welfare. Thus, welfare has an inverted-U shape relationship with the degree of common ownership. Moreover, our result shows that there exists a strictly positive socially optimal degree of common ownership.

4 The Case Without Common Ownership Before Entry

We now discuss an alternative model in which entrants do not have common ownership before the entry. In this case, $\psi^O(n, \lambda) = 0$, and thus, the number of firms in free-entry equilibrium is given by

$$\pi^S(n, \lambda) = 0. \tag{7}$$

Let n^{**} be the solution to equation (7). Because $\pi^S(n^*, \lambda) > 0$ and $\pi^S(n^{**}, \lambda) = 0$, we obtain $n^* < n^{**}$.

Using the circular-market model, we obtain the following equilibrium number of firms n^{**};

$$n^{**}(\lambda, F/t) = \sqrt{\frac{t}{(1-\lambda)F}} > \frac{1}{2}\sqrt{\frac{t}{F}} = n^O. \tag{8}$$

Thus, for any $\lambda \in [0, 1)$, $n^{**}(\lambda, F/t)$ is excessive for welfare. Because $n^{**}(\lambda, F/t)$ is increasing in λ, common ownership exacerbates the excessive entry. Therefore, an increase in λ is always harmful for welfare.

Figure 3 illustrates the relationship among n^O, n^*, and n^{**} (in the numerical example, $t/F = 2,000$). In general, $n^* = n^{**}$ if $\lambda = 0$, and $n^* < n^{**}$ otherwise. In the circular-market model, $n^{**} > n^O$ for any λ and $n^* < n^O$ ($n^* > n^O$) when λ is large (small).

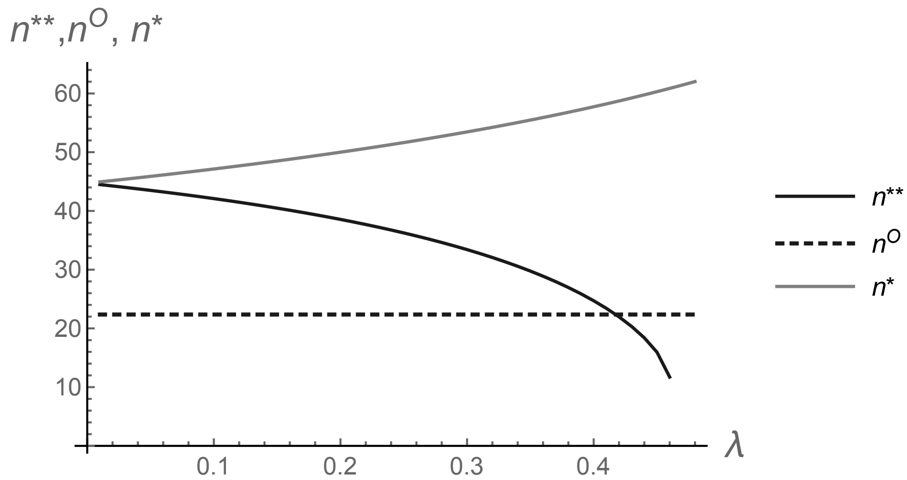

Figure 3: Comparison of n^O, n^*, and n^{**}

5 Concluding remarks

In this note, using a circular-market model, we show that whether or not firms have common ownership before entry is crucial. If firms have common ownership before entry, common ownership reduces the number of firms. This may or may not improve welfare because the equilibrium number of firms may or may not be insufficient. Meanwhile, if firms do not have common ownership before entry, common ownership increases the number of firms, which is harmful for welfare.

In this note we use a standard circular-market model with inelastic demand. Incorporating elastic demand systems makes the analysis intractable and we failed to obtain clear-cut result.[10] This extension would enrich the welfare implications of common ownership in free entry markets and remains for future research.

[10]The number of firms can be insufficient even without common ownership if the demand is elastic. See Gu and Wenzel (2009).

Appendix

Proof of Proposition 1

The implicit function theorem implies that

$$\frac{dn^*}{d\lambda} = -\frac{\partial G/\partial \lambda}{\partial G/\partial n}\Bigg|_{n=n^*(\lambda)}, \quad \text{and } \frac{dn^*}{d(F/t)} = -\frac{\partial G/\partial (F/t)}{\partial G/\partial n}\Bigg|_{n=n^*(\lambda)}. \tag{9}$$

Because

$$\frac{\partial G}{\partial \lambda} = -\frac{t}{(1-\lambda)^2 n(n-1)} < 0,$$

$\mathrm{sign}(\partial G/\partial(F/t)) = \mathrm{sign}(\partial H/\partial(F/t)) < 0$, and $\mathrm{sign}(\partial G/\partial n) = \mathrm{sign}(\partial H/\partial n) < 0$ at $n = n^*(\lambda)$ because n^* is the largest solution to a cubic equation with negative coefficient on n^3, we have $dn^*/d\lambda < 0$ and $dn^*/d(F/t) < 0$. This implies Proposition 1. Q.E.D.

Proof of Proposition 2

Proposition 2-(i) simply holds due to the concavity of welfare function. $\Gamma(n^O, \lambda) < 0$ if and only if

$$\lambda > \frac{3(n^O - 1)}{7n^O - 3} =: \bar{\lambda}.$$

Let $\gamma(n^O) := 3(n^O - 1)/(7n^O - 3)$. Because $n^O = \sqrt{t/F}/2 > 1$, $\gamma(1) = 0$, $\gamma'(n^O) > 0$, and $\lim_{n^O \to \infty} \gamma(n^O) = 3/7$, we obtain $\bar{\lambda} = \gamma(n^O) \in (0, 3/7)$ for any $n^O > 1$. Q.E.D.

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