Appendix: Proofs

1. A Model with No Interdependence within Firms

In this basic model, the setup is similar to that of Dixit (1980) and Spence (1977): A monopolistic incumbent and a low-cost entrant, both having complete information about each other's costs,[1] play a two-stage game. The market's inverse demand function is given by $P = 1 - Q$. Before the game starts, the incumbent operates in a monopolistic market. It produces q_i^M units of goods at capacity K_i^M, with a constant marginal cost of c_i, for a profit of π_i^M. Optimizing its profit function generates its optimal outcomes:

$$K_i^M = q_i^M = \frac{1-c_i}{2},\ \pi_i^M = (1 - q_i^M - c_i)q_i^M = \frac{(1-c_i)^2}{4}. \tag{1}$$

In the first stage, facing an entry threat, the incumbent invests in a capacity level K_i at a cost of $r_i K_i$. The entrant observes K_i and decides whether to enter with a fixed entry cost of f and a variable cost of c_e. In the second stage, if entry occurs, the incumbent and the entrant simultaneously choose their output (q_i and q_e, respectively). The incumbent's marginal cost is c_i if $q_i \leq K_i$, and $c_i + r_i$ if $q_i > K_i$. The incumbent is expected to choose optimal capacity using backward induction.

If entry happens, Dixit and Spence show that in the second stage, the incumbent's optimal choice is to produce $q_i = K_i$, at which its second-stage marginal cost will be c_i rather than $c_i + r_i$. The entrant chooses q_e to maximize its profit of $\pi_e = (1 - q_e - q_i)q_e - c_e q_e - f$. The first-order condition gives the best response output of

$$q_e = R(q_i) = -\frac{q_i}{2} + \frac{1-c_e}{2}. \tag{2}$$

Foreseeing the entrant's response to the incumbent's capacity choice and using backward induction, the incumbent will choose a pre-entry capacity level to either (1) *deter* (prevent) entry by making entry unprofitable for the potential entrant, or (2) *accommodate* (allow) entry but maximize the incumbent's post-entry profits in the duopolistic market.

We plot in Figure 1 a framework to analyze the dynamic process as the entry cost declines from the right of the spectrum to the left. If the entry cost is high enough, entry is not viable for the entrant even with no response from the incumbent, so the incumbent will ignore the threat. When the entry cost drops below

[1] This is a reasonable assumption in our context given that the incumbent airlines faced actual competition from Southwest on many routes for at least a decade before our sample period.

$\bar{f}_D$ but remains above $\bar{f}_A$, the incumbent's monopoly is attainable only via deterrence. When the entry cost drops below $\bar{f}_A$, the incumbent will find that the cost of deterrence is too high and accommodation is more profitable. Finally, if the entry cost is sufficiently low and the operating cost of the entrant is lower than that of the incumbent, the incumbent might find it no longer profitable to stay in the market and exit. We focus on these cutoff points to determine the incumbent's best response strategy.

If the incumbent decides to deter, it has to set a capacity level that leaves the entrant too small a residual demand to make entry profitable. That is, the incumbent will produce q_i such that

$$\pi_e = (P - c_e)q_e - f = [1 - (q_i + q_e) - c_e]q_e - f = \left[1 - \left(q_i + R(q_i)\right) - c_e\right]R(q_i) - f$$

$$= \left[1 - \left(-\frac{q_i}{2} + \frac{1 - c_e}{2} + q_i\right) - c_e\right]\left(-\frac{q_i}{2} + \frac{1 - c_e}{2}\right) - f = \frac{(1 - c_e - q_i)^2}{4} - f \leq 0$$

$$\Rightarrow\ (1 - c_e - q_i)^2 \leq 4f \ \Rightarrow\ 1 - c_e - q_i \leq 2\sqrt{f}$$

$$\Rightarrow\ q_i \geq K_i^D = (1 - c_e) - 2\sqrt{f} \tag{3}$$

where K_i^D will be the capacity preset by the incumbent to deter entry.

Inequality (3) suggests that if the incumbent expects to deter entry and monopolize the market, its deterrence capacity will decrease in both the operating cost and the entry cost of the potential entrant. That is, the less efficient the potential entrant is, the less profit it will make upon entry, the less likely the potential entrant will enter the market and, therefore, the less aggressive the incumbent needs to be in entry deterrence. With the deterrence strategy, the incumbent's profit is

$$\pi_i^D = \pi_i^M - (K_i^D - K_i^M)r_i = \frac{(1-c_i)^2}{4} - \left((1 - c_e) - 2\sqrt{f} - \frac{1-c_i}{2}\right)r_i \tag{4}$$

However, if the entry cost drops further, and the incumbent expects to co-produce with the entrant, the incumbent will pre-set a capacity to maximize its post-entry profits in a duopolistic market:

$$\max_{q_i^A} \pi_i^A = \begin{cases} Pq_i^A - c_i q_i^A & : q_i^A \leq K_i^M, \\ Pq_i^A - c_i q_i^A - r_i(q_i^A - K_i^A) & : q_i^A > K_i^M, \end{cases} \quad \text{or}$$

$$\max_{q_i^A} \pi_i^A = \begin{cases} \left(1 - q_i^A - R(q_i^A)\right) q_i^A - c_i q_i^A & : q_i^A \leq K_i^M \\ \left(1 - q_i^A - R(q_i^A)\right) q_i^A - c_i q_i^A - r_i(q_i^A - K_i^M) & : q_i^A > K_i^M \end{cases}$$

For simplicity, we assume that $K_i^A < K_i^M < K_i^D$; hence we only consider the case $q_i^A \leq K_i^M$ when calculating the monopoly equilibrium.

The equilibrium outcomes in the post-entry duopolistic market are as follows:

$$K_i^A = q_i^A = \frac{1 + c_e - 2c_i}{2}$$

$$q_e^A = \frac{1 + 2c_i - 3c_e}{4}$$

$$\pi_i^A\left(q_i^A, R(q_i^A)\right) = \frac{(1+c_e-2c_i)^2}{4} \tag{5}$$

These results suggest that if the incumbent expects to co-produce with the entrant, the incumbent will pre-set a capacity that increases in the cost advantage of the potential entrant.

2. Premium vs. low-cost incumbents

We now extend the basic model and consider the case where the market can support two products, one low cost (Product 1) and one premium (Product 2). A low-cost incumbent and a low-cost entrant will always offer Product 1 and face an inverse demand function of $P_1 = 1 - Q_1 - sQ_2$, where $Q_1 = q_i + q_e, Q_2 = 0$. A premium incumbent will always offer Product 2 and face an inverse demand function of $P_2 = 1 - \theta Q_2 - sQ_1, Q_1 = q_e$. $\frac{1}{\theta} \in [0,1]$ represents the price sensitivity of consumers for Product 2, relative to Product 1. $\frac{1}{\theta} < 1$ means that consumers are less price sensitive for Product 2 than for Product 1. $s \in [0,1]$ represents the degree of substitution between the two products. When $s = 0$, the demand functions for the two products are independent: $Q_1 = 1 - P_1$ and $Q_2 = \frac{1-P_2}{\theta}$, respectively. When $s = 1$, the demand functions for Product 1 and Product 2 are: $Q_1 = 1 - \frac{\theta P_1}{\theta-1} + \frac{P_2}{\theta-1}$ and $Q_2 = \frac{P_1-P_2}{\theta-1}$, respectively. We compare two scenarios: (1) The monopolist incumbent is a low-cost firm with the same operating cost as the entrant ($c_{iL} = c_e$), and (2) the monopolistic incumbent is a premium firm with a higher operating cost than the entrant ($c_{iP} > c_e$).

First, $\bar{f}_D$ is the point where the monopolistic profits equal the profits from deterrence, and the deterrence capacity equal to monopoly output $q_i^m = K_i^D$. A low-cost incumbent and the entrant provide the same product; solving the equation $q_{i1}^m = K_{i1}^D$ results in $\bar{f}_{D1} = \frac{(1+c_{iL}-2c_e)^2}{16}$. A premium incumbent and the entrant provide different products; solving the equation $q_{i2}^m = K_{i2}^D$ results in $\bar{f}_{D2} = \frac{[(2\theta(1-c_e)-s(1-c_{iP})]^2}{16\theta^2}$. By assumption, we know that $0 \le c_e = c_{iL} \le c_{iP} \le 1, s \le 1, \theta \ge 1$; hence $\theta(1-c_e) = \theta(1-c_{iL}) > s(1-c_{iP})$; hence

$$\bar{f}_{D2} - \bar{f}_{D1} = \frac{[(2\theta(1-c_e)-s(1-c_{iL})]^2}{16\theta^2} - \frac{(1+c_{iP}-2c_e)^2}{16} = \frac{1}{16}\left(\frac{\left(2\theta(1-c_e)-s(1-c_i)\right)^2}{\theta^2} - (1-2c_e+c_{iL})^2\right) =$$

$$\frac{1}{16}\left(\frac{2\theta(1-c_e)-s(1-c_{iP})}{\theta} + 1 + c_{iL} - 2c_e\right)\frac{\theta(1-c_{iL})-s(1-c_{iP})}{\theta} > 0 \qquad (6)$$

This means that as the entry cost declines, the threshold for a premium incumbent to deter (rather than ignore) entry, $\bar{f}_{D2}$, is to the right of the threshold for a low-cost incumbent to deter, $\bar{f}_{D1}$. The intuition is that because a premium incumbent has a higher operating cost than a low-cost incumbent, the monopolistic output for the premium incumbent is lower than that of the low-cost incumbent in a similar market, which leaves a bigger residual demand for the potential entrant. Therefore, the premium incumbent needs a higher entry cost $\bar{f}_D$ to deter entry. That is, as the entry cost drops, a premium incumbent will start deterring entry earlier than a low-cost incumbent.

Second, $\bar{f}_A$ is the point where the accommodation profits equal the profits from deterrence, which can be obtained by solving $\pi_i^A = \pi_i^D$, where π_i^A is determined in Equation System (5). Following similar steps as in section 1, we derive the equilibrium outcomes as follows.

	Low-cost incumbent with Product 1	Premium incumbent with Product 2
Monopoly (Price, Output)	$(P_1^m, q_{i1}^m) = \left(\frac{1+c_{iL}}{2}, \frac{1-c_{iL}}{2}\right)$	$(P_1^m, q_{i2}^m) = \left(\frac{1+c_{iP}}{2}, \frac{1-c_{iP}}{2\theta}\right)$
Monopoly Profit	$\pi_{i1}^m = \frac{(1-c_{iL})^2}{4}$	$\pi_{i2}^m = \frac{(1-c_{iP})^2}{4\theta}$
Deterrence Capacity	$K_{i1}^D = 1 - c_e - 2\sqrt{f}$	$K_{i2}^D = \frac{1-c_e-2\sqrt{f}}{s}$
Deterrence Profit	$\pi_{i1}^D = \left(1 + c_{iL}^2 + \left(-2+4c_e+8\sqrt{f}\right)r_i - 2c_{iL}(1+r_i)\right)\frac{1}{4}$	$\pi_{i2}^D = \frac{(1-c_{iP})(1-c_{iP}+2r_i)}{4\theta} + \frac{\left(-1+c_e+2\sqrt{f}\right)r_i}{s}$
Cutoff Point between Monopoly and Deterrence ($\bar{f}_D$)	$\bar{f}_{D1} = \frac{(1+c_{iL}-2c_e)^2}{16}$	$\bar{f}_{D2} = \frac{[(2\theta(1-c_e)-s(1-c_{iP})]^2}{16\theta^2}$
Accommodation (Price, Outputs)	$(P_1^A, q_{i1}^A, q_e^A) = \left(\frac{1+c_e+2c_{iL}}{4}, \frac{1+c_e-2c_{iL}}{2}, \frac{1-3c_e+2c_{iL}}{4}\right)$	$(P_1^A, q_e^A) = \left(\frac{4\theta(1+c_e)-2s(1-c_{iP})-s^2(1+3c_e)}{8\theta-4s^2}, \frac{1-c_e}{2} - \frac{2s(1-c_{iP})+s^2(1-c_e)}{4(2\theta-s^2)}\right)$ $(P_2^A, q_{i2}^A) = \left(\frac{(4\theta-4-s^2)(2-(1c_e)s)+2c_{iP}(4-s^2)}{8\theta-4s^2}, \frac{2(1-c_{iP})+(c_e-1)s}{2(2\theta-s^2)}\right)$
Accommodation Profit	$\pi_{i1}^A = \frac{(1+c_e-2c_{iL})^2}{8}$	$\pi_{i2}^A = \frac{(-2+2c_{iP}+s-c_es)^2}{8(2\theta-s^2)}$

Cutoff Point between Accommodation and Deterrence ($\bar{f}_A$)	$\bar{f}_{A1} = (-1 + c_e^2 + 2c_{iL}^2 + c_e(2 - 4c_{iL} - 8r_i) + 4r_i + 4c_{iL}r_i)^2 \frac{1}{256r_i^2}$	$\bar{f}_{A2} = \Big(16\theta^2(1-c_e)r_i + 2(1-c_i)(1-c_i+2r_i)s^3 + \theta s\big(s(1-c_e)(s(1-c_e) - 4(1-c_i)) + 8r_i(1-c_i + s(1 - c_e))\big)\Big)^2 \frac{1}{256\theta^2 r_i^2 (2\theta - s^2)^2}$

To simplify without loss of generality, we assume that $c_e = c_{iL} = 0$. We plot $(\bar{f}_{A2} - \bar{f}_{A1})$ against c_i and θ in Figure A1a.[2] Figure A1a shows that $\bar{f}_{A2} < \bar{f}_{A1}$ when r_i is small relative to c_i $(\mathrm{e.g.}, r_i = 0.1c_i)$. This means that when the investment cost is sufficiently low, as the entry cost declines, the cutoff point for the premium incumbent to accommodate (rather than deter) entry, $\bar{f}_{A2}$, is to the left of the cutoff point for the low-cost incumbent, $\bar{f}_{A1}$. That is, the premium incumbent will be more likely than the low-cost incumbent to deter rather than to accommodate entry.

Combining the analysis of $\bar{f}_D$ and $\bar{f}_A$, we plot $(\bar{f}_{D2} - \bar{f}_{A2}) - (\bar{f}_{D1} - \bar{f}_{A1})$ as functions of c_i and θ in Figure A1b, which shows that $(\bar{f}_{D2} - \bar{f}_{A2}) - (\bar{f}_{D1} - \bar{f}_{A1}) > 0$, or $(\bar{f}_{D2} - \bar{f}_{A2}) > (\bar{f}_{D1} - \bar{f}_{A1})$ when r_i is small relative to c_i $(\mathrm{e.g.}, r_i = 0.1c_i)$. That is, the premium incumbent will be more aggressive than the low-cost incumbent in deterring (rather than ignoring or accommodating) entry.

Proposition 1. *Following the threat of entry from a low-cost entrant, if investment costs are sufficiently low relative to operating costs, a premium incumbent is more likely to invest in deterrence capacity as compared with a low-cost incumbent.*

It is interesting to note that at each level of r_i, $(\bar{f}_{D2} - \bar{f}_{A2}) - (\bar{f}_{D1} - \bar{f}_{A1})$ does not seem to be very sensitive to θ. To reduce the number of variables, we therefore assume that $\theta = 5$ for analyses in the next two sections, though our results are robust to other values of θ.

3. <u>Within-market substitutability</u>

[2] In all the graphs in this Appendix, we have removed unrealistic range of parameter values where firms' output is negative, or the incumbent's profit is negative.

We now focus on markets where the incumbent is a premium firm. We plot $\frac{\partial(\bar{f}_D-\bar{f}_A)}{\partial s}$ against c_i and s in Figure A2. It shows that $\frac{\partial(\bar{f}_D-\bar{f}_A)}{\partial s} > 0$ for a majority of feasible cases. That is, the deterrence interval $(\bar{f}_D - \bar{f}_A)$ in Figure 1 becomes wider as s increases, which implies that the premium incumbent will be better off deterring than ignoring or accommodating entry when the potential entrant provides a more substitutable product.

Proposition 2. *Following the threat of entry from a low-cost entrant, a premium incumbent will be more likely to invest in deterrence capacity when substitutability of customer demand is high.*

4. Between-market complementarity

We now investigate the case when the premium incumbent offers one product in each of the two markets—*j* and *k*—with complementary demand, and the entrant can enter only the low-value segment of market *j*. The inverse demand functions in market *j* are $P_{j1} = 1 - Q_{j1} - sQ_{j2}$ for the low-cost product and $P_{j2} = 1 - \theta Q_{j2} - sQ_{j1}$ for the premium product, where $Q_{j1} = q_e, Q_{j2} = q_{ij2}$. The inverse demand function in market *k* is $P_k = 1 - \theta Q_k + mQ_j$, where $Q_k = q_{ik}, Q_j = Q_{j1} + Q_{j2}$, and $m \in [0,1]$ represents the degree of complementarity between the two markets. When $m = 0$, the demand functions in the two markets are independent: $Q_{j1} = \frac{\theta}{\theta-s^2}(1 - P_{j1}) - \frac{s}{\theta-s^2}(1 - P_{j2}), Q_{j2} = \frac{1}{\theta-s^2}(1 - P_{j2}) - \frac{s}{\theta-s^2}(1 - P_{j1})$ and $Q_k = \frac{1}{\theta}(1 - P_k)$. When $m = 1$, the demand functions in the two markets are: $Q_{j1} = \frac{\theta}{\theta-s^2}(1 - P_{j1}) - \frac{s}{\theta-s^2}(1 - P_{j2}), Q_{j2} = \frac{1}{\theta-s^2}(1 - P_{j2}) - \frac{s}{\theta-s^2}(1 - P_{j1})$ and $Q_k = \frac{1}{\theta}(1 - P_k) + \frac{\theta-s}{\theta(\theta-s^2)}(1 - P_{j1}) + \frac{1-s}{\theta(\theta-s^2)}(1 - P_{j2})$; all consumers in market *j* also demand the product in market *k*.

Before the game starts, the incumbent operates as a monopolist in both markets *j* and *k*: $K_{ij2}^M = q_{ij2}^M = \frac{1-c_i}{4-m}, K_{ik}^M = q_{ik}^M = \frac{1-c_i}{4-m}$, $\pi_i^M = \pi_{ij2}^M + \pi_{ik}^M = (1 - 2q_{ij2}^M - c_i)q_{ij2}^M + (1 - 2q_{ik}^M + mq_{ij2}^M - c_i)q_{ik}^M = \frac{(1-c_i)^2}{4-m}$. If entry happens in market *j*, the entrant chooses q_e to maximize its profit of $\pi_e = (1 - q_e - sq_{ij2})q_e - c_e q_e - f$. The first-order condition gives the best response output of $q_e = R(q_{ij2}, q_{ik}) = -\frac{sq_{ij2}}{2} + \frac{1-c_e}{2}$.

Foreseeing the entrant's response to the incumbent's capacity choice and using backward induction, the incumbent will choose a pre-entry capacity level to either (1) *deter* (prevent) entry by making entry unprofitable for the potential entrant, or (2) *accommodate* (allow) entry but maximize the incumbent's joint post-entry profits in the duopolistic market *j* and the monopolistic market *k*.

If the incumbent decides to deter, it will produce q_{ij2}, q_{ik} such that

$$\pi_e = (P_{j1} - c_e)q_e - f = [1 - q_e - sq_{ij2} - c_e]q_e - f = [1 - R(q_{ij2}) - sq_{ij2} - c_e]R(q_{ij2}) - f$$

$$= \frac{1}{4}(1 - c_e - sq_{ij2})^2 - f \leq 0$$

$$\Rightarrow (1 - c_e - sq_{ij2})^2 \leq 4f$$

$$\Rightarrow q_{ij2} \geq \frac{1 - c_e - 2\sqrt{f}}{s}.$$

and the incumbent will also maximize its joint profits across two markets:

$$\max_{q_{ij2}, q_{ik}} \pi_i = (P_{j2} - c_i)q_{ij2} + (P_k - c_i)q_{ik}$$

$$= [1 - R(q_{ij2}) - sq_{ik} - c_i]q_{ij2} + [1 - 2q_{ik} + m(R(q_{ij2}) + q_{ij2}) - c_i]q_{ik}$$

When we combine the two constraints above, the incumbent's deterrence capacities and deterrence profit are solved as follows:

$$K_{ij2}^D = \frac{1 - c_e - 2\sqrt{f}}{s}$$

$$K_{ik}^D = \frac{m(1 - c_e - 2\sqrt{f}) + s(1 - c_i - r_i) + ms\sqrt{f}}{4s}$$

$$\pi_i^D = \pi_i^M - (K_{ij}^D + K_{ik}^D - K_{ij}^M - K_{ik}^M)r_i$$

$$= \frac{4(1 - c_i)^2 s + (4 - m)r_i^2 s + r_i\left(c_e(16 - m^2) + \sqrt{f}(4 - m)(8 + m(2 - s)) - (4 + m)(4 - m - s + c_i s)\right)}{4(4 - m)s}$$

If the incumbent decides to accommodate, it will behave as a quantity leader in a Stackelberg game, producing q_{ij}^A, q_{ik}^A such that

$$\max_{q_{ij}, q_{ik}} \pi_i = (P_{j2} - c_i)q_{ij2} + (P_k - c_i)q_{ik}$$

$$= [1 - R(q_{ij2}) - sq_{ik} - c_i]q_{ij2} + [1 - 2q_{ik} + m(R(q_{ij2}) + q_{ij2}) - c_i]q_{ik}$$

$$\frac{\partial \pi_i}{\partial q_{ij2}} = 0, \frac{\partial \pi_i}{\partial q_{ik}} = 0 \Rightarrow$$

$$q_{ij2}^A = \frac{c_i(16 + 2m(2 - s)) - 2m(2 - s) - m^2(1 - c_e)(2 - s) + 8(2 - s + c_e s)}{(2 - s)(m^2(s - 2) + 16(2 + s))}$$

$$q_{ik}^A = \frac{4(2+s) - 2c_i(4+m+2s) + m(6+s-c_e(4+s))}{m^2(s-2)+16(2+s)}$$

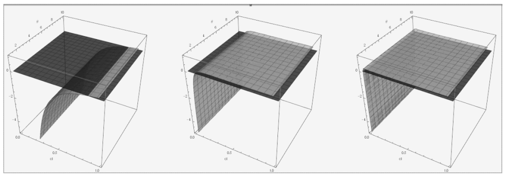
$$\pi_i^A = \frac{1}{(2-s)\big(m^2(s-2)+16(2+s)\big)}\Big((2-3c_e+c_e^2)m^2(2-s) + 2c_i^2(8+m(2-s)-s^2)$$
$$- 2(4(1-c_e)s + (2-c_e)c_e s^2 - 8) + m(2-s)\big(6+s-c_e(4+s)\big)$$
$$+ c_i\Big(-32-(1-c_e)m^2(2-s) + 8(1-c_e)s + 4s^2 - m(2-s)\big(8+s-c_e(4+s)\big)\Big)\Big)$$

Again, for simplicity, we assume that $c_e = 0$. To single out the impact of *m* from *s*, we also assume a small value for s (s = 0.1). By setting $K_{ij2}^M = K_{ij2}^D$, we can get the cutoff point between deterrence and monopoly: $\bar{f}_D = \frac{1}{361(4-m)^2(80+19m)^2(336-19m^2)^2 r_i^2}\Big(4c_i^2(-8+78m+19m^2) + 19c_i\big(m(640-336r_i) + m^3(-40+19r_i) + 4m^2(-3+19r_i) - 64(1+21r_i)\big) - 19\Big(190m^4 r_i + m^3(-80+19r_i-19r_i^2) + 4m^2(38-1581r_i+19r_i^2) - 64(1-819r_i+21r_i^2)16m(41-21r_i+21r_i^2)\Big)\Big)^2$. By letting $\pi_i^A = \pi_i^D$, we can get the cutoff point between accommodation and deterrence: $\bar{f}_A = \frac{1}{19(-4+m)^3(80+19m)^3(-336+19m^2)^3 r_i^2}\Big(2\Big(8c_i^2(-220416-102272m-24960m^2+8m^3+2261m^4+361m^5) + 1806336(39+19r_i+19r_i^2) + 361m^6(80+21r_i+19r_i^2) - 2888m^5(38+59r_i+19r_i^2) - 304m^4(-905+521r_i+437r_i^2) + 384m^3(541+15694r_i+5054r_i^2) - 256m^2(69602+5901r_i+6783r_i^2) - 2048m(-15181+26019r_i+8379r_i^2) + c_i\big(361m^6(-40+19r_i) + 2888m^5(-3+19r_i) - 2128m^4(-91+57r_i) + 86016(-799+441r_i) - 256m^3(401+7581r_i) - 256m^2(-19120+8379r_i) + 2048m(2039+8379r_i)\big)\Big)\Big(-4c_i^2(-8+78m+19m^2) - 19c_i\big(m(640-336r_i) + m^3(-40+19r_i) + 4m^2(-3+19r_i) - 64(1+21r_i)\big) + 19\Big(190m^4 r_i + m^3(-80+19r_i-19r_i^2) + 4m^2(38-1581r_i+19r_i^2) - 64(1-819r_i+21r_i^2) + 16m(41-21r_i+21r_i^2)\Big)\Big)\Big)$.

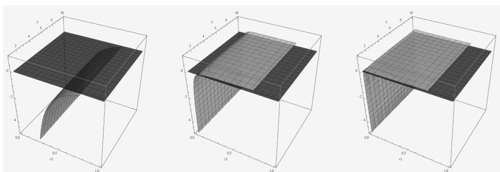
As in the previous section, we plot the value of $\frac{\partial(\bar{f}_D - \bar{f}_A)}{\partial m}$ against c_i and *m* in Figure A3. It shows that the range of entry cost for deterrence decreases with m when r_i is small enough relative to c_i and m is not too small. That is, the incumbent will face a narrower range of entry cost for deterrence if the entrant provides a more complementary product. Put differently, the premium incumbent will be better off accommodating than deterring an entrant that provides a more complementary product.

Proposition 3. *Following the threat of entry from a low-cost entrant, if investment costs are sufficiently low relative to operating costs, a premium incumbent will be less likely to invest in deterrence capacity when there is greater demand complementarity between its threatened and unthreatened markets.*

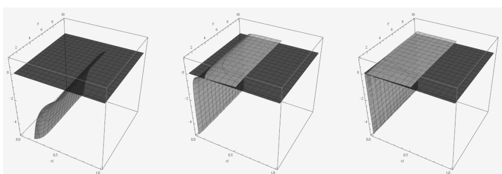
Figure A1a: Difference in cutoff points in entry cost for accommodation between a market with a premium incumbent and a market with a low-cost incumbent ($(\bar{f}_{A2} - \bar{f}_{A1})$).



$r_i = 0.1c_i, s = 0.1$; $r_i = c_i, s = 0.1$; $r_i = 10c_i, s = 0.1$.

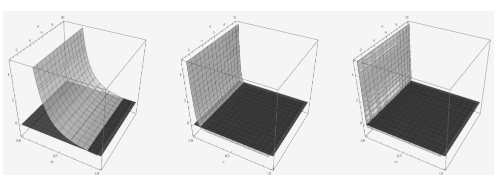


$r_i = 0.1c_i, s = 0.5$; $r_i = c_i, s = 0.5$; $r_i = 10c_i, s = 0.5$.

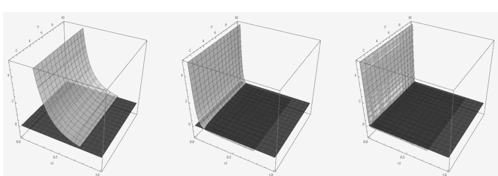


$r_i = 0.1c_i, s = 0.9$; $r_i = c_i, s = 0.9$; $r_i = 10c_i, s = 0.9$.

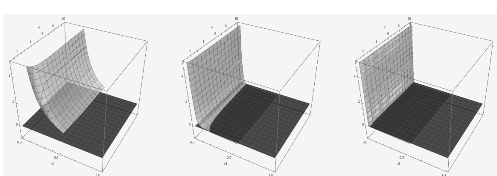
Figure A1b: Difference in deterrence interval between a market with a premium incumbent and a market with a low-cost incumbent ($(\bar{f}_{D2} - \bar{f}_{A2}) - (\bar{f}_{D1} - \bar{f}_{A1})$).



$r_i = 0.1c_i, s = 0.1$; $r_i = c_i, s = 0.1$; $r_i = 10c_i, s = 0.1$.

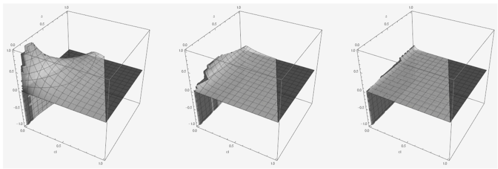


$r_i = 0.1c_i, s = 0.5$; $r_i = c_i, s = 0.5$; $r_i = 10c_i, s = 0.5$.



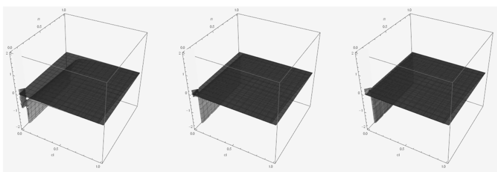
$r_i = 0.1c_i, s = 0.9$; $r_i = c_i, s = 0.9$; $r_i = 10c_i, s = 0.9$.

Figure A2: Partial derivative of cutoff entry cost for deterrence ($\frac{\partial(\bar{f}_D - \bar{f}_A)}{\partial s}$)



$c_e = 0, r_i = 0.1c_i$. $c_e = 0, r_i = c_i$. $c_e = 0, r_i = 10c_i$.

Figure A3: Partial derivative of entry cost interval for deterrence ($\frac{\partial(\bar{f}_D - \bar{f}_A)}{\partial m}$)



$c_e = 0, s = 0.1,$ $c_e = 0,\ s = 0.1,$ $c_e = 0, s = 0.1,$

$r_i = 0.1c_i$. $r_i = c_i$. $r_i = 10c_i$