Location Choice and Profit-Increasing Entry

Raphael Thomadsen*
UCLA Anderson School of Management
UCLA
110 Westwood Plaza, Suite B411, Los Angeles, CA 90095-1481
raphael.thomadsen@anderson.ucla.edu

Amit Pazgal
Jesse H. Jones Graduate School of Business
Rice University
6100 Main Street (MS-531), Houston, TX 77005
pazgal@rice.edu

David Soberman
Rotman School of Management
University of Toronto
105 St. George St., Toronto, Ontario, Canada M5S 3E6
david.soberman@rotma.utoronto.ca

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* The authors’ names are listed randomly. All authors contributed equally to the paper.
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Abstract

Despite conventional wisdom that firm profits decrease with competitive entry, the empirical literature highlights a number of situations where the entry of a quality-equivalent profitable competitor into a market has resulted in higher profits for the incumbent firms. Our paper uses a standard spatial model based on the circular market of Salop (1979) or the linear market of Hotelling (1929) to study how location choices affect the possibility that profits increase for all incumbents with a competitive entry by a new rival. Our key findings are as follows:

1) Profit-increasing entry occurs only when a significant fraction of potential consumers have needs that are unmet by the incumbents, and only when the new entrant locates such that it is close, but not too close, to the incumbent competitors.

2) The locations where profit-increasing entry can occur include scenarios where the entrant is located closer to the incumbent firms than the incumbent firms are to each other.

3) Profit-increasing entry can be the outcome of an endogenous location-choice game.

4) Profits must be higher for a monopolist than for firms facing any level of competition.

5) If profit-increasing entry is going to occur in a given market, profits will have a down-up-down shape with respect to the number of competitors in the market.

6) Profits can increase for all incumbents even if the new competitor only competes with one of the firms directly.

Key words: market entry, spatial models, direct and indirect competitors, marketing battlefield, dimensions of competition.
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1. Introduction

The literature in economics, industrial organization and marketing relies on the assumption that increased levels of competition invariably lead to lower average prices, reduced profits, and higher levels of total welfare. In fact, competition policy is generally designed to reduce market concentration and ensure healthy levels of competition within categories. Similarly, conventional wisdom states that incumbent firms should erect “barriers” that make it difficult for a new firm to enter the market in order to protect any above-normal levels of profit.¹

Empirical observations, however, paint a more-complicated picture about the relationship between entry and profits. For example, it has been observed that the opening of a new Starbucks may lead to higher profits for existing coffee shops that serve a market.² Similarly, it has been shown that entry increases the profit margins earned by incumbents in 6% of the industries studied (Geroski 1989). Vitorino (2012) finds that the profits of midscale and upscale department stores increase with the presence of additional midscale stores. One can explain why profits increase with competitive entry when the new product possesses complementarities with the incumbent products or when the new entry leads to increased levels of marketing within a category (for example, the effect of Lipitor’s entry into the statin market).³ However, in many of the observed cases where entry leads to increased profits for incumbents, there are no complementarities and the new product is an unequivocal substitute for the incumbent products. Later in the paper, we discuss examples where profit-increasing entry has been observed in the video download, energy, soap and fashion industries.

The basic intuition for how profits can increase with entry is that competitive entry can lead to increased, rather than decreased, prices by giving firms a commitment device to utilize niche pricing instead of mass market pricing. If prices rise enough to offset lost sales, profits can increase. Chen and Riordan (2007) demonstrate that this effect can occur under the Spokes model, which is an address-based model of global competition. Note that having higher prices is not necessarily enough for profits to increase. For example, Hauser and Shugan (1983), Perloff

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¹ Bain (1956) notes that incumbents can act together to create barriers to entry and thereby maintain their profitability in the face of potential entry.
² See Clark (2007).
³ For further details, see Lipitor (A) by Reinhard Angelmar, INSEAD published case 2006.
et. al. (1996), Thomadsen (2007) and Chen and Riordan (2008) all analyze models where prices increase as markets move from monopoly to duopoly. However, firms are always better off as a monopolist than as a firm facing any level of competition. In fact, this result can be stated as a theorem: *Under any standard choice model, a monopolist always loses profits with the entry of a second firm in the absence of a complementarity or market-size externality.* The essence of the argument is that a monopolist will make more sales at any price than a duopolist would make at the same price. Further, a monopolist must make more profits by charging the monopoly price than it would obtain as a monopolist charging the price that would be set under a duopoly by revealed preferences.4

The same reasoning, however, does not extend to entry in a market where there are two or more incumbents. In such an environment, each firm’s optimal price is affected by their competitors’ prices as well as their own demand conditions. Entry by a new competitor in a range of locations can increase the incumbent firms’ profits because the competitors’ prices can increase enough to offset lost sales.

We push this literature further by using standard horizontal product-differentiation models to study how location choices affect the possibility that profits increase for all incumbents with a competitive entry. Our key findings are:

1) Profit-increasing entry occurs only when a significant fraction of potential consumers have needs that are unmet by the incumbents, and only when the new entrant locates such that it is close, but not too close, to the incumbent competitors.

2) The locations where profit-increasing entry can occur include scenarios where the entrant is located *closer* to the incumbent firms than the incumbent firms are to each other.

3) Profit-increasing entry can be the outcome of an endogenous location-choice game.

4) Profits must be higher for a monopolist than for firms facing any level of competition.

5) If profit-increasing entry is going to occur in a given market, profits will have a down-up-down shape with respect to the number of competitors in the market.

6) Profits can increase for all incumbents even if the new competitor only competes with one of the firms directly.

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4 We use duopoly in this sentence, but the logic applies to any number of firms.
These results are new and have important and sometimes surprising implications for empirical researchers and managers. We first contrast our results with the previous literature. We then discuss the implications of our findings.

There are only two papers that we are aware of that have found profit-increasing entry using standard product differentiation models. The first, Chen and Riordan (2007), looks at the Spokes model of global (not local) competition and finds that profits can increase under restrictive conditions. Because the objective of the Spokes model is different than that of our paper, it has properties that limit its usefulness to analyze the relationship between entry and firm (or industry) profitability. First, the nature of the Spokes model obliges each new entrant to locate at the end of a new spoke; i.e. the entrant has no location decision to make in the Spokes model. Moreover, by definition, every entrant is located at precisely the same distance from every incumbent in the market.

In contrast, real markets are characterized by products that compete closely with some competitors and less directly with others. We show that for standard models of local competition, profit-increasing entry can occur under asymmetric locations, including ones where the entrant is located closer to each of the incumbent firms than the incumbent firms are to each other. Our analysis also demonstrates that an observation of entry leading to increased profits for incumbents represents neither a mistake nor a coincidence driven by an unobserved change in demand. Rather, it is the competitive outcome of an environment where the entrant endogenously positions itself in the market such that the incumbents are dissuaded from trying to attract distant consumers who have low willingness to pay. Further, profits can increase for an incumbent firm, even if the entrant only competes directly with that particular firm.

Second, when the market parameters are such that profit increasing entry occurs in the Spokes model, the relationship between the number of entrants and profits is strictly positive for all entry after the first profit-increasing entrant, independent of how many more firms enter the market. This finding of a U-shaped relationship between profits and the number of firms is both an unappealing artifact of the Spokes model and a finding that contrasts with the reality of what

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5 There are some papers which demonstrate profit-increasing entry through alternative mechanisms. Most of these papers show that profits can increase when entry creates a positive externality on incumbent firms or substantially expands the size of the market. For example, the literature on geographic agglomeration shows that firms may choose to locate near competitors due to the fact that consumers prefer shopping where there is a cluster of stores (e.g. Dudey 1990 and Gauri, Sudhir and Talukdar 2007). Alternatively, Thomadsen (2012) demonstrates that profits for all firms can increase when existing incumbent firms offer new products because the desire to avoid intra-firm cannibalization enforces a commitment by incumbents to be softer competitors.
we observe in markets with significant entry. The result obtains because the Spokes model does not capture the notion of “market crowding,” which is important for a model that examines the relationship between profitability and market entry. In contrast, we demonstrate that in models of local competition the market-crowding effect eventually dominates and erodes profits, so the pattern of profits with respect to the number of firms in the market always follows a down-up-down pattern in a scenario where profit-increasing entry will occur. As we note in Section 3, this shape has important implications regarding the validity of much of the empirical entry literature.

The other paper that finds profit-increasing entry is Ishibashi and Matsushima (2009), which shows that entry by low-quality entrants (a vertically differentiated entrant) can increase the profits of high-quality incumbents. In contrast to Ishibashi and Matsushima, we focus on markets with only horizontal differentiation. Ishibashi and Matsushima also do not consider endogenous product choices.

Our results have several important implications for managers and academics. For example, we show that the sets of conditions that lead to profit-increasing entry include some counter-intuitive scenarios, such as cases where the entrant locates closer to an incumbent than the distance that separates the incumbent firms. Classically, one would think that if an entrant were to locate this close to an incumbent, competition would be intensified. Our results also demonstrate that measures managers and academics might use as proxies for the intensity of competition, such as the distance to the nearest competitor or average distance between competitors, are not robust, as profits can increase even when these distances shrink.

Further, the fact that profits can increase for a firm even if it is the only firm that directly competes with the new entrant is important for both managers and academics. As an example, a firm deciding on how to respond to new entry may want to accommodate the entry and raise prices, which may lead to higher profits. In the conclusion, we discuss briefly an example about a firm that did just that. The other incumbent responded by raising its prices, and profits for the firm increased.

More broadly, firms often work hard to obstruct entry by their competitors, expending costly resources lobbying politicians, retailers or other groups to make entry difficult for new rivals. Our results provide conditions under which firms should not only avoid the costs of spending these resources, but where they would be better off encouraging the entrant.
The rest of the paper is organized as follows. In Section 2, we present a set of locations under which profits increase with new competitive entry; one key finding is that incumbent profits can increase even if the new competitor is located closer to the incumbents than the original firms are located to each other. In Section 3, we extend the model to allow firms to choose among a set of available locations on the circle and examine more-broadly how profits are related to the number of firms in the market. We find that industries where profits increase with competitive entry will exhibit a "down-up-down" relationship between profits and the number of firms in the market. We also discuss the implications of this finding on empirical entry research. In Section 4, we show that the finding that profits increase with endogenous entry is not driven by a constraint on available locations. Finally, in Section 5, we present a basic model using a linear city, and show that profits can increase for all incumbents even when the entrant locates such that it only competes directly with one of them. Thus, we identify separately a direct and an indirect effect that the entrant's location choice has on the profits of the incumbent firms.

2. The Circular Market

This section is based on the standard circular market of Salop (1979) where consumers are uniformly distributed around a market with a circumference of 1. Firms are located at various locations along the market, and consumer i's utility from buying and consuming the product from firm j can be represented as

\[ U_{ij} = V - p_j - d_{ij} \]  

(1)

where \( V \) is the benefit a consumer realizes from a product that perfectly suits her taste, \( p_j \) is the price charged by Firm j and \( d_{ij} \) is the distance between consumer i and Firm j.\(^6\) A consumer may decide not to buy from either firm in which case they consume an outside good, and earn a normalized utility of zero. We assume that all firms have a constant marginal cost,\(^7\) so profits for each firm are given by \( (p_j - c)q_j \), where \( q_j \) is the quantity sold. Without loss of generality, we set the marginal cost to zero, implying that \( p \) is the absolute mark-up over marginal cost.

The market we analyze starts with two incumbents where the shortest distance between them is a distance \( 2D \). We then assume that a new firm enters the market at the midpoint of the

\(^6\) The seemingly more general expression \( U = v - \alpha P - td \) is equivalent under the normalization \( V = v/t \) and \( p = tP/\alpha \).

\(^7\) We discuss the case of increasing marginal (convex) costs in the conclusion.
long side of the market. This implies that the entrant is situated a distance $\frac{1}{2} - D$ from each of the incumbents. The market is shown in Figure 1. While we focus on the case of 2 incumbents and one entrant in this section (to highlight the factors that affect profit increasing entry), we build on this result and consider other scenarios in Section 3.

**Figure 1: The Circular Market**

![Diagram of the circular market with two incumbents and an entrant](image)

Before we derive general conditions under which profits increase, we discuss a simple example where each of the firms is located a distance $\frac{1}{3}$ apart from each other and profits increase due to the entry of the third firm. Details of the calculations in the example are presented in the online Appendix.

**Example**

If the incumbents (I1 and I2) are $\frac{1}{3}$ from each other and $V = \frac{1}{2}$, then the market between the incumbents is covered, but there is a section of the market on the long-side of the circle that is not covered. Each firm’s demand is $q_j = V - p_j + D + \frac{p_{-j} - p_j}{2}$. Note that $\frac{\partial q_j}{\partial p_j} = -1.5$. Solving the first-order conditions yields prices of $\frac{4}{15}$ and profits of $\frac{8}{75}$ for both firms.

Suppose a third firm, $E$, enters at a distance of $\frac{1}{3}$ from the incumbents. Demand for the entrant is $q_E = \frac{1}{3} + \frac{p_{I1}}{2} + \frac{p_{I2}}{2} - p_E$. Demand for the incumbents is equivalent due to symmetry.
Note that \( \frac{\partial q_j}{\partial p_j} = -1 \) post entry, so demand is less price-sensitive post entry than it is pre-entry. Equilibrium prices and profits are higher than before entry: prices are \( \frac{1}{3} \) and profits are \( \frac{1}{9} \).

The result that profits increase with entry is not a general phenomenon that happens for any \( V \); rather it relies on \( V \) being low enough such that there are some consumers on the long side of the market who prefer the outside option prior to the new firm’s entry.

Not only do incumbent profits increase with entry, but consumer surplus decreases. Before entry, consumer surplus is \( \frac{47}{450} \). After entry, some consumers are better off because the new product is a better match for them than the incumbent products. However, customers who do not switch pay more, and are therefore worse off post entry. In total, the losses outweigh the gains: after entry, total consumer surplus drops to \( \frac{1}{12} < \frac{47}{450} \).

**General Case**

We now derive the set of locations, conditional on \( V \), under which entry of a third firm leads to increased profits for both incumbents. Specifically, the analysis considers the change in incumbent profits between two scenarios. In the pre-entry scenario, the two incumbents are alone in the market and compete with each other. By compete, we mean that the indifferent consumer between the two firms (on the short side of the circle) strictly prefers to buy rather than consume the outside good.\(^9\) Post-entry, the incumbents retain the same locations as in the pre-entry scenario, but a third firm is added to the market at a different location. These three firms then set prices and compete for customers. We examine locations under which profits for the two incumbents increase after the entry of the third firm. To retain tractability, we constrain the analysis to *symmetric-across-incumbents*, pure-strategy pricing equilibria.

Before we provide the general conditions under which the new entry increases profits for both incumbents, we briefly discuss properties of demand curves for location models where some consumers purchase the outside good. In particular, when the benefit associated with a

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\(^8\) The lower consumer surplus is consistent with the findings of Cowan and Yin (2008) and Zacharias (2009). Total social welfare increases with the new entry when there are no entry costs because all consumers buy post-entry and a significant fraction of the consumers on the long side of the market incur lower travel costs.

\(^9\) This condition seems innocuous, but we show that it is necessary for incumbents to realize profit increases from the entry of a new competitor.
consumer’s preferred product, \( V \), is sufficiently low in a spatial model, the demand curves of competing firms may have kinks in them (Salop 1979, Perloff et. al. 1996). The kinks occur due to the fact that when prices are low (relative to \( V \)), the firm’s marginal consumer substitutes between the firm’s product and its rival’s product. In such a case, it is difficult to attract consumers by a price cut because the more distant a consumer is from the firm in question, the closer that same consumer is to the competitor. In contrast, when prices are high, a firm’s marginal consumer substitutes between the firm’s product and the outside good. In such a case, the attractiveness of this outside good is independent of how far the consumer is from the firm, so a price cut attracts more new customers. Figure 2 illustrates this phenomenon.\(^{10}\) Of course, the demand curves do not always have kinks. When a firm’s competitors are close enough such that all of its customers prefer the rival’s product over the outside good, the firm will not have a kink in its demand curve. These are typically the conditions analyzed with spatial models i.e. \( V \) is sufficiently large such that the market is completely covered.

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\(^{10}\) When the firm has competitors on both sides, the demand curve can have two kinks, each corresponding to the price where the next-best alternative on each side changes from the outside good to the neighboring product.
buying from either of the two firms and not buying at all. That is, the utility of the marginal consumer between the two neighboring firms obtains exactly zero utility from consuming either product.  

The optimal price for a firm can occur along any part of its demand curve, including at a kink point. If the optimal price occurs at a kink-point in a firm’s demand curve then the equilibrium price does not correspond to a first-order condition. It is also useful to remember that each segment of a firm’s demand curve corresponds to a different first-order condition: the optimal price only occurs along that segment of the demand function if the first-order condition for that line-segment is satisfied (within the range of prices corresponding to that segment). Because marginal revenues are monotonically (but discontinuously) decreasing, it must be that the first-order conditions are satisfied on exactly one of the line segments (if a firm has a kinked demand curve) or that the optimal price occurs at one of the kink-points, but not both. 

Having covered the possibility of having kinked demand curves, we now return to comparing firm profits before and after the entry by a new competitor. Pre-entry, when only two firms are present, each firm’s demand curve may have a kink in it. If the firms price at a kink-point in the demand curve before entry and entry causes the firm to raise its price, then the firm's profits must decrease: after all, the firm had the option to increase its price before the competitor's entry and sell to all consumers who attain a positive utility at that higher price, so the profits it would have obtained at the higher post-entry price before entry must be at least as large as its profits after entry. Alternatively, if the new entry causes the incumbent firm to decrease its price, it is immediately apparent that the other incumbent's profits must decrease because the quantity of sales for the other incumbent must be less than their sales were pre-entry (assuming no change in the other incumbent’s price).

Thus, we focus our attention on the set of parameters \((V, D)\) where firms price along the linear part of the demand curve below the kink. This is the only area of the parameter space

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11 The properties of these kinks are described in-depth by Salop (1979) and Perloff et. al. (2006).
12 With linear travel costs, there is a discontinuity in the demand curve at the price that makes consumers at the rival firm’s location indifferent between the two products because at this price the firm “steals” all of the rival’s demand. This discontinuity interferes with the monotonicity property of the marginal revenue and can prevent the existence of a pure-strategy price equilibrium. Thus, we confirm in each of the cases we study that firms will not undercut other firms.
consistent with pure-strategy pricing equilibria where entry can increase profits. However, there are equilibria below the kink where the market is fully covered even on the long side of the market. We show the profit increases for the incumbents post-entry are only possible in the part of the parameter space \((V, D)\) where the market is not completely covered before entry. In fact, profit-increasing entry is only possible for combinations of \((V, D)\) such that a) each incumbent’s marginal consumer on the long side of the market substitutes between its product and the outside good and b) the marginal consumer on the short side of the market obtains a positive utility from consumption. Theorem 1 provides the set of \((V, D)\) parameters under which such a pure-strategy pricing equilibrium is possible.

**Theorem 1:** There exists a pure-strategy pricing equilibrium between two incumbents situated a distance \(2D\) apart such that each incumbent’s marginal consumer on the long arc between the incumbents is indifferent between that incumbent’s product and the outside good, while each incumbent’s marginal consumer on the short arc between the incumbents is indifferent between the 2 available products, but obtains positive utility from either if and only if (i) \(V \leq \frac{5}{6} - D\) and (ii) \(\frac{7}{3}D < V \leq \max \left( \frac{7\sqrt[3]{10}}{3}, D, \frac{5}{6} - \frac{5}{6}\sqrt{\max(1-12D,0)-D} \right)\).

The details of the proof (and all proofs) are in the online appendix. The condition that \(V \leq \frac{5}{6} - D\) ensures that the market is not covered before the entry of the third firm. The condition that \(\frac{7}{3}D \leq V\) ensures that the incumbents choose a price below the kink-point in their demand curve pre-entry. If this constraint is not satisfied then the incumbents are either pricing at the kink point or are *de facto* monopolists in the pre-entry market equilibrium. Finally, the condition that \(V \leq \max \left( \frac{7\sqrt[3]{10}}{3}, D, \frac{5}{6} - \frac{5}{6}\sqrt{1-12D-D} \right)\) ensures the existence of a pure-strategy price equilibrium. As with all location models that entail linear travel costs, firms need to be

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\(^{13}\) Profits also cannot increase if the firms price above the kink before entry, since in those cases the firms are de facto monopolists competing over separate competitors. We noted in the introduction that in such a case profits can only fall with new entry.
sufficiently distant or the pure strategy price equilibrium breaks down. This is the basis for the first limit i.e. \( V \leq \left[ \frac{7}{3} + \frac{5\sqrt{10}}{3} \right] D \). The second limit \( V \leq \frac{5}{6} - \frac{5}{6}\sqrt{1-12D} - D \) is needed because when \( D < \frac{1}{12} \) but close to \( \frac{1}{12} \), the firms’ ability to undercut a rival is more limited than situations where \( D \) is larger.

Given that the conditions of Theorem 1 are satisfied, we now identify sufficient conditions for the profits of incumbents to increase. To simplify the presentation, we assume that the entrant is positioned at the mid-point of the long arc separating the two incumbent firms, as shown in Figure 1. After entry, there are 4 possible symmetric-across-incumbents pure-strategy equilibria: (1) the new firm is so far from the incumbents that it acts as a monopolist (here, the incumbents are unaffected by the entrant), (2) the market is fully covered and all 3 firms price along the linear part of their demand curve i.e., below any kink in the demand curve, if such a kink exists, (3) all 3 firms price at a kink-point in their demand curves, and (4) the incumbents can price at a kink-point in their demand curves such that the marginal consumer between the two incumbents obtains zero utility, while the entrant prices along a linear part of its demand curve. Theorem 2 describes which of the 4 equilibria occurs as a function of \((V, D)\).

**Theorem 2:** When the incumbents are located a distance \(2D\) apart and the entrant is situated at a distance \(\frac{1}{2} - D\) away from each incumbent, then the symmetric-across-incumbent pure-strategy pricing equilibrium for the set of \((V, D)\) satisfying Theorem 1 are as follows:

- **If** \( V \leq \frac{5}{11} - \frac{6}{11} D \) and \( \frac{7}{3} D \leq V \leq \left[ \frac{7 + 5\sqrt{10}}{3} \right] D \), the entrant will price as a monopolist, and the prices and profits of the two incumbents are not affected by the new entry.

- **If** \( \frac{7}{3} D \leq V \leq \min \left\{ \frac{15}{16} + \frac{21D}{8} - \frac{9}{8}\sqrt{\frac{11D^2}{3} + \frac{D}{3} + \frac{1}{4}} + \frac{1}{3} + \frac{7+5\sqrt{10}}{3} D \right\} \) and \( \frac{5-6D}{11} \leq V \leq \min \left\{ \frac{3}{5} - \frac{3}{5} D, \frac{3}{2} - 6D \right\} \), then the entrant prices at a kink-point such that its marginal customers earn zero surplus. Equilibrium profits for the incumbents are always higher than in the two-firm case.

- **If** \( \frac{3}{5} - \frac{3}{5} D \leq V \leq \frac{5}{6} - D \) and \( \frac{15\sqrt{17} - 39}{256} \leq D \leq \frac{5}{6} V - \frac{1}{4} \), then the 3 firms price along the linear part of their demand curve (and below any kink in their demand curve, if such a kink exists). The
profits of the incumbents are \( \pi_I = \frac{1}{25} \left( \frac{3}{2} + D \right)^2 \) and the entrant \( \pi_E = \frac{4}{25}(1-D)^2 \). In this situation, profits for the incumbents increase as a result of the new entry when \( V < \frac{D}{\sqrt{6}} - D + \frac{\sqrt{6}}{4} \).

- If \( \frac{3}{2} - 6D \leq V \leq \frac{5}{6} - D \) and \( \frac{7}{3} D \leq V \leq \frac{6}{5} D + \frac{3}{10} \) then the incumbents set prices at a kink-point in the demand curve such that the marginal consumer between the incumbents obtains zero utility and the entrant prices along the linear part of its demand curve. Profits for the incumbents are \( \pi_I = \frac{1}{8}(V-D)(3-2V+4D) \). In this situation, profits for the incumbents increase as a result of the new entry when \( \frac{27}{98} D - \frac{5}{98} \sqrt{2204D^2 - 852D + 225} + \frac{75}{196} \leq V \leq \frac{27}{98} D + \frac{5}{98} \sqrt{2204D^2 - 852D + 225} + \frac{75}{196} \).

- If \( \max \left( \left[ \frac{7 + 5\sqrt{10}}{3} \right] D, \frac{5}{6}\sqrt{\max(1-12D,0)} - D \right) \geq V > \frac{15}{16} + \frac{21D}{8} - \frac{9\sqrt{11D^2}}{8} \frac{D}{3} + \frac{1}{4} \) and \( D < \frac{15\sqrt{17} - 39}{256} \) then a pure-strategy symmetric-across-incumbents pricing equilibrium does not exist.

The areas for these 5 sub-sections of the allowable parameter space are non-empty and do not overlap (in the online Appendix, we show that the boundaries of these sub-sections regions constitute the entirety of the allowable space associated with Theorem 1). To provide a sense of what these sub-sections look like in \((V,D)\) space, we provide an illustration of the region of where the conditions of Theorem 1 are satisfied in Figure 3.

In Figure 3, the interior of the cone outlined by the thick lines represents the region where the conditions of Theorem 1 are satisfied. Within the cone, there are the 5 sub-regions specified by Theorem 2 and the boundaries between the sub-regions are thin solid lines. The sub-regions listed in Theorem 2 start from the bottom of the cone. As we proceed upwards to the right, we move through 4 sub-regions of the theorem. The fifth sub-region, where there is no pure-strategy equilibrium, is located in along the top-left side of the cone.

Figure 3 shows that when \( V \) is small, the entrant prices as if it were a monopolist. In this situation, a significant fraction of the market is not served prior to entry and the entrant effectively fills the market hole as a monopolist.
When \( V \) is somewhat larger (relative to \( D \)), the 3 firms compete by pricing at a kink-point. In this sub-region, the market for the entrant and the incumbents only slightly overlap and this explains why the optimal prices are at a kink point. In fact, the incumbents have an incentive to raise their prices slightly with the entry of the new firm; however, once prices for the incumbents are slightly higher than they were before entry, the realized market of the entrant does not overlap with the realized market of the incumbents, and the incumbents have no further incentive to raise prices (some consumers between the incumbents and the entrant would choose to consume the outside good were an incumbent to raise price).

Finally, when \( V \) is large enough, all three firms price along the linear part of the demand curve and the first order conditions are satisfied unless \( V \) and \( D \) are both large. When \( V \) and \( D \) are both large, prices increase to the point at which the marginal consumer between the incumbents obtains zero utility. At this price, the incumbents do not have an incentive to further increase prices, but the entrant finds that the set of consumers who obtain positive utility from its product overlaps with the realized markets for the two incumbents. As a result, the entrant prices along
the linear portion of its demand curve according to its first-order condition while both incumbents price at a kink-point.

Theorem 2 also specifies conditions under which profits of the incumbents increase as a result of the new-firm’s entry; the relevant area is the interior of the area outlined by the dashed gray lines in Figure 3. A significant fraction of the region involves firms pricing at kink points; nevertheless, there is also a region where all firms price according to standard first-order conditions and profits increase. Ultimately, the results of Theorem 2 demonstrate that the potential for entry to lead to increased profits for incumbents relies primarily on the relationship between $V$ (the benefit associated with consumption of the ideal product), the distance between the incumbents, and the location of the new entrant.

Note that the region where profits increase in Figure 3 include areas where $D > \frac{1}{6}$. Because the incumbent firms are located a distance $2D$ apart, this means that the incumbents are located more than $\frac{1}{3}$ of the circle apart, and the entrant locates less than a distance of $\frac{1}{3}$ from each of the incumbents. Thus, profits increase even in scenarios where the entrant is located closer to the incumbents than the incumbents are to each other.14

The preceding analysis focuses on situations where the market is not fully covered prior to entry. The reason for this is that there are no symmetric-across-incumbents pure-strategy pricing equilibria where profits increase when the market is covered prior to the new-firm’s entry (the proof is found in the Appendix following the proof of Theorem 2). The intuition for this is as follows. When $V > \frac{5}{6} - D$, profits for the incumbents before entry are strictly higher than the profits that would be obtained by two incumbents with the same distance between them but a lower $V$. If we consider the 3-firm competitive analysis, the equilibria for the case where $V > \frac{5}{6} - D$ is an extension of the results illustrated in Figure 3: the three-firm equilibrium for most of this area consists of the case where the market is covered and all firms price along the linear part of their demand curves. In such a case, the profits depend only on $D$ and not on $V$. As a result, profits cannot increase. There are indeed cases where the market is covered before entry

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14 This region includes cases where the firms all price according to first-order conditions (as opposed to kink points) after the entry.
and the incumbents price at kink-points after entry; however, in the appendix, we show that profits do not increase in this situation.

3. Broader Relationship of Incumbent Profits to Entry by New Firms

The purpose of this section is to understand the pattern that exists between incumbent profits and the number of firms in the market, where firms choose their locations endogenously.

As noted earlier, a monopoly’s profits weakly exceeds the profits a firm can earn in the same market when more than one firm is present. In this section, we show that once a threshold number of firms are present in a circular spatial market, profits of incumbents decrease with the number of competitors. Thus, in conditions where entry does lead to higher profits for incumbents, the relationship between profits and the number of firms in the market has a down-up-down pattern rather than the monotonic down pattern which is the basis for most of the thinking in economics and industrial organization regarding the effect of competition. This finding reinforces the importance of recognizing the possibility of entry causing profits to increase, but also legitimizes the modelling context we propose. Any reasonable model of competitive entry to a market should ultimately exhibit a negative relationship between profits and the number of competitors.

In Section 2, we focus our analysis on entry by a third firm. Before proceeding, we note that while the earlier analysis considered entry by a third firm leading to increased profits, one can construct examples where entry by an $N^{th}$ firm for any $N \geq 3$ can increase profits. This suggests that there is nothing unique about the third entrant as opposed to the $N^{th}$ entrant.

We start our analysis by first presenting a theorem stating that profits trend towards zero when there are enough firms present in the market. Then we present two examples that illustrate the down-up-down pattern of profits.

**Theorem 3**: In a market with total size $M$, if consumer $i$ purchases product $j$ she gets a utility $U_{ij} = V - p_j - f(d_{ij})$, where $f$ represents a positive-valued non-decreasing function of distance, and $U_{i0} = 0$ if the consumer consumes only the outside good, then the average profits for each firm when there are $N$ firms in the market are bounded by $\frac{VM}{N} \to 0$ as $N \to \infty$. 

The proof of Theorem 3 is simple: The average demand for each firm is bounded by \( \frac{M}{N} \) and prices must be strictly below \( V \) (or else no customers choose to buy).

Theorem 3, along with the fact that profits will be highest when only one firm is present in the market, as shown in the introduction, suggests that profits will either steadily decrease, or else decrease, then increase, and finally decrease again as more firms enter.\(^{15}\) To demonstrate the possibility of the down-up-down pattern, consider a situation where firms are sequentially allowed to enter into a circular market, as studied in Section 2. Suppose that the monetary benefit of consuming an ideal product is \( V = \frac{1}{2} \) and that the market has 6 equally-spaced discrete locations zoned for entry. This means a new firm can enter in any zone that is unoccupied (by another firm). We assume that there are 6 potential entrants and in each period only one new firm enters the market. Thus, in a period, the entrant chooses its location, and then firms compete by choosing prices. The game proceeds for 6 periods, and the objective of each entrant is to maximize its sum of profits over all periods in which it operates. Clearly, early entrants have more periods over which they accumulate profits than late entrants. The solution to this game is presented in Theorem 4.

**Theorem 4:** In a circular market with the rules for entry and optimization as described above, there exists a Subgame Perfect Equilibrium that involves the first firm entering the market and earning a monopoly profit of \( \frac{1}{8} \) in period 1. In period 2, the second firm locates at a distance \( \frac{1}{3} \) away from the first firm, and both firms earn profits of \( \frac{8}{75} \). The third firm locates at a distance \( \frac{1}{3} \) away from each of the two incumbents, and all 3 firms earn profits of \( \frac{1}{9} \). The fourth, fifth and sixth firms locate at the remaining available locations. In such a case, the first three firms earn profits of either \( \frac{1}{16} \) or \( \frac{49}{576} \) in period 4, profits of either \( \frac{100}{3249} \) or \( \frac{169}{3249} \) in period 5, and profits of \( \frac{1}{36} \) in period 6.\(^{16}\)

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\(^{15}\) As noted earlier, a monopolist always earns higher profit than a duopolist in the absence of complementarities so the relationship between incumbent profit and the number of firms must always be downward sloping at \( n=1 \).

\(^{16}\) There are many ways that the firms could choose their locations when multiple locations provide equal profits. The equilibrium above assumes that the firms enter their locations randomly – i.e., an entrant chooses one of \( k \) locations with probability \( \frac{1}{k} \) when the \( k \) locations offer equal and maximum profit for the entrant. That said, the equilibrium is not unique, and there are strategies that lead to different equilibria.
The proof of Theorem 4 is provided in the online Appendix. In Figure 4, we plot the average profits and prices for the first firm in the market when firms locate according to Theorem 4. Figure 4 shows that profits decrease, then increase, then decrease. Moreover, prices increase until there are 3 firms in the market, but then decline with further entry. Similar to the findings of Section 2, higher equilibrium prices when the third firm enters is a necessary condition for entry to be profit increasing. However, we recover the conventional economic relationship between competition and prices once there are a sufficient number of competitors in the market.

Figure 4: Price and Profits when there are 6 available locations.

Figure 5 shows the average profits and prices for the first two firms in a similar game when $V = 0.35$, and where there are 8 firms that enter the market sequentially, each choosing to locate at one of 8 equally-spaced locations zoned for entry.\(^\text{17}\) Again, we see that profits at first decrease, then increase, then decrease as the number of firms increases.

\(^\text{17}\) The 8 firm case is solved using numerical methods but we have verified the results analytically. As in the 6-firm case, there are multiple Subgame Perfect Equilibria. The one we present involves the 2nd firm locating $\frac{1}{4}$ away from the first, the 3rd firm locating $\frac{1}{4}$ from the 2nd, and the 4th firm locating half way in between the 1st and 3rd firms. The 5th firm locates between the 3rd and the 4th firms, where that location is always chosen in a tie-breaker. The 6th firm locates across from the 5th firm. The 7th firm locates between the 4th and 1st firms, and the 8th firm takes the last remaining spot.
Figure 5: Price and Profits when there are 8 available locations

The 8-firm case highlights two key observations. First, average profits increase with the entry of the fourth and not the third firm. In this particular equilibrium, the first entrant’s profits increases with the entry of the third firm, and then decreases slightly with the entry of the fourth firm, although the average profits for the first two firms when there are 4 firms is higher than the average profit earned when there are only 2 firms. For the second incumbent, profits decrease with the entry of a third firm, but increase with the entry of the fourth firm, in such a way that the 4-firm average profits are higher than the 2-firm average profits. This highlights the fact that entrants often affect incumbents in an asymmetric fashion. Second, as before, we find that prices increase with entry when there are few firms in the market, and then decrease once the number of competitors exceeds a threshold.

The observation that profits may not decline monotonically in the number of competitors is not purely of theoretical interest. For example, Bresnahan and Reiss (1991) study the impact of competition on profits. They consider entry by only a small number of firms, and find that entry by the first 3 firms reduces profits, but entry by the 4th or 5th firm has almost no effect. They conclude that markets with 3 firms must have achieved a “competitive state.” However, our results suggest that the monotonic decline in profits with the number of firms in an industry can reverse before the industry reaches a level close to full competition. Thus, the findings of Bresnahan and Reiss may be unrelated to the notion that 3 firms are sufficient for an industry to
achieve a “competitive state.” Similarly, Berry (1992) studies the factors that affect profitability and adopts the generic-sounding assumption that profits decrease in the number of competitors. Our analysis shows such an assumption in an empirical analysis may be less innocent than it sounds.

It is also interesting that a number of recent structural estimations of entry games rely on a reduced-form relationship between profits and the number of competitors. In fact, the analysis of these structural games is often based on a reduced-form profit function with the number of competitors as an explanatory variable. For example, Seim (2006) assumes that profits are a linear combination of several factors and a linearly-decreasing function of the number of competitors, where the coefficient on the number of competitors is a function of the distance between the firm and each competitor. Singh and Zhu (2008), Ciliberto and Tamer (2009) and Datta and Sudhir (2012) also model profits as declining linearly in the number of competitors in their respective entry games. Similarly, Cleeren et. al. (2010) studies inter-format competition and assumes that profits decline with competitive entry, although they do not assume linearity.

Because the results of an empirical analysis depend on the legitimacy of the reduced form at the heart of the model, it is important to recognize that profits can increase with a new entrant, especially when analyzing entry into markets with a small number of firms. While the above papers make important contributions, it is worth noting that the papers assume away the possibility that profits may increase, which can cause distortions in the empirical estimates. Further, counter factual simulations using the estimated results of these models will not show profits increasing with entry, even under conditions where profits would actually increase in reality, because the possibility of such a decline is ruled out by the assumed functional form. Our results demonstrate the need to use flexible profit functions, especially when studying entry by a small number of firms.

4. **Endogenous Location Choice**

The analysis of Section 2 demonstrates that profits can increase with entry; however, a natural question that follows is whether profit-increasing entry is consistent with firms choosing their locations optimally. In a sense, Section 3 is a first step in showing that the profit-increasing entry may occur even when firms make a choice about location prior to the pricing game. Nevertheless, in Section 3, firms do not have complete freedom in making their location choice:
they are obliged to choose from a limited set of locations. The logic of limiting the number of locations is driven by the constraint of studying location decisions in spatial models where consumers have linear travel costs. In particular, with linear travel costs, there is no pure-strategy price equilibrium if two outlets are located too close to each other. In the models of Section 3, the \( V \) parameter is chosen such that there are pure-strategy price equilibria even when firms are located at the minimum distance between the ”allowable locations.” In addition, if one allows for many locations and firms in the market, solving the game of where firms locate is cumbersome.

To further demonstrate the generality of the finding that entry can lead to profit increases as opposed to profit decreases, we consider a game with more location choices but fewer firms. In order to allow firms to choose locations that are close to each other, we assume that consumers incur quadratic travel costs instead of the linear costs used in earlier sections, i.e.,

\[
U_{ij} = V - p_j - d_{ij}^2.
\]

The logic of using quadratic travel costs is that the instability observed when firms have linear travel costs is eliminated and the equilibrium of the pricing game entails pure-strategies.

The specifics of the game are as follows. As before, the market is a unit circle, with consumers located uniformly around the circle with density 1. In each period, consumers make a discrete choice, consuming from one of the firms in the market in that period. Consumer \( i \) gains a utility of

\[
U_{ij} = V - p_j - d_{ij}^2
\]

if she consumes 1 unit of Firm \( j \)’s product. The consumer can alternatively choose to consume the outside good and receive \( U_{i0} = 0 \).

There are \( N \) periods. In each period, exactly one firm has the opportunity to enter the market. If the firm enters the market, it chooses a location on the circle. Then all firms operating in the market in that period pay a fixed cost \( F \) and set prices.\(^ {18} \) Consumers then make their consumption choices, and profits are realized. The firms’ objective is to maximize the sum of their profits for the remaining periods in the game. A firm may also choose not to enter, in which case it earns zero profits (if \( F \) is sufficiently high, then a firm can lose money by entering). We further assume a firm cannot change its location after entry.

We analyze the game with the following parameter values: \( N = 4, V = 0.14 \), and \( F = 0.02 \). Thus, the game has four periods. The following equilibrium can then be found using backward

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\(^{18}\) The fixed cost is paid each and every period by operating firms.
induction. In the first period, the first firm locates anywhere on the circle, and earns monopoly profits in that period. In the second period, the second firm locates at a distance

\[ \frac{1}{6} \left( 2 + \frac{162^{1/3} (3V - 1) + 3V}{\left( 3\sqrt{297 - 3048V + 9744V^2 - 6144V^3 - 25 + 180V^2} \right)^{1/3}} \right) \]

from the first firm. At \( V = 0.14 \), this is approximately a distance of 0.338. Profits for each firm are approximately 0.0165 after subtracting the fixed costs. Note that even by locating \( \frac{1}{2} \) of the circle away, it is not possible to pre-empt entry by a third firm when \( F = 0.02 \). When the second firm chooses its optimal location, it anticipates that the third firm will enter half-way in between the first two firms on the long part of the circle; by locating further than \( \frac{1}{3} \) of the circle from the first firm, the second firm nudges the 3rd entrant’s location over a bit. However, the location is not too much beyond \( \frac{1}{3} \) because once the second entrant locates at the distance given by equation (2) away from the first firm, the period 3 equilibrium goes from one where all 3 firms price according to first-order conditions (when the distance between the incumbents is smaller) to one where the incumbents price at a kink-point in their demand curve. The third firm locates half-way in between the two firms (approximately 0.331 away from each firm – slightly closer than the incumbent firms were located to each other). Each of the two incumbent firms earns approximately 0.0171 net of fixed costs in each period after entry, while the entrant earns 0.0169. Thus, the entry by the third firm increases profits for each of the incumbents. A fourth (or later, if one considered additional periods) firm chooses not to enter the market because its profits will not be sufficient to offset the fixed costs.

The intuition for the above result is that when the second firm chooses its optimal location, it anticipates the third firm’s subsequent entry, and thus chooses its location not just based on the second period profits, but also based on profits in future periods. In fact, a necessary element to obtain an outcome where profits increase from entry is that the above game be played for 4 or more periods: there needs to be a realization of profits for the first two firms for at least

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19 The algebra used to solve for the values here are presented in the web appendix. We provide only the numerical approximations here because the equations are so large as to be distracting in the text.
two periods after the entry of the third firm.\textsuperscript{20} Profits for the firms in the second period are higher when the two firms are further apart, but in later periods, the entry of the third firm places a check on how far the second firm chooses to locate from the first.

Given the importance that having more than one period where all 3 firms are present, one might ask whether designing a game to have more periods than the number of entering firms is a reasonable assumption. Recent empirical work on entry supports the idea that a typical pattern for entry is that there is a relatively short period of time where significant entry occurs, followed by a long period of time where market shares (and key competitors) remain stable. For example, Bronnenberg, Dhar and Dubé (2009) find that market shares for a wide range of consumer packaged goods (CPG) categories remain stable for decades if not longer, and that market shares in different U.S. cities today are strongly correlated with the brand which entered a city’s market first (even when the entry occurred over 100 years earlier). Thus, using a long-term game seems to be a reasonable approach to model competitive entry and category growth for many industries.\textsuperscript{21}

5. The Linear Model: Direct and Indirect Effects

In this section we consider the impact of an entrant on the profitability of incumbents using a finite linear market of length L (Hotelling 1929).\textsuperscript{22} We utilize this model to demonstrate how entry that impacts the incumbents asymmetrically changes the results in the previous sections. Ultimately, we show that profits of all incumbent firms can increase, even if only one of the firms directly competes with the new incumbent. That is, a firm does not need entry to directly change the incentives of its rivals in order for its profits to increase.

We assume that consumers are uniformly located along the market with a constant density of 1. Consumer preferences are modeled as in equation (1), consistent with that in previous sections. Firms are similarly assumed to have zero marginal costs.

We assume that the incumbents are located at interior market locations (not near the endpoints). We do not speculate why these firms have the positions they do; rather, we only

\textsuperscript{20} Similar results are obtained when a moderate amount of discounting between periods is introduced, or a longer time horizon – even an infinite one – is considered.

\textsuperscript{21} Neven (1987) pushes this logic further and assumes that firms only care about long-run profits in a computational entry paper with high $V$ values.

\textsuperscript{22} The results from this section could all be derived from a circular market where the firm locations are such that there is an un-served segment of the market even after the third firm's entry.
suggest that there is significant literature related to the pioneering effects of first movers with the observation that “market needs” evolve away from the initial positions of the pioneers over time (for example see Carpenter and Nakamoto 1989). To simplify the exposition, we give names to the two incumbents. The first is Firm I, which is the incumbent for which the distance to an end of the market is shortest. The distance from incumbent I to the nearest end of the market is A. The second incumbent is Firm C (centrally located) and the distance to an end of the market for Firm C is longer than for Firm I. We call the distance between the two incumbents D. We assume the entrant, E, selects a location adjacent to incumbent C but not between the incumbents. The distance between incumbent C and entrant E is S. Finally the distance between Firm E and the far end of the market is B. Figure 6 illustrates the market.

Figure 6: The Linear Market

![Diagram of the Linear Market]

Given a minimum length of the market (in terms of $V$), our objective is to identify conditions related to the distances $A$, $D$, $S$ and $B$ that lead to profit increases for Firms I and C due to the entry of Firm E.

Before presenting the analysis, we highlight the mechanism through which Firm E’s entry can increase the profits of Firm C and Firm I. Suppose that E’s entry is at a location that induces Firm C to increase its price. Firm I would be strictly better off because its nearest competitor prices higher. This allows I to both raise its price and increase its quantity sold, leading to higher profits. The key question is can Firm C be better off when this occurs? The answer is yes. Firm I’s best response to C’s higher price is to raise its price, which clearly helps offset the loss of profits from C’s lost volume to the new entrant. Whether Firm C is better off or not depends on the relative sizes of the price increases and the lost sales. We show conditions under which the price increase has a larger impact and Firm C’s profits do increase.

Note that the mechanisms leading to profit increases for Firms I and C are different. Firm I benefits from the direct effect of Firm E’s entry changing the price-sensitivity of Firm C’s

23 We assume Firm I is to the left of Firm C without loss of generality.
demand (Firm E’s presence reduces Firm C’s ability to attract consumers near E by reducing its price), causing Firm C to charge a higher price. However, this also leads to an indirect effect of Firm E’s entry on Firm C’s profits. In particular, once Firm E enters, Firm I increases its price because it anticipates that Firm C will charge a higher price. Firm I’s reaction, in turn, confers a benefit on Firm C. It is this mechanism that we call the indirect effect. We show that Firm C’s profits can increase due to the indirect effect, even though there is no direct impact of E’s entry on Firm I’s incentives. These effects provide intuition for the mechanism behind how incumbents’ profits can increase when a new competitor enters the market.

In presenting the conditions that can cause both incumbents' profits to increase, we first provide a theorem that outlines what any equilibrium with increased profits must look like. We then provide specific details of the firms' locations that lead to profit-increasing entry.

Theorem 5 states that in order for the profits of both Firm I and C to increase post-entry, Firm C will price at a kink-point after the entry of Firm E.

**Theorem 5:** Any locations for Firms I, C, and E that lead to (1) a pure strategy pricing equilibria for all firms before and after entry, and (2) higher profits for both Firms I and C after Firm E’s entry than each firm obtains before the entry, must entail Firm C setting prices such that its first-order conditions are satisfied along the linear portion of its demand curve where the marginal consumer to the left of Firm C substitutes between Firms C and I before Firm E’s entry, and Firm C prices at a kink-point in its demand curve after Firm E’s entry.

The proof is provided in the online Appendix. The basic intuition behind Theorem 5 is similar to the intuition behind Theorem 1. If before entry, Firm C prices along a linear portion of its demand curve where the marginal consumers substitute between Firm C and the outside good, then Firm C must be charging the monopoly price and earning monopoly profits, i.e. Firms I and C are so far apart, that they serve different markets. We mentioned in the introduction that profits decrease with competitive entry in such a scenario. If Firm C prices at a kink-point in demand before entry and entry causes Firm C to raise its price, then Firm C’s profits must decrease since it had the option to increase its price before the entry of Firm E and sell to all consumers who attain a positive utility from that higher price but chose not to price in that way. Similarly, if Firm E’s entry causes Firm C to decrease its price then Firm I’s profits obviously decrease.
This implies that any situation where the entry of Firm E results in higher profits for Firms I and C must be associated with Firm C setting a price (before entry) that corresponds to the linear part of Firm C’s demand curve where the marginal consumers to the left of Firm C substitute between Firms C and I. In the Appendix, we show that the profits of both Firms I and C can only increase after entry when Firm C prices at a kink-point post-entry.

It is also helpful to note that Firm C’s demand curve after Firm E’s entry has 3 segments. At low prices, the marginal consumers substitute between Firms C and I to the left of Firm C and between Firms C and E to the right of Firm C. At slightly higher prices, marginal consumers substitute between Firms C and I to the left of Firm C and between Firm C and the outside good to the right of Firm C. Finally, at high prices, marginal consumers to both the left and right of Firm C substitute between Firm C and the outside good. The demand curve is very steep at the bottom of the demand curve (i.e. at low prices). In any scenario where entry leads to higher profits for Firms I and C, Firm C’s price after entry must be at the kink-point just above the steepest part of the demand curve. This price must also be higher than the price Firm C charged prior to Firm E’s entry.

Theorem 5 provides necessary, but not sufficient, conditions for Firms C and I’s profits to increase. Theorem 6 gives sufficient conditions Firm E’s entry to increase C and I’s profits.

**Theorem 6:** If the incumbents I and C are in a market of finite length where

a) The distance between I and the edge of the market, \( A \geq V \left( \frac{69}{67} - \frac{2}{67} \sqrt{10} \right) \),

b) The distance between the incumbents, \( D \in \left( \frac{6}{7 + 5\sqrt{10}}, \frac{6}{7} V \right) \) and

c) The length of the market, \( L \geq A - V \left( \frac{972}{465} - \frac{2}{67} \sqrt{10} \right) \).

and E enters at a distance \( S \in \left( \text{Max} \left[ \frac{18}{379} V - \frac{47}{49} D, \frac{4}{49} \sqrt{18 V^2 - 30 V D - 12 D^2}, \frac{598}{395} V - \frac{18}{89} D, D \right], \frac{11}{10} V - \frac{1}{5} D \right) \) from incumbent C, then there exists an equilibrium such that profits increase for both incumbents.

Intuitively, Firms I and C need to be sufficiently close so that a pure-strategy price equilibrium occurs along the steep part of the demand curve in the pre-entry (2-firm) scenario.\(^{24}\) In addition, the incumbents cannot be too close or they will undercut each other’s prices. The

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\(^{24}\) I.e. the part of the demand curve where the marginal consumer between Firm I and Firm C obtains a strictly positive utility from either product.
range on $S$ ensures that Firm $E$ is (a) sufficiently distant from Firm $C$ such that Firm $C$ prices at a kink-point in its demand curve after Firm $E$ enters the market and (b) sufficiently close to Firm $C$ such that Firm $E$’s realized market touches the realized market for Firm $C$.

6. Conclusion

This paper studies how the locations of incumbents and entrants affect the possibility that profits for incumbent firms increase after entry. We provide conditions on locations for entry that can lead to higher profits, and show that these locations include scenarios where the entrants are closer to the incumbent firms than the incumbent firms are to each other, and that these location choices are consistent with endogenous location choices. Further, markets where profit-increasing entry occurs are characterized by a down-up-down relationship between profits and the number of firms in the market. Finally, we demonstrate that profits can increase for a firm even if it is the only firm that competes with a new entrant.

While we assume throughout the paper that firms have constant marginal costs, the result of profit-increasing entry is robust to relaxing this assumption. For example, the results are robust to models with increasing marginal costs, such as models where total costs are $q_j^2$. We also demonstrate that the result of profit increasing entry can occur under either quadratic or linear travel costs. In sum, we show that the potential for profit increasing entry is robust to relaxing many assumptions that were used to construct the base model of Section 2.

Our findings that profits can increase in markets with horizontal differentiation and local competition are not purely hypothetical. For example, we worked with a firm in a segment of the entertainment download and streaming video industry that originally faced only one key competitor, but recently faced a new entrant. The original competitor and our focal firm overlapped largely competing for younger consumers, but the new entrant and the focal firm overlapped largely competing for older consumers. Thus, competition in this market followed a scenario consistent with the Hotelling market presented in Section 5. Before entry, this firm had tested its prices to make sure prices were being set optimally. After entry, we advised the firm to

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25 As an example, consider a circular market where firms are located a distance of 1/3 away from the other firms, total costs are $q_j^2$, and $V = 7/6$. Then profits for the two incumbents before entry will be $80/363$, while profits after entry will be $2/9$, which are higher. As in the example in Section 4, the equilibrium prices both satisfy the first-order conditions and occur at kink-points. Thus, if $V$ is slightly higher, profits will increase even while all firms price according to first-order conditions both before and after entry. If $V$ is slightly lower, all firms will price at kink-points after entry.
test its optimal prices again, and found that the new optimal price was 20% higher than before entry. Ultimately, profits increased after this change (compared to pre-entry profits) by an amount somewhat less than 5%.

Unfortunately, the manager of this firm did not want to have us share any more details that might be used to identify their firm. We have found that this concern is common – managers who find that profits increase with competitive entry do not want to share this result, partially out of a fear that this may weaken the negotiating power of the firm.26

There is other evidence that profits do increase with entry in other markets. Pauwels and Srinivasan (2004) find that Dove, Lever 2000 and Dial soap experienced increased profits from store-brand entry.27 Further, Qian (2008) shows that profit margins increased for authentic shoes after the entry of counterfeiters in China, and that, on average, profits for the authentic shoes were higher two years after counterfeiters of a brand were discovered. In each of these cases the new entry was by a lower-quality producer, although our results suggest that profits for Dial soap, for example, could increase from the store-brand entry, even if the store brand was positioned such that it most directly competed with Dial. This is borne out somewhat in Qian’s analysis, where it is the brand that is counterfeited whose profits were observed to increase.

We also see several markets where a necessary (but not sufficient) ingredient for our effect – prices rising with competition – occurs. For example, Perloff et. al. (1996), Ward et. al (2002), Yamawaki (2002), Simon (2005), Goolsbee and Syverson (2008) and McCann and Vroom (2010), show that entry can lead to price increases in the pharmaceutical, consumer packaged goods, luxury car, magazine, airline and hotel industries, respectively. While we do not have data on profit changes in these industries, the large share of the outside good in the luxury car market make it especially fertile ground for us to observe increased profits from entry. We also surmise that many papers that observe patterns consistent with profit-increasing entry attribute their findings to other causes due to the strength of the conventional wisdom that more competition must lead to lower profits. For example, Vitorino (2012) observes that entry patterns of retailers in malls are consistent with the presence of complementarities between retailers, but her findings are also consistent with profit-increasing entry.

26 We know of multiple energy markets where entry led to increased profits, but we are forbidden from using the details of these examples in publication.
27 Pauwels et. al. do not directly measure profits, but the paper provides price and quantity information. We assume that higher revenues and lower unit sales (which should mean lower total costs), or higher prices and higher quantity together lead to higher profits.
Our results have important implications for managers and empirical researchers. Managers often expend costly resources trying to obstruct entry by competitors – perhaps lobbying governments to put restrictions on entry or lobbying retailers to keep competing manufacturers off store shelves. Our results suggest that in many cases, firms should avoid expending these resources, and instead accommodate entry and raise prices. Managers need to know that their profits can increase even if their firm is the only one that competes directly with the new entrant or if the new entrant is located closer in “product space” than the incumbent’s competitor. We also provide lessons for empirical researchers seeking to measure the relationship between profits and the number of firms in a market. Notwithstanding endogeneity concerns that often arise in measuring these types of relationships, our findings suggest that researchers need to reflect on the functional form that relates the number of competitors to profits. In particular, our findings raise concern about the plausibility of the linear (or log-linear) functional form and suggest that researchers need to consider functional forms that allow for the possibility of non-monotonic (and non-U-shaped) relationships between the number of firms and profits. Importantly, this functional form issue is not merely an issue for reduced form estimation. It is also an issue that affects studies of entry – and entry games – that while “structural” in spirit use reduced-form profit functions as building blocks. It may seem trite, but the results of any model-based analysis rely on the legitimacy of the reduced form of the model. Our analysis shows that profits sometimes increase when new competitors enter markets with small numbers of firms. This is the precise situation considered in many of these studies.
References


