Weak entrants are welcome

Ashiya, Masahiro

(Citation)
International Journal of Industrial Organization,18(6):975-984

(Issue Date)
2000-08

(Resource Type)
journal article

(Version)
Accepted Manuscript

(URL)
https://hdl.handle.net/20.500.14094/90001227

Weak Entrants Are Welcome

Masahiro ASHIYA

The Institute of Social and Economic Research, Osaka University
6-1 Mihogaoka, Ibaraki, Osaka, 567-0047, Japan
e-mail: ashiya@iser.osaka-u.ac.jp

Abstract

This paper investigates the decision problem of an incumbent firm confronted by both a weak and strong entrant in a differentiated market. Suppose that the incumbent can deter entry of the weak firm, but cannot deter entry of the strong firm by itself. Then the incumbent may allow entry of the weak firm and use it to alter the strong firm's entry decision. The present paper formalizes this idea, and it sheds new light on the fact that domestic firms are sometimes able to block strong foreign firms after trade liberalization. The idea also explains why a dominant firm lets fringe firms be in the market.

Keywords: Entry deterrence; Product differentiation; Commitment; Protection; Dominant firm.
JEL Classification Codes: D43, F13, L13.

1. Introduction

This paper demonstrates that an incumbent firm may intentionally allow entry of a weak firm to stop entry of a strong firm. In other words, an incumbent firm that is confronted by a strong entrant may *welcome* a weak entrant. Consider the incumbent firm confronted by both a weak and strong entrant in a differentiated market. Suppose the incumbent can deter entry of the weak firm, but cannot commit to deter entry of the strong firm by itself. Then, the incumbent has two options if the weak firm moves before the strong firm: to prevent entry of the weak firm, or to allow it. The former option leads to entry of the strong firm. On the other hand, the latter option may make it possible to block entry of the strong firm, since the market is now crowded. This article clarifies the conditions in which the incumbent will choose the latter option.

This argument can explain many interesting phenomena. Let us imagine a developing country. The incumbent domestic firms are too weak to stop entry of strong foreign firms by themselves. What if the government temporarily restricts trade? Then domestic entrants can move before foreign entrants, and the incumbents will allow entry of weak domestic firms to fill up the market. This will block the entry of foreign firms after trade liberalization since the entrants cannot earn enough profit. [1]

These arguments give rise to one question: why does the incumbent need a weak entrant to deter the entry of a strong firm? Why can it not block the entry of a strong firm by making additional plants itself instead of depending on the weak firm? Schmalensee (1978) suggests that an incumbent firm can prevent entry by filling up the product spectrum. Judd (1985), however, shows this strategy is not credible if an exit cost is small. The reason is the incumbent has an ex post incentive to withdraw some products in response to entry by another firm. To illustrate this point, Judd considers a simple example with two close substitutes, say tea and coffee. All firms can produce them at the same constant marginal cost after they bear fixed costs, and they compete on price. Suppose that the incumbent produces both goods, and that entry occurs in coffee. If the incumbent continues to produce coffee, it will earn zero gross profit from coffee, and the price war in coffee reduces demand for tea. In contrast, if the exit cost is not high then the incumbent can do better by stopping production of coffee, since this raises the

price of coffee and profit from tea. Thus it will leave the coffee market and consequently entry by a new firm will occur.

The above argument simplifies the real world on two important points; the incumbent may not be the same type of firm as the entrant, and there are many substitutes such as juice and cocoa in reality. An incumbent is usually mature and has a wide variety of products, while a newcomer has a limited variety of products. Therefore the incumbent may be able to deter entry by clustering its products. Suppose the incumbent can choose any variety of products and the entrant can choose one kind only. At first, the incumbent may choose many products, all of which are close substitutes. If entry occurs in one of them, the incumbent withdraws the directly competing product as Judd suggests but may keep the other products. Then, surrounded by many substitutes, the entrant may not be able to earn enough profit. Consequently it may not enter the market.

We shall examine this possibility in the standard Hotelling model with quadratic transportation costs. Martinez-Giralt and Neven (1987) shows that quadratic transportation costs make competition between similar products so severe that a firm prefers to have one product rather than two. The same logic shows that, even if an incumbent firm can fill up the product spectrum, it has an ex post incentive to withdraw not only the directly competing product but also other products near to the strong firm. Therefore an incumbent firm cannot deter entry of a strong firm without help of a weak entrant.

A brief review of the previous literature is in order now. A considerable number of studies have been made of entry deterrence over the past few decades, and some articles consider the idea of sequential entry. Among them, Prescott and Visscher (1977), Brander and Eaton (1984), Bonanno (1987), and Neven (1987) investigate how the possibility of further entry affects each firm's optimal product choice in a differentiated market. Martinez-Giralt and Neven (1988) show that both firms choose only one good if two firms simultaneously choose product varieties. Hadfield (1991) considers spatial preemption and argues that an incumbent manufacturer can escape the commitment problem by delegating pricing authority to independent franchisees. [2] Gilbert and Vives (1986) show that oligopoly firms facing a potential entrant never under-invest in entry

deterrence if they can commit to the quantity they produce. Vives (1988) shows that the incumbent(s) will either allow all the potential entrants in or keep them out when there is a large pool of potential entrants. Other articles take account of the entrant's strength explicitly. Gelman and Salop (1983) argue that an entrant can elicit a less aggressive reaction from an incumbent by limiting its own capacity. Gallini (1984), and Crampes and Hollander (1993) consider R&D competition. Gallini (1984) shows that an incumbent may license its technology to reduce an entrant's incentive to develop better technology. Crampes and Hollander (1993) suggest that an incumbent may raise an entrant's profit by selling at a high price instead of licensing.

Nevertheless, many markets involve a variety of potential entrants. In contrast to the existing literature, where only one type of entrant is assumed to exist, in reality different types of entrants coexist; some are strong, and others are weak. Therefore, for a more realistic analysis it is necessary to integrate the heterogeneity of entrants into the model. The present paper addresses this issue.

The paper is organized as follows. Section 2 describes the model. Section 3 explains why an incumbent does not proliferate its brands. Section 4 identifies the conditions for the incumbent to permit entry of the weak firm. Section 5 discusses some further issues, and Section 6 concludes this paper.

2. The model

We use a variant of Hotelling's (1929) model with three players: *A* denotes an incumbent, *S* denotes a strong entrant, and *W* denotes a weak entrant. [3] The potential product range is represented by the unit-segment $[0,1]$. A location on this segment corresponds to the attribute of the product.

The timing of each firm's action, which is common knowledge, is as follows. At date 1, the incumbent *A* chooses a finite set of products $X_A = \{x_A^1, \cdots, x_A^n\} \subset [0,1]$. We assume $x_A^1 < \cdots < x_A^n \le 1 - x_A^1$ (and consequently $0 \le x_A^1 \le 0.5$) without loss of generality. At date 2, *W* observes X_A and chooses X_W. At date 3, *S* observes X_A and X_W, and chooses X_S. We suppose *W* and *S* are inexperienced firms that can choose one product at most. [4] Each firm sinks a fixed cost *F* per product if it enters the

market. If firm *i* does not enter the market, $X_i = \phi$.

At date 4, each firm observes the product choice (X_A, X_S, X_W), and simultaneously selects a set of products to withdraw. [5] Each firm can withdraw its product(s) with no additional cost, but cannot recover the fixed cost. This assumption, which will play a central role in the analysis, is reasonable since a firm can get out of the market at will in reality. [6] Let $\hat{X}_i$ be the set of products firm *i* does not withdraw ($\hat{X}_i \subseteq X_i$). If $\hat{X}_i = \{x_i\}$, we write $\hat{X}_i = x_i$.

At date 5, each firm observes $(\hat{X}_A, \hat{X}_S, \hat{X}_W)$, and simultaneously selects prices of its products. Each pays variable costs and earns sales revenue. Each firm makes goods at constant marginal cost C_i. Let us assume $C_W > C_S = C_A$. [7]

Consumers are uniformly distributed with density 1 on the segment $[0,1]$, and their locations correspond to their favorite products. Each of them always purchases one unit of the good for which her indirect utility is maximized; the utility of a consumer in $y \in [0,1]$ who bought x_i^j at price P_i^j is

$$U(x_i^j; y) = a - t(x_i^j - y)^2 - P_i^j \quad (t > 0)$$

where $t(x_i^j - y)^2$ is the disutility of distance in the attribute space. [8]

The equilibrium concept we adopt is a weak refinement of subgame-perfect Nash equilibrium that assumes no weakly dominated strategy is played in equilibrium. [9] Let $\Pi_i(\hat{X}_A, \hat{X}_S, \hat{X}_W)$ be the equilibrium profit of firm *i* gross of the fixed costs. Entry occurs when Π_i is equal to or larger than the fixed costs.

3. Why does the incumbent need the weak firm?

Suppose an incumbent cannot deter entry of the strong firm by choosing one product. Then, no matter how many products it chooses, the incumbent cannot deter entry of the strong firm without help of the weak firm. If an incumbent chooses more than one product (instead of letting the weak firm in), it faces the commitment problem: it cannot commit to keep its products after entry occurs since withdrawal of competing products relaxes price competition and raises profits from the remaining products. Hence choosing

two or more products is useless for entry deterrence.

Bonanno (1987) calculates the equilibrium prices of two firms when one firm produces two goods and another firm produces one good. Martinez-Giralt and Neven (1988) use this result and shows that, if two firms choose their product varieties simultaneously, both firm choose one product only and locate at opposite ends in order to mitigate price competition. Ashiya (1998) extends their results to the *n*-goods case, and proves the next lemma (Proofs of all propositions in this paper are available both on the editorial web page and on request from the author). [10]

Lemma 1.

Suppose *A* chooses n (≥ 2) products, *W* does not enter the market, and *S* chooses $x_S = 1$. Then *A* withdraws $n-1$ products and keeps the farthest product from x_S, but *S* does not withdraw its product in the unique equilibrium of this subgame.

Keeping the nearest product to the other firm has two opposing effects on *A*'s profit; it enlarges its market share, but it intensifies competition. The assumption of quadratic transportation costs makes the latter negative effect so strong that the incumbent withdraws products nearer to the strong firm.

This is also true of the entrant: choosing the product nearer to the incumbent reduces its profits. Hence *S* chooses $x_S = 1$ if it enters, and Proposition 1 follows.

Proposition 1.

Suppose that *W* does not enter the market and that *A* cannot deter entry of *S* by itself when it chooses one product. Then *A* cannot deter entry of *S* by itself even if it can choose any number of products.

4. When to allow entry of the weak firm?

We shall confine our attention to the case in which the incumbent can stop entry of the weak firm but cannot stop entry of the strong firm by itself (Other cases are trivial). Namely, let us assume

$$\Pi_S(0.5,1,\phi) \geq F \qquad (1)$$

and $\Pi_W(0.5,\phi,1) < F \qquad (2)$

(Note that choosing $x_A = 0.5$ minimizes the remaining space and that an entrant chooses the market end to avoid competition). Then Lemma 2 shows the sufficient conditions for the incumbent to permit entry of the weak firm and use it for entry deterrence.

Lemma 2.

Suppose

$$\Pi_S(0,x_S^*,1) < F \quad \text{where} \quad x_S^* \equiv \arg\max \Pi_S(x_A,x_S,x_W), \qquad (3)$$

$$\Pi_W(0,\phi,1) \geq F\,, \qquad (4)$$

and $\Delta \equiv \dfrac{C_W - C_S}{t} \leq 1.$

Then the unique equilibrium outcome is that *A* chooses $x_A = 0$, *W* chooses $x_W = 1$, and *S* does not enter the market.

The outline of proof is as follows. Now that *A* cannot stop entry of *S* without *W* from (1), it is better for *A* to allow entry of *W* and use it for entry deterrence. Then choosing $x_A = 0$ maximizes Π_A from Lemma 1, and *W* chooses $x_W = 1$ to avoid competition ((4) shows the net profit is positive). This blocks entry of *S* because of (3).

Proposition 2 shows that there exists a set of parameters that meets all conditions of Lemma 2.

Proposition 2.

There exists a set of parameters under which the following statements are true;

(a) *A* lets *W* enter to deter entry of *S* in the unique equilibrium.

(b) *A* could not deter entry of *S* if *S* moved before *W*.

(c) *A* would deter entry of *W* if *S* did not exist.

Lemma 2 shows that (a) is true if (1), (2), (3), and (4) are satisfied and $\Delta \leq 1$. (b)

and (c) are true if (1) and (2) hold. Let us consider F that satisfies (1) with equality. Then all of (2), (3), and (4) are satisfied for sufficiently small Δ because

$$\Pi_S(0, x_S^*, 1) < \Pi_S(0.5, 1, \phi) = \Pi_W(0.5, \phi, 1) < \Pi_W(0, \phi, 1)$$

at $\Delta = 0$ and all functions are continuous. This completes the proof of Proposition 2.

If $\Pi_S(0, x_S^*, 1)$ is a bit larger than F, A and W prevent entry of S by narrowing their distance. Ashiya (1998) shows that A moves inward just enough to deter entry of S and that W chooses the market end in the unique equilibrium. The intuition is, provided that A and W must choose closer products, it is better for A to move inward and secure the customers. Ashiya (1998) proves in addition that W does not enter the market when S can enter after it because it cannot earn enough profit. We derive from these results the necessary and sufficient conditions under which A uses W for entry deterrence.

Proposition 3.

The necessary and sufficient conditions for A to stop entry of S by use of W in the unique equilibrium is (1), (2), and the following;

・ A and W can prevent entry of S: $\Pi_S(0.5, x_S^*, 1) < F$.

・ W can enter the market when A moves in enough to deter entry of S: $\Pi_W(x_A^*, \phi, 1) \geq F$

where $x_A^* \equiv \min\{x_A \in [0, 0.5] \mid \Pi_S(x_A, x_S^*(x_A), 1) \leq F\}$.

・ To deter entry of S is better for A than to allow it: $\Pi_A(x_A^*, \phi, 1) \geq \Pi_A(\bar{x}_A, 1, \phi)$

where $\bar{x}_A \equiv \min x_A$ such that $\Pi_S(x_A, x_S^*(x_A, x_W), x_W) \geq F$ for any x_W that satisfies

$$\Pi_W(x_A, \phi, x_W) \geq F.$$

Corollary of Proposition 3.

(a) If A uses W for entry deterrence, it chooses $x_A = x_A^*$ and W chooses $x_W = 1$.

(b) If $\Pi_S(0, x_S^*, 1) > F$, x_A^* is increasing in Δ and decreasing in F.

A does not use W if it is too weak, i.e. C_W is too large. In this case A may provide

technical assistance for *W without charge* in order to lower C_W and use it for entry deterrence.

5. Positive exit costs

Our argument until now has assumed zero exit cost. What will happen if the exit cost, *E*, is positive? Suppose the incumbent clusters its products and entry occurs. Then withdrawing one of them may not mitigate price competition enough to recover the exit cost. Thus the incumbent may be able to keep all products. Ashiya (1998) shows that, for any positive exit cost, there exists a set of parameters where the incumbent can deter entry of the strong firm by choosing two close substitutes. This strategy, however, leaves broad room for an entrant in the market ends. Therefore the incumbent needs a weak entrant to fill it up if the fixed cost is small. Proposition 4 shows that, for moderate exit costs, there exists a set of parameters under which *A* uses *W* to deter entry of *S* in the unique equilibrium.

Proposition 4.

There exists a set of parameters under which

(a) *A* chooses one product and lets *W* enter to deter entry of *S* in the unique equilibrium;

(b) *A* could not deter entry of *S* if *S* moved before *W*;

(c) *A* would deter entry of *W* if *S* did not exist; and

(d) $E > 0.25F$.

The outline of proof is as follows. We show that the conditions of Proposition 4 are satisfied when *a* (consumers' reservation price) and *F* (the fixed cost) are small, while *E* (the exit cost) is moderate. Since *A*'s monopoly profit is increasing in *a*, *A* prefers duopoly with one good to monopoly with four or more goods when *a* is small in comparison with *F*. Namely *A* never chooses more than three varieties in equilibrium when *a* is small. Then the best *A* can do for entry deterrence is to choose three close substitutes. When *E* is moderate, however, *A* cannot cover the whole market with only three products. Hence it needs *W* to deter entry of *S* in the market ends when *F* is small.

Proposition 4 indicates that *A* uses *W* even if the exit cost is as much as a quarter of the fixed cost. This result demonstrates generality of our argument.

6. Conclusions

We have considered a differentiated market where an incumbent firm is confronted by a weak entrant and a strong entrant. If the weak entrant moves before the strong entrant, the incumbent concedes the product space intentionally and permits the weak firm in the market. Then the market is filled up and entry of the strong firm is prevented. The first-mover's advantage is so strong in this model that the fittest, i.e. the strong entrant, may not survive in the market. From the weak firm's point of view, its successful entry is due to the strong firm because the incumbent would prevent the weak firm's entry without the threat of the strong firm. Past literature has not focused on this idea.

We show moreover that the incumbent firm and the weak firm choose closer products and commit themselves to compete fiercely as the threat of entry becomes severe. This idea explains very well one of the notable features of the Japanese market, "tough competition between domestic firms with similar products". When Japan gradually removed import quotas and reduced tariff rates in the 1960's and 1970's, Japan was still a developing country and its domestic firms were weak. Confronted by strong foreign firms, the Japanese domestic firms chose similar products and committed themselves to intense competition. As a result, the Japanese market became unattractive and foreign firms did not enter.

Our results can be applied to a homogeneous market if each firm commits itself to a variable like investment level (in capacity or in R&D) before production. By committing itself to a low investment level, the incumbent can persuade the weak firm to enter the market. Thus it can use the weak firm to prevent entry of the strong firm.

There are many arguments about why a dominant firm does not drive fringe firms out of the market. [11] The result here offers a new explanation of this puzzle: the dominant firm uses weak fringe firms to deter entry of strong potential competitors.

Notes

1. This argument fits well the Japanese car industry around 1960, for example (The incumbents were Toyota and Nissan; the weak domestic entrants were Mitsubishi, Mazda, and Honda; strong foreign entrants were the Big 3).

2. This assumes homogeneous retailers at regular intervals that are eager to join in the franchise. The incumbent deters entry by combining these retailers.

3. We can make similar arguments with two or more incumbent firms by assuming a circular market.

4. To let each entrant choose two or more products does not alter the conclusion; the entrant chooses one product in the unique equilibrium.

5. Judd (1985 p.156 fn. 3) argues that "this is the correct static approximation of a truly dynamic analysis of entry into a growing market. Intuitively, in a continuous-time analysis, no one firm can commit itself to staying since tomorrow will give another chance to exit."

6. An exit cost is the cost arising only because of the act of exit. One example is a printing cost of a new catalogue (from which withdrawn products are deleted). Note that irreversible investment in product-specific capital is a sunk cost and is not an exit cost. We shall consider the case of positive exit costs in Section 5.

7. Our argument can be easily extended to other cases (e.g. $C_A > C_W > C_S$).

8. The marginal disutility of the consumer increases as the product she bought locates farther from her favorite one.

9. Consider the Judd's example in the introduction. Suppose the incumbent chooses tea and coffee, and entry occurs in coffee. Then it is also a subgame-perfect Nash equilibrium after this history that the incumbent keeps both products and the entrant exits from coffee. We need further refinement to exclude this rather unrealistic equilibrium.

10. Ashiya (1999) obtains the same result in a vertically differentiated market.

11. For example, myopic behavior of fringe firms (Berck and Perloff (1988)), demand uncertainty (Appelbaum and Lim (1985)), and the possibility of antitrust action.

Acknowledgement

I am grateful to Michihiro Kandori, Masahiro Okuno-Fujiwara, Toshihiro Matsumura, Takatoshi Tabuchi, Tadashi Sekiguchi, Kanji Muramatsu, anonymous referees, the managing editor, and especially Nobuaki Hori for their helpful comments. Any remaining errors are mine.

References

Ashiya, M., 1998. Weak Entrants Are Welcome. Discussion Paper No. 468, Institute of Social and Economic Research, Osaka University.

Ashiya, M., 1999. Brand Proliferation Is Useless to Deter Entry. Discussion Paper No. 476, Institute of Social and Economic Research, Osaka University.

Appelbaum, E., Lim, C., 1985. Contestable Markets under Uncertainty. RAND Journal of Economics 16, 28-40.

Berck, P., Perloff, J. M., 1988. The Dynamic Annihilation of a Rational Competitive Fringe by a Low-cost Dominant Firm. Journal of Economic Dynamics and Control 12, 659-678.

Bonanno, G., 1987. Location Choice, Product Proliferation and Entry Deterrence. Review of Economic Studies 54, 37-45.

Brander, J. A., Eaton, J., 1984. Product Line Rivalry. American Economic Review 74, 323-34.

Crampes, C., Hollander, A., 1993. Umbrella Pricing to Attract Early Entry. Economica 60, 465-74.

Gallini, N. T., 1984. Deterrence by Market Sharing: A Strategic Incentive for Licensing. American Economic Review 74, 931-41.

Gelman, J. R., Salop, S. C., 1983. Judo Economics: Capital Limitation and Coupon Competition. Bell Journal of Economics 14, 315-25.

Gilbert, R., Vives, X., 1986. Entry Deterrence and the Free Rider Problem. Review of Economic Studies 53, 71-83.

Hadfield, G. K., 1991. Credible Spatial Preemption through Franchising. RAND Journal of Economics 22, 531-43.

Hotelling, H., 1929. Stability in Competition. Economic Journal 39, 41-57.

Judd, K. L., 1985. Credible Spatial Preemption. RAND Journal of Economics 16, 153-66.

Martinez-Giralt, X., Neven, D. J., 1988. Can Price Competition Dominate Market Segmentation? Journal of Industrial Economics 36, 431-442.

Neven, D. J., 1987. Endogenous Sequential Entry in a Spatial Model. International Journal of Industrial Organization 5, 419-434.

Prescott, E. C., Visscher, M., 1977. Sequential Location among Firms with Foresight. Bell Journal of Economics 8, 378-93.

Schmalensee, R., 1978. Entry Deterrence in the Ready-to-Eat Breakfast Cereal Industry. Bell Journal of Economics 9, 305-27.

Vives, X., 1988. Sequential Entry, Industry Structure, and Welfare. European Economic Review 32, 1671-1687.